Appendix B-4

Scope Book

2025 Request for Proposals

for

Developmental Combined-Cycle Combustion Turbine Resources

for

Entergy Arkansas, LLC

EAL CCCT Plant

B-O-T Scope Book

September 3~~July 9~~, 2025

TABLE OF CONTENTS

ATTACHMENTS:

* EAL's requirements for this Attachment are included in this Scope Book.
** EAL's requirements for this Attachment are included in this Scope Book with Seller input.
*** Attachment to be inserted by Bidder as part of Proposal.

B-4.1 PROJECT SCOPE BOOK

This Appendix B-4 and its attachments form the Scope Book. The Scope Book will be an exhibit to and part of the B-O-T Acquisition Agreement between Seller and Buyer (i.e., the Agreement) and, notwithstanding anything to the contrary in the Scope Book, subject to the Agreement's terms in all respects. The priority of documentation and terms forming part of the Agreement (including the Scope Book) and ancillary agreements will be set forth in the main body of the Agreement.

The Scope Book describes certain requirements with respect to the Work (which will be as defined in the Agreement). The Work requires Seller to provide, among other things, development, design, engineering, procurement, construction, contracting, permitting, commissioning, testing, performance verification, quality control, operation, maintenance, repair, replacement, and Buyer personnel training with respect to the Project and the project site in accordance with the terms of the Agreement (including the Scope Book). Notwithstanding anything to the contrary in the Scope Book, all Work to be performed by or for Seller pursuant to the Scope Book shall be performed in accordance with the performance standard (as generally described in Appendix B-3 (B-O-T Term Sheet) to this RFP and as fully defined in the Definitive Agreement).

The Purchase Price set forth in the Agreement will be established based upon the total Project requirements for Work supplied by Seller and is intended to include all Work requirements for the Project. The Scope Book is not intended to be a comprehensive list of every component or Work element required to complete the overall Project. The supplies or particular work elements that are not detailed in the Scope Book and any revisions to details that are not contained within the Scope Book, but that are agreed upon by the Parties with documented authority during the design review process, will not serve as a basis for adjustment to the Purchase Price. The terms for adjusting the Purchase Price are set forth exclusively in the Agreement.

B-4.1.1 PROJECT DESCRIPTION

The Project will be located on a site in MISO LRZ-8.

The Project will consist of a Commercially-Proven CCCT with a capacity from 600 to 800 MW at Summer Conditions. Operating parameters will include a maximum heat rate of 7,000 Btu/kWh at full output without supplemental duct-firing (if included as part of the facility). The Project will be fully permitted, and the CTGs, STG, and HRSGs will have the agreed upon equipment warranties.

The project will utilize natural gas. Pipeline-quality natural gas will be supplied via one or more lateral pipelines interconnected to the Project with sufficient operating pressure to serve the project site. The Project shall be capable of running at full design capability utilizing the interconnection pipeline(s).

A more detailed description of the Project is contained in Attachment A-4 ("Design Basis").

B-4.1.2 PROJECT OBJECTIVES

B-4.1.2.1 Seller shall work to complete the Project in accordance with the following "Project Objectives":

The Project will be designed taking into consideration the following objectives:

- Ensure safe operations, maintainability, and construction.
- Achieve a thirty (30)-year life.
- Facilitate maintenance work and provide access to all equipment according to the Project Standard (including OSHA).
- Minimize operator surveillance.
- Provide reliable power to the grid meeting the latest NERC reliable power standards to minimize false trips.

Achieve compliance with all Permit requirements (including local, states and federal permits must be secured) and guarantees required by the Agreement, including this Appendix B-4.

Achieve specified requirements for Project output capacity, heat rate, reliability, emission limits, and noise limits.

Minimize adverse local community impacts.

Minimize changes throughout engineering, design, procurement, and construction.

B-4.2 SCOPE BOOK

B-4.2.1 KEY PERSONNEL CHART

B-4.2.1.1 The document entitled "Key Personnel Chart," attached hereto as Attachment A-1, is adopted and fully incorporated by reference as if it were reproduced in its entirety.

B-4.2.2 PROJECT EXECUTION PLAN REQUIREMENTS

B-4.2.2.1 The document entitled "Project Execution Plan Requirements," attached hereto as Attachment A-2, is adopted and fully incorporated by reference as if it were reproduced in its entirety.

B-4.2.3 PROJECT PERFORMANCE TESTS

B-4.2.3.1 The document entitled "Plant Performance Tests," attached hereto as Attachment A-3, is adopted and fully incorporated by reference as if it were reproduced in its entirety.

B-4.2.4 PROJECT REQUIREMENTS AND DESIGN CRITERIA

B-4.2.4.1 The document entitled "Project Requirements and Design Criteria," attached hereto as Attachment A-4, is adopted and fully incorporated by reference as if it were reproduced in its entirety.

B-4.2.5 CIVIL/STRUCTURAL/ARCHITECTURAL DESIGN

B-4.2.5.1 The document entitled "Civil/Structural/Architectural Design," attached hereto as Attachment A-5, is adopted and fully incorporated by reference as if it were reproduced in its entirety.

B-4.2.6 MECHANICAL DESIGN

B-4.2.6.1 The document entitled "Mechanical Design Criteria," attached hereto as Attachment A-6, is adopted and fully incorporated by reference as if it were reproduced in its entirety.

B-4.2.7 ELECTRICAL DESIGN

B-4.2.7.1 The document entitled "Electrical Design Criteria," attached hereto as Attachment A-7, is adopted and fully incorporated by reference as if it were reproduced in its entirety.

B-4.2.8 CONTROLS DESIGN

B-4.2.8.1 The document entitled "Controls Design Criteria," attached hereto as Attachment A-8, is adopted and fully incorporated by reference as if it were reproduced in its entirety.

B-4.2.9 BUILDING AND EQUIPMENT ENCLOSURE DESIGN CRITERIA

B-4.2.9.1 The document entitled "Building and Equipment Enclosure Design Criteria," attached hereto as Attachment A-9, is adopted and fully incorporated by reference as if it were reproduced in its entirety.

B-4.2.10 CONSTRUCTION REQUIREMENTS

B-4.2.10.1 The document entitled "Construction Requirements," attached hereto as Attachment A-10, is adopted and fully incorporated by reference as if it were reproduced in its entirety.

B-4.2.11 TERMINAL POINTS

B-4.2.11.1 The document entitled "Terminal Points," attached hereto as Attachment A-11, is adopted and fully incorporated by reference as if it were reproduced in its entirety.

B-4.2.12 DIVISION OF RESPONSIBILITY

B-4.2.12.1 The document entitled "Division of Responsibility," attached hereto as Attachment A-12, is adopted and fully incorporated by reference as if it were reproduced in its entirety.

B-4.2.13 EQUIPMENT LABELING AND SIGNAGE PROCEDURE

B-4.2.13.1 The document entitled "Equipment Labeling and Signage Procedure," attached hereto as Attachment A-13, is adopted and fully incorporated by reference as if it were reproduced in its entirety.

B-4.2.14 TRAINING

B-4.2.14.1 The document entitled "Training Procedure," attached hereto as Attachment A-14, is adopted and fully incorporated by reference as if it were reproduced in its entirety.

B-4.2.15 DRAWING SPECIFICATION

B-4.2.15.1 The document entitled "Drawing Specification," attached hereto as Attachment A-15, is adopted and fully incorporated by reference as if it were reproduced in its entirety.

B-4.2.16 APPROVED MANUFACTURERS LIST

B-4.2.16.1 The document entitled "Approved Manufacturers List," attached hereto as Attachment A-16, is adopted and fully incorporated by reference as if it were reproduced in its entirety.

B-4.2.17 FIRE PROTECTION

B-4.2.17.1 The document entitled "Fire Protection Requirements and Design Criteria," attached hereto as Attachment A-20, is adopted and fully incorporated by reference as if it were reproduced in its entirety.

B-4.2.18 MAJOR TECHNICAL SPECIFICATIONS

The following major equipment technical specifications are adopted and fully incorporated by reference as if it were reproduced in its entirety:

B-4.2.18.1 Attachment A-17 – Combustions Turbine Generator Technical Specification

B-4.2.18.2 Attachment A-18 – HRSG Technical Specification

B-4.2.18.3 Attachment A-19 – Steam Turbine Generator Technical Specification

B-4.2.18.4 Attachment A-21 – GSU Transformer Specification

B-4.3 ENGINEERING & DESIGN

Seller shall be responsible for all engineering and design of the Project in accordance with this Scope Book and the remainder of the performance standard. If, during the Work, Seller discovers any conflicts between this Scope Book and the remainder of the performance standard, Seller shall promptly disclose to Buyer any such conflicts, which shall be resolved according to the Agreement. Seller shall cause all design and engineering materials, documents, drawings and calculations pertaining to the Project (collectively, the "Engineering Materials") to be prepared by qualified, and authorized professional engineers licensed in the state in which Project is constructed.

Seller is responsible for assuring that the Scope Book for the Project, including Seller's technical specifications referenced elsewhere in the Agreement or its attachments and any Buyer approved changes made by Seller thereto, will provide adequate and accurate information, and Seller is responsible for assuring that its Contractors and Subcontractors deliver their respective scopes of supply in a manner that will meet the Project Objectives set forth in this Appendix B-4 and will be in accordance with the Project Warranty and Performance Guarantees.

B-4.3.1 ENGINEERING MATERIALS REVIEW

All Engineering Materials (including the design basis and documents of conceptual, basic, and detailed design) must comply with this Scope Book and otherwise with the performance standard and shall be new. Engineering design packages for conceptual design related to the Project, including for major procurement selection ("Phase A Deliverable"), for Permit applications or submissions ("Phase B Deliverables"), and, prior to issuance thereof, drawings for construction ("Phase C Deliverables") shall be submitted for review and approval by Buyer in accordance with the dates therefor set

forth in the Project Schedule. Within fifteen (15) Business Days after receipt of any Phase A Deliverable, and within ten (10) Business Days after receipt of any Phase B Deliverable, Phase C Deliverable, or subsequent revision to a Phase A Deliverable, Buyer may submit comments to Seller with respect to such Engineering Materials. In the event that Buyer does not provide comments within such ten (10) or fifteen (15) Business Day period, as applicable, such Engineering Materials shall be deemed approved. If Buyer provides comments within such ten (10) or fifteen (15) Business Day period, as applicable, Seller shall modify such Engineering Materials in response to any Buyer comments that identify errors or omissions in design or failures to comply with the performance standard, including this Scope Book, or the other terms of the Agreement, and Seller shall consider in good faith all other comments Buyer provides within such ten (10) or fifteen (15) Business Day period, as applicable. Seller shall resubmit the applicable revised Engineering Materials to Buyer within ten (10) Business Days after receiving Phase A comments from Buyer. Seller shall maintain a log of comments received from Buyer and how they have been addressed and shall submit such log to Buyer with the revised Engineering Materials. This procedure shall be repeated until such Engineering Materials are approved by Buyer. Seller shall not implement any portion of the Work based on any Engineering Materials until the same have been approved by Buyer; provided, however, that Seller shall be entitled to address issues identified in one design phase in the next subsequent design phase if necessary, for Seller to preserve the Project Schedule. Any change proposed to the Engineering Materials after approval thereof shall be subject to further approval by Buyer according to the process in this Section 3.2.

For the avoidance of doubt, and without limiting the performance standard, the Engineering Materials shall not include equipment that does not comply with Attachment A-16.

B-4.3.2 CERTAIN APPLICABLE STANDARDS

Without limiting any other aspect of the performance standard (including other standards that may be listed elsewhere in this Scope Book or the Agreement), the Project (including its design) shall comply with the standards of the following organizations as listed in Attachment A-4 (Design Basis), to the extent applicable to the Work being performed.

B-4.3.3 ENGINEERING DELIVERABLES

All engineering deliverables and services shall be provided by Seller to the Buyer in accordance with the Project Execution Plan and the remainder of the performance standard. The latest version of the following deliverables with respect to the Project shall be delivered to Buyer as provided below. Updates to any such deliverable shall be delivered to Buyer as completed (with the final version of each delivered to Buyer no later than Final Completion). Prior to the final versions, Seller shall provide such deliverables in native file format, if possible, but otherwise in PDF file format. The final version of all deliverables shall be provided (no later than Final Completion) in

native file format. Final drawings must adhere to the Drawing Specification as shown in Attachment A-15. The listings in this Section 3.3 are not intended to and do not include all deliverables from Seller to Buyer required by this Scope Book or the Agreement. Nothing in this Section 3.3 shall limit Seller's obligation to provide to Buyer any additional deliverable that may be required by this Scope Book or the Agreement. Items denoted "X" in Table A.4-1 must be completed/accepted by the Buyer to achieve the stated Contractual Milestones.

B-4.3.4 SYSTEM DESCRIPTIONS

System descriptions of as-built systems included in Table A.4-1 shall be provided by Seller to Buyer based on draft examples supplied by Buyer to Seller at Mechanical Completion, with the final version of such system descriptions provided to Buyer by Final Completion.

B-4.3.5 OPERATING PROCEDURES

Project-specific operating procedures shall be provided by Seller based on examples provided by Buyer of procedures currently in use at existing facilities. The operating procedures are listed in Attachment A-10.

The operating procedures shall be task-oriented procedures in Buyer's format. They shall be initially issued by Seller prior to the Closing and reviewed with Buyer prior to initial issue. Following the Closing, the operating procedures shall be revised as necessary during the course of the Work to reflect the as-built status of Project systems and equipment and to take into account any comments from Buyer. The operating procedures shall by finalized by Final Completion and shall not be considered finalized until they reflect the final as-built status of Project systems and equipment and are approved by Buyer.

B-4.3.6 FIRE PROTECTION SYSTEM

Without limiting the performance standard, the Project (including facilities, systems, and equipment) shall have a fire protection system that meets all applicable Laws and Attachment A-20 Fire Protection

B-4.3.7 STORM WATER DRAINAGE SYSTEM

Without limiting the performance standard, the Project shall have a storm water drainage system that meets all applicable Laws (including local, state, and federal requirements) and permits. The storm water drainage system shall be a combination of piped storm water, catch basins, buried pipes, culverts, swales, and sheet flow.

B-4.4 ADDITIONAL REQUIREMENTS

This Section 4 describes certain general requirements for the Project. Such requirements are the sole responsibility of Seller to manage.

B-4.4.1 GENERAL

Seller shall furnish a safe, quality built, timely, complete, functional Project while safeguarding the environment and adhering to the performance standard, including all Laws and applicable Permits, Good Industry Practices, and the other requirements of this Scope Book and the Agreement. Seller shall utilize safe work practices throughout the Project's execution and have in place and maintain effective safety and quality control programs. Seller shall strictly follow all installation and instruction manuals of the OEMs in the performance of the Work.

B-4.4.2 PROCUREMENT PLAN

Seller shall provide procurement of goods and services needed for the Project in accordance with the Project Procurement Plan described in Attachment A-2 ("Project Execution Plan Requirements"), Section 7 ("Procurement Plan") which addresses the purchase of equipment, material, goods and services.

B-4.4.3 SCOPE OF APPLICABILITY OF PROCUREMENT PLAN

The policies, responsibilities, standard procedures, and instructions included in the Procurement Plan shall apply to all procurement activities conducted by Seller to fulfill its obligations as detailed in the Agreement.

B-4.4.4 CONSTRUCTION

Seller shall (whether directly or otherwise through for example its EPC Contractor) arrange for and manage the construction of the Project in accordance with the Project Execution Plan and the Agreement.

Seller will comply with the EPC Contractor's project health & safety plan, until Substantial Completion has been achieved and the facility is turned over to Buyer.

Seller will liaise with representatives of the Buyer throughout the duration of the Project to demonstrate compliance with the PEP.

B-4.4.5 MOBILIZATION PLAN

Seller is responsible for the mobilization of field forces and all necessary construction facilities at the Project Site, including temporary office trailers as necessary or advisable for completion of the Work. Seller shall provide a temporary area lighting system sufficient for construction activities at the Project Site and to provide safe access to the Work areas during early morning and late evening hours of operation.

Seller is also responsible for the preparation and maintenance of unloading and laydown areas, Project Site craft parking areas, storage facilities, temporary buildings and other necessary facilities, as may be required.

Seller shall adequately prepare the laydown/office/parking areas to minimize any adverse effects from weather or other hazards to facilities or stored materials. Where required by the equipment manufacturer(s), air-conditioned storage including provisions for heaters, and covered indoor climate-controlled storage shall be provided by Seller. Any action taken by Seller for Project Site preparation shall not increase the risk that the Project Site could cause flooding to the adjacent properties.

B-4.4.6 SITE CONDITIONS

Seller shall take appropriate surface water, erosion, and dust control measures for the Project Site and the other areas where Seller is performing Work, including Project access roads utilized to perform Work, laydown areas, and craft parking areas, in accordance with the erosion and sedimentation Permit issued by the local conservation district or other relevant Governmental Authority and the performance standard.

Hazardous Substances shall be stored in accordance with applicable federal and state EPA requirements and other Laws and applicable Permits, and Project Site spill control measures shall be implemented in accordance with the performance standard.

Seller shall be responsible for all site development activities, including obtaining site survey, site preparation, necessary permits, and site security. Seller is responsible for all required construction power, potable water, and sanitary water supply and disposal. Refer to Attachment A-4.

B-4.4.7 RIGGING/EQUIPMENT PLANS

Seller is responsible for lifting, rigging, unloading and transporting of all equipment associated with the Project.

Seller shall prepare a comprehensive lifting and rigging plan for all major equipment/components lifts during construction. A rigging and lifting plan shall be developed an approved for all high-risk engineered lifts or critical lifts (including but not limited to lifting activity that requires the use of custom designed “below the hook” lifting devices, blind lifts, multiple cranes, lifts requiring greater than 75% of the lifting capacity, or establishment of safeguards to control movement in the vicinity of energized facilities). Rigging and lifting plans for each high-risk engineered/critical lift shall be provided to the Buyer for approval at least four weeks in advance of when the lift is scheduled to take place. All rigging and lifting plans shall be prepared and sealed by a Professional Engineer licensed in the state where the Project is located.

Seller shall evaluate any special equipment requirements, including major crane needs prior to mobilization.

B-4.4.8 GENERAL CLEANING

Through Substantial Completion, Seller shall maintain the Project Site in a clean and orderly state. Seller shall remove all excess materials and ensure that all Work and maintenance areas, and all Work area access paths, remain unobstructed and in good, safe

condition. After Substantial Completion, Seller shall be responsible for ensuring that any area where it is performing Work is kept clean and orderly and returned to at least substantially the same condition as existed prior to its performance of such Work (excluding any condition whose repair was a part of the Work).

B-4.4.9 DEMOBILIZATION

Upon completion of all required Work, Seller shall completely demobilize trailers, equipment, and other construction facilities or items, remove all temporary service connections, protect all equipment, systems, connections, and property for future use, and, unless otherwise instructed by Buyer, remove any Hazardous Substances and all non-hazardous construction debris, chemical wastes, etc. in strict accordance with Laws and applicable Permits and otherwise with the performance standard. Any lay down, construction parking, and/or work areas constructed on a temporary basis shall be retained for future use.

B-4.4.10 SECURITY

Seller shall develop and implement the Project Site Security Plan as required by the Agreement. Without liming the foregoing, the Project Site Security Plan shall include:

a) Installing security gates at all Project entrances with signs indicating an emergency contact telephone number;

b) Plan and install permanent and temporary site security fencing and, as required, Seller shall provide remaining perimeter fence around the construction laydown/parking areas and the construction offices area for the duration of construction and Commissioning.

c) Implementing a reasonably designed Project entrance gate procedure to provide controlled and monitored access;

d) Staffing Project gate entrance as required by gate guards who maintain a date-and-time sign-in log for all deliveries and visitors;

e) Providing security personnel with a telephone at the guard shacks and with mobile communication capability; and

f) Providing security with emergency contact information and with communication capability with local emergency and law enforcement agencies for assistance in the event of a construction emergency.

B-4.4.11 SITE WORK, EXCAVATION, FILL, and GRADING

Seller shall be responsible for the proper handling, storage (spoils pile(s)), and disposal, as applicable, of excavated soil materials in compliance with the procedures outlined in the Agreement for the handling and disposal of waste and/or contaminated Hazardous Substances.

All excavations shall be protected from the elements. Once foundations are stripped, Seller shall use all reasonable means to backfill the excavations adjacent to foundations. Any washouts or other deviations shall be immediately Remedied. Refer to Attachment A-5 for additional requirements.

B-4.4.12 COMMUNITY RELATIONS

Seller shall make best efforts to manage for all community relations for and with respect to the Project through Substantial Completion. Seller shall use best efforts to undertake such works and other activities as necessary or advisable to engender and maintain, and shall use best efforts perform the Work and its other obligations under the Agreement in a manner that is intended to engender and maintain, a positive perception of the Project within, and a harmonious relationship with, the surrounding community, such that Buyer could reasonably be expected to inherit that perception and relationship at the Closing and thereafter preserves the same through Substantial Completion and, to the extent based on Seller's or Seller Service Providers' acts or omissions, thereafter.

B-4.4.13 FACILITIES FOR BUYER

Seller shall, starting at the start of physical construction on the Project Site and continuing until Substantial Completion. See Attachment A-10 for additional requirements.

B-4.4.14 LESSONS LEARNED

Buyer shall supply a lessons learned knowledge database to Seller.

Seller shall evaluate and incorporate lessons learned into the planning, work processes and work activities of this project.

B-4.4.15 ACRONYMS

Refer to the Attachment A-4 for acronyms, abbreviations, and definitions as used in the Scope Book and its attachments.

BOT Scope Book
Attachment A-3
Project Performance Tests

Table of Contents

Formatted: Indent: Left: 0"

Formatted: Centered, Indent: Left: 0"

Formatted: Font: 8 pt

Formatted: Font: 12 pt

Formatted: Left, Indent: Left: 0"

Formatted: Indent: Left: 0"

A-3.1 PLANT PERFORMANCE GUARANTEES AND COMPLIANCE TESTING

A-3.1.1 Guarantees

The guarantees provided in this Attachment are for reference pending final negotiations based on Seller's proposal.

A-3.1.1.1 Guaranteed Net Electrical Output and Guaranteed Net Plant Heat Rate

The performance guarantees listed in Table A-3.1 are subject to the Guarantee Test Conditions stated in this Attachment.

Table A-3.1 Performance Guarantees when firing 100% Natural Gas

Guaranteed Net Electrical Output	By Seller
Guaranteed Net Plant Heat Rate	By Seller

A-3.1.1.2 Performance Guarantees provided in this Attachment are based on the Guarantee Test Conditions shown in Table A-3.2 below. All Performance Test results shall be corrected for deviation from the Guarantee Test Conditions.

Table A-3.2 Guarantee Test Conditions

Conditions for Guarantees	Net Plant Performance
Ambient Dry Bulb Temperature (°F)	
Ambient Relative Humidity	
Evaporative Cooler Status	On
Duct Burner Status	On
Barometric Pressure (psia)	
Generator Power Factor (Both STG and CTG)	0.85 Lagging
Frequency	60 hz
Fuel	Natural Gas
Fuel Gas Temperature at Seller Terminal Point (°F)	By Seller
Fuel Gas Pressure at Seller Terminal Point (psig)	By Seller
HRSG Blowdown	0%
CTG(s) Load	100% Load
CTG and STG Condition	New and Clean (1)
Auxiliary Power	By Seller

Formatted: Indent: Left: 0"

Conditions for Guarantees	Net Plant Performance
Performance Test Uncertainty Tolerance	Performance test uncertainty shall be calculated as part of the performance test procedure to verify compliance with ASME Performance Testing Codes. Performance test uncertainty shall not be used as a test tolerance for plant performance testing.

Notes:
1. New and clean condition means that the actual operating hours from the initial firing of the combustion turbine is less than 200 hours. A performance degradation correction is applied to correct as-tested results when the actual operating hours of the combustion turbine exceed 200 hours. The degradation correction shall be based on equivalent degradation hours (EDH) and shall include degradation due to plant trips, load rejections and rapid load changes, even if such events occur before the actual hours of the combustion turbine achieved 200 hours.
2. No tolerance will be applied prior to comparing the Performance Test results with the performance guarantee.

A-3.1.1.2.1 The performance guarantees stated in A-3.1.1 include the auxiliary consumption of equipment supplied by Seller as needed for steady state operation.

A-3.1.1.3 Guaranteed Emission Limits

A-3.1.1.3.1 Emissions guarantees shall be in accordance with the facility's air permit.

A-3.1.1.4 Emissions Guarantee Basis

A-3.1.1.4.1 The emissions guarantees provided in the facility's air permit are subject to the fuel properties in the Seller's fuel specification. If the sulfur content or fuel bound nitrogen content exceeds the value indicated in the Seller's fuel specification, the emissions guarantees shall be adjusted accordingly.

A-3.1.1.4.2 If part of project scope, Emergency Diesel Generator and Fire Pump Diesel Engine PM10 emissions will be satisfied by supplier provided documentation. No actual source testing will be performed by Seller.

A-3.1.2 Mechanical Completion

A-3.1.2.1 Prior to initiating Performance Testing, the Seller is required to verify Mechanical Completion, by the submittal of turnover and Commissioning procedures that all equipment and systems necessary for Performance Testing are ready for initial operation and may be operated in a manner in which they are normally intended to operate, without damage to the Project or any other property and without injury to any person. The Seller must complete turnover, testing and Commissioning procedures, such as hydrostatic and pneumatic pressure tests, high pot tests, insulation resistance and continuity test, calibrations, clean-outs, and flushes, and

Formatted: Indent: Left: 0"

completed system startup testing, back feed, and synchronizing in accordance with prudent industry practice and Buyer approved procedures.

A-3.2 Guarantee Test Conditions and Procedures

A-3.2.1 General

A-3.2.1.1 The Buyer shall assist the Seller in the coordination of the Performance Test requirements as defined in the Contract and this Appendix. Scheduling of the Performance Test shall be coordinated between the Buyer and Seller.

A-3.2.1.2 All tests shall be conducted with the combustion turbine operating as described in the specific test procedure. Corrections to the Performance Test results will be made based on the actual Higher Heating Value (HHV) of fuel sampled during the Performance Test. Fuel supplied for the Performance Test shall be confirmed to meet minimum manufacturer's fuel specification requirements, prior to initiating the Performance Test.

A-3.2.2 General Test Requirements

A-3.2.2.1 During all testing, the Project equipment will be operated within the normal design limits of the equipment and in a manner consistent with prudent industry practices for continuous long-term operation. However, cycle isolation shall be allowed as specified in the Performance Test procedure.

A-3.2.2.2 During all testing, the steam turbine inlet temperature and the combustion turbine control temperature shall not exceed the manufacturers recommended temperature for continuous long-term operation.

A-3.2.2.3 All the systems shall be in their normal operating mode for the entire duration of the Performance Test and the Reliability Test, as required for normal operation.

A-3.2.2.4 During all testing, the control system must be in the normal continuous long-term operation mode. No software points shall be forced, and no hardware points shall be jumpered or have lifted leads.

A-3.2.2.5 The Project shall be operated during the Performance Test, the Reliability Test, the Turbine Run Back and Trip Test, the CTG Islanding Demonstration Test, the Plant Operating Startup Demonstration Test, and the Plant Operating Shutdown Demonstration Test by the Buyer's operating personnel under the technical direction of the Seller. Seller shall be responsible for all maintenance until Substantial Completion is achieved. Before the transfer of care, custody, and control of the Project to Buyer, Buyer's personnel shall be under the direction and control of Seller with respect to operating the Project. After the transfer of care, custody, and control of the Project to Buyer, operation and maintenance of the Project shall be under the direction and control of Buyer.

A-3.2.2.6 The Turbine Run Back and Trip Testing may be performed either during the Reliability Test or separately, at the Seller's election. All tests must be performed in compliance with the Guaranteed Emission Limits, as determined by a certified continuous emissions monitoring system (CEMS), excluding operation below

Formatted: Indent: Left: 0"

MECL, maintenance, startup, and shutdown (MSS). Testing for non-continuous constituents will only be done during the prescribed emissions measurement period utilizing grab samples. The Performance Test shall be invalidated in the event of failure to achieve compliance with the Guaranteed Emission Limits for the duration of the Performance Test.

A-3.2.2.7 The initial draft of the project Performance Test procedures and the Air Emissions Testing Procedures shall be submitted to Buyer by Seller at least 180 days prior to the scheduled Performance Test date for review by Buyer and the Buyer's Engineer. Seller shall design the Performance Test and shall conform to the requirements of the Contract and applicable ASME PTC, to demonstrate compliance with the Performance Guarantee. Seller shall design the Air Emissions Testing Procedures according to applicable regulatory codes to demonstrate compliance with the Guaranteed Emission Limits. The Buyer and Buyer's Engineer will review and submit comments to Seller, if any, within 30 Days of receiving such procedures. If Buyer provides comments with respect to such procedures, Seller will promptly incorporate such comments that are mutually agreed to between the Buyer and the Seller.

A-3.2.2.8 Seller to provide the Performance Test procedure that shall include correction curves. The Performance Test procedure will be reviewed and mutually agreed upon by Buyer and Seller.

A-3.2.2.9 Seller shall include in the test procedure a checklist of cycle isolation manual and automatic drain valves that are normally closed during operations. These valves shall be checked and verified closed prior to conducting the test.

A-3.2.2.10 Using the agreed upon Performance Test procedures, the raw data shall be corrected to the Guarantee Test Conditions using the agreed Performance Test correction curves and Performance Test procedure.

A-3.2.2.11 An adjustment for plant performance degradation, based on the number of combustion turbine fired hours as calculated according to the combustion turbine supplier's procedures, shall be included in the overall adjustment.

A-3.2.3 Performance Test

A-3.2.3.1 The guaranteed Net Electrical Output and guaranteed Net Plant Heat Rate will be demonstrated during the Performance Test using station and/or temporary instrumentation and generally following the ASME PTC, as applicable. The Performance Test will be conducted in general accordance with ASME PTC 46.

A-3.2.3.2 The Net Electrical Output and Net Plant Heat Rate test will be conducted within a continuous twenty-four (24) hour period. The Performance Test will consist of four one-hour, uninterrupted, individual, periods for evaluation of Net Electrical Output and Net Plant Heat Rate. At least three of the four one-hour test periods shall meet the minimum test stability criteria of AMSE PTC 46. The results of the selected three (3) one-hour test periods, as corrected, shall be averaged to determine Net Electrical Output and Net Plant Heat Rate. The measurement uncertainty associated with the test results will be evaluated in accordance with

Formatted: Indent: Left: 0"

ASME PTC 19.1 ("Measurement Uncertainty"). The measurement uncertainty calculation will only be used to determine that the project Performance Test meets the requirements of ASME PTC 46. If the results are not consistent (as detailed below), individual evaluation periods may be repeated until repeatable results are obtained. Any interruption of an individual evaluation period, within the Seller's responsibility, will require that such evaluation period be repeated at Seller's cost (excluding fuel costs).

A-3.2.3.3 An individual evaluation period is considered consistent if the Net Electrical Output value, corrected to the Guarantee Test Conditions, is within one (1) percent of the average of all submitted evaluations; and, the Net Plant Heat Rate value, corrected to the Guarantee Test Conditions, is within two (2) percent of the average of all submitted evaluations.

A-3.2.3.4 The as-tested Net Electrical Output and Net Plant Heat Rate values determined during the Net Electrical Output and Net Plant Heat Rate Test shall be corrected to the Guarantee Test Conditions using the methodology and correction curves as described in the Performance Test procedure.

A-3.2.3.5 If the CTG supplier provides a new correction curve for the combustion turbine after the integrated Dry Low NOx (DLN) tuning at the site, it will be integrated in the Performance Test procedures subject to Buyer review and approval.

A-3.2.3.6 After the as-tested values for each of the Performance Test runs are determined, corrections to the as tested Net Electrical Output and Net Plant Heat Rate shall be performed by Seller for each test period in accordance with this Attachment and the Performance Test procedures to determine an average of the corrected results. If the actual test conditions differ from the Guarantee Test Conditions, corrections shall be made for each of the Guarantee Test Conditions, and in particular the following:

A-3.2.3.6.1 Generator power factor and frequency

A-3.2.3.6.2 Fuel composition, heating value and chemical and physical characteristics, including analysis.

A-3.2.3.6.3 Barometric pressure

A-3.2.3.6.4 Ambient relative humidity

A-3.2.3.6.5 Ambient dry bulb temperature

A-3.2.3.6.6 Degradation

A-3.2.3.6.7 Evaporative Cooler Status (On/Off)

A-3.2.3.6.8 Duct Burner Status (On/Off)

A-3.2.3.6.9 Cycle Leakage

A-3.2.3.6.10 Fuel gas temperature at supply point at the specified pressure

A-3.2.3.7 During the Net Electrical Output and Net Plant Heat Rate Test, the Project will be stabilized for at least one (1) hour and followed by actual test data taken during

Formatted: Indent: Left: 0"

each 1-hour interval (selected 1-hour intervals used for evaluation are to be mutually agreed upon in order to minimize the magnitude of correction). Raw test data will be made available to Buyer and Buyer's designated representatives for each 1-hour interval, after completion of the Performance Test. Raw test data taken during these intervals cannot be corrected from its raw form.

A-3.2.4 Emissions Testing

A-3.2.4.1 Continuous Emissions Monitoring System (CEMS) equipment shall be tested and certified in accordance with the Air Permit and applicable requirements of 40 CFR Parts 60 and 75, and their applicable appendices, prior to the start of Performance Testing. The CEMS must be in service throughout the tests. Alternatively, if the Facility CEMS is not available for Performance Testing, portable CEMS equipment that meets LDEQ and US EPA reference testing standards may be utilized. Onsite acceptance tests shall include onsite functional acceptance tests (OFATs) and onsite performance specification tests (PSTs). Turnover of Seller's CEMS shall be after successful completion of the EPA onsite performance and certification testing stipulated in 40 CFR 60 and 40 CFR 75, and when all documentation and report writing are completed and accepted by both the EPA and local/state authorities as certified. Buyer will review linearity and software calculations.

A-3.2.4.2 Air Emissions Tests shall be conducted concurrently with the Net Electrical Output and Net Plant Heat Rate Tests as much as practical according to the Air Emissions Testing Procedure.

A-3.2.4.3 Seller shall meet guarantees, based on measurement at the HRSG stack.

A-3.2.4.4 Air Emissions Testing Procedures will be based upon use of data obtained from the Continuous Emissions Monitoring System CEMS and/or certified stack testing as mutually agreed upon. It is intended that the CEMS equipment shall be fully tested and certified prior to conducting the Performance Test. The Project specific test procedure shall be developed in accordance with regulatory codes.

A-3.2.4.5 It is the intent of Buyer that the Air Emissions Tests will be run in accordance with the latest editions of the EPA Methods listed below:

A-3.2.4.5.1 EPA Method 20 or 7E shall be used to measure NOx.

A-3.2.4.5.2 EPA Method 10 shall be used to measure CO.

A-3.2.4.5.3 EPA Method 18 & 25A shall be used to measure total VOC emissions.

A-3.2.4.5.4 EPA Test Method CTM-027 shall be used to measure NH3 emissions.

A-3.2.4.5.5 EPA Test Method 323 or equivalent shall be used to measure H-CHO emissions.

A-3.2.4.5.6 EPA Test Method 201A/202 or equivalent shall be used to measure PM10 emissions.

A-3.2.4.5.7 EPA Test Method 9 shall be used to measure Opacity emissions.

Formatted: Indent: Left: 0"

A-3.2.4.6 Compliance with Guaranteed Emission Limits that can be continuously monitored are required during the Performance Test.

A-3.2.4.7 Before Final Acceptance, the Air Emissions Tests shall be repeated if directed by the LDEQ. If Seller has already demonstrated compliance with Guaranteed Emission Limits during the Performance Test, such additional Air Emissions Tests shall be Buyer's responsibility.

A-3.2.4.8 Air Emissions Testing shall demonstrate compliance with all emission limits defined in the facility's air permit.

A-3.2.5 Measurement and Test Results

A-3.2.5.1 Calibration tests shall be made on all temporary test instruments prior to initiating the Net Electrical Output and Net Plant Heat Rate Test. These calibration test data will be recorded and made a matter of record. All calibrated temporary test instruments necessary to conduct the tests shall be provided by the Seller. All calibration services, calibration gases, gas analysis, etc. necessary to conduct the Project Performance Test and report on the results shall be provided at the Seller's cost.

A-3.2.5.2 The Seller shall provide scaffolding (as required), material and labor for installation of test instrumentation, and removal of temporary instruments.

A-3.2.5.3 Within fourteen (14) days after receipt of the analysis of the test fuel, the Seller shall deliver to Buyer a letter report certifying the Performance Test results. Within seven (7) days after receipt of such letter report, Buyer shall give notice to Seller either accepting the Performance Test results or specifying in what respects such letter report is incomplete, incorrect, or unacceptable.

A-3.2.5.4 Within thirty (30) days after receipt of the analysis of the test fuel, Seller shall deliver to Buyer a detailed report (the " Performance Test Report"). Within ten (10) days after Buyer's receipt of the Performance Test Report, Buyer shall give notice to Seller either accepting the Performance Test Report or specifying in what respects such report is incomplete, incorrect, or unacceptable. In the event that Buyer gives notice to Seller specifying that the Performance Test Report is incomplete or incorrect, Seller shall promptly provide additional information required by Buyer.

A-3.2.5.5 If the project Performance Test criteria is not met, then an additional test period will be added to the end of the Performance Test; or the Performance Test will be stopped and re-started.

A-3.3 RELIABILITY TEST

A-3.3.1 Test Procedure

A-3.3.1.1 The Project Reliability Test will be conducted over a period of three days (the "Measurement Period") after Substantial Completion in accordance with the test procedures. The intent of the Reliability Test is to demonstrate that the Project can continuously generate and deliver electric power to the utility grid during the

Formatted: Indent: Left: 0"

Measurement Period while operating the combustion turbine and steam turbine, in accordance with the Guaranteed Emission Limits (demonstrated by the CEMS in accordance with Air Emissions Testing Procedures) and operating on gas fuel.

A-3.3.1.2 Any turbine trip caused by equipment or services under the control of the Seller shall result in a failed test requiring restarting the Reliability Test. The Measurement Period will be suspended during any period when Buyer fails to provide the fuel or personnel (in accordance with the Contract) for purposes of the test, or if Buyer causes a turbine trip. The Measurement Period shall also be suspended during any outage caused by a Force Majeure event and any curtailment by Buyer, provided that, during such period of Force Majeure or curtailment, Seller shall not take any corrective action unless Buyer approved. If any such corrective action is taken during such period, the Reliability Test shall be rerun by Seller at no cost to Buyer other than fuel and Buyer labor costs.

A-3.3.1.3 The three-day Reliability Test Measurement Period shall be seventy-two (72) rolling hours with one hundred forty-four (144) half-hour periods of operation over which the Project shall demonstrate an overall Reliability Factor (RF), as defined below, of 94.5 percent. The Reliability Test shall commence after Substantial Completion and shall be completed no later than 12 months following Substantial Completion. The Reliability Test may not commence until a mutually agreed upon punch list of items that affect the safety and operation of the Project have been completed by the Seller.

A-3.3.2 Reliability Factor Calculation

A-3.3.2.1 The three-day Reliability Factor ("RF"), will be determined as follows:

RF= (A+ B + C) / (144) x 100%

Where:

A= The summation of those one half-hour operating periods during which the Project operates between the Project Maximum and Minimum Limits defined below and a) meets the actual demand of Net Electrical Output; or b) under utility dispatch operation, meets the utility dispatch requirements.

This includes start-up, shut down and ramping required by Project or utility dispatch operation. During startup and ramping, Seller recommended loading limits shall not be exceeded. The Project shall be considered at the demand load while it is controlling or ramping to the load demanded.

This also includes those one half-hour operating periods during which the demand of Net Electrical Output is higher than the Maximum Limit, provided the Project operates at the Maximum Limit.

B= The summation of those one half-hour operating periods during which the Project operates between the Project Maximum and Minimum Limits defined below, but a) does NOT meet the actual demand of Net Electrical Output; or b) under utility dispatch operation, does NOT meets the utility dispatch requirements. The Project shall be considered at the demand load while it is controlling or ramping to the load demanded.

$B = \sum (n1 \times NECF1 + n2 \times NECF2 \ldots ni \times NECFi)$

Formatted: Indent: Left: 0"

Where:

ni is the number of half-hour periods (If NECFi is less than 0.7, enter 0 for that ½ hour period)

NECF = Actual Net Project Electrical Output / Demand

C = The summation of those one half-hour operating periods during which the Project is not operating or not synchronized to the grid, but is available and capable of operation or synchronization but not capable of achieving minimum Net Electrical Output or dispatch requirements due to a) no dispatch or Project demand; b) failure or limitations of system/equipment not supplied by Seller; or c) Buyer's error.

Those half-hour increments during which the Project demand or utility dispatch demand is below the Project minimum load limit shall be disregarded and a number of half-hour increments equal to those disregarded shall be added to the end of the testing period to reach the total 72 hours.

A-3.3.2.2 Maximum Limit shall be defined as the combustion turbine operating at base load and the steam turbine in operation with no bypass.

A-3.3.2.3 Minimum Limit shall be defined as the combustion turbine operating at no less than manufacturer's minimum turndown load within emissions compliance and with steam turbine in operation within manufacturer's minimum turndown load.

A-3.3.2.4 The dispatch schedule during the Measurement Period shall not include more than 4 starts and 2 stops. Any dispatched starts beyond 4 during the Measurement Period that results in a failed start will not be counted as a failed period and will be excluded. A number of periods equal to those excluded shall be added to the end of the testing period to reach the total 72 hours.

A-3.3.2.5 The plant shall be operated in accordance with the a dispatch schedule coordinated between Buyer, Seller, and with the approval of the transmission system operator.

A-3.3.2.6 Automatic Generation Control (AGC) will be in-service during the testing periods.

A-3.3.2.7 Emissions compliance as indicated by the certified Continuous Emission Monitoring System (CEMS) shall be met during the Reliability Test. No credit shall be taken for any period not meeting the Guaranteed Emission Limits, except operation below MECL, MSS and during calibration of CEMs analyzers.

A-3.3.2.8 The Reliability Test shall be deemed successful if the Reliability Factor calculated for the Measurement Period meets or exceeds the guaranteed value of 94.5%. If the calculated reliability is less than the guaranteed value, the Seller shall take appropriate remedial action. Following such remedial action, the Reliability Test shall be repeated, and Reliability Factor calculated for the new Measurement Period. Once the required Reliability Factor for a Measurement Period is achieved in the most recent Reliability Test, the test will be deemed successfully completed.

Formatted: Indent: Left: 0"

A-3.3.3 Conditions Applicable for the Reliability Test

A-3.3.3.1 Excluded are outage hours which are not under Seller's control, including but not limited to those caused by low fuel gas supply pressure, grid frequency variations outside of the operating manuals and instruction manuals, Buyer's error, equipment not supplied or installed under this Specification, acts of the Buyer or its agents or its other Sellers and subcontractors (not including Seller's Subcontractors), Force Majeure events and Buyer's failure to comply with its obligations under the terms of the Contract. If the unit is shut down or derated due to any of the reasons listed above, the test will be interrupted for the duration of the shutdown or derating. When the test is restarted and the unit has reached dispatched load, the clock shall be restarted at the number of hours achieved just before the shutdown or derating occurred. The achievement of the Reliability Factor is based upon the anticipated operating parameters of the Project (e.g., duty cycle, fuel specifications etc.) specified in the Contract.

A-3.3.3.2 Seller shall not be liable for the outage hours arising from Buyer's failure to adhere to the operating manuals, instruction manual and other written operational recommendations of the Seller. If the unit is shut down or is derated due to any of the reasons listed above, the test will be interrupted for the duration of the shut down or derating. When the test is restarted and the unit has reached dispatched load, the clock shall be restarted at the number of hours achieved just before the shutdown or derating occurred, except as stated above.

A-3.3.3.3 Buyer shall maintain an operator log sheet, following a mutually agreeable format, indicating in detail performance parameters, cycles, and maintenance actions. Buyer shall report key performance parameters to the Seller on a daily basis. Seller shall be entitled to inspect the operator log sheet.

A-3.3.3.4 Seller shall have a field representative present during performance of the Reliability Test.

A-3.3.3.5 The Buyer shall use all reasonable efforts to notify the Seller as soon as possible following any forced outage or if the unit is incapable of achieving a target load within the minimum allowable load to base load capabilities of the unit.

A-3.3.3.6 To the extent forced outage hours are accumulating due to remedial actions for which Seller is not responsible, Buyer shall perform such remedial actions diligently.

A-3.3.3.7 Within 45 days of completion of a successful Reliability Test, the Seller shall provide a written report to Buyer detailing the results of the test, calculations of corrected output and calculations of the Reliability Factor, including a notification of Reliability Factor guarantee compliance.

A-3.4 PROJECT DEMONSTRATION TEST

A-3.4.1 Load Demonstration Tests

A-3.4.1.1 The Seller shall demonstrate the following load carrying capability no later than 12 months after Substantial Completion.

Formatted: Indent: Left: 0"

A-3.4.1.1.1 The combustion turbine operating at manufacturer's minimum turndown load within emissions compliance and with steam turbine in operation.

A-3.4.1.1.2 Steam bypass operation with the combustion turbine operating at base load with steam turbine in full bypass and duct burners off.

A-3.4.1.2 The load demonstration test shall be considered successful if the adjusted Plant load is accomplished for a minimum period of one hour with controls in normal automatic mode, emissions that are in compliance with the Guaranteed Emission Limits herein, and all loops remain within the design operating parameters of the Plant.

A-3.4.2 Turbine Run Back and Trip Testing

A-3.4.2.1 Turbine Run Back and Trip Test to be completed no later than 12 months after Substantial Completion will be designed to demonstrate plant response to the trip of a major balance of plant component, run back to reduced load, and Plant operation under individual combustion turbine and steam turbine trip conditions. The test shall be considered successful if the trip response and load runback is accomplished with controls in normal automatic mode and emissions are in compliance with the Guaranteed Emission Limits except operation below MECL, MSS and, all critical process parameters are maintained within defined operating limits and remain stable during transition and continuous load conditions.

A-3.4.2.2 The test scenarios to be demonstrated shall be conducted at the maximum Net Electrical Output and include:

A-3.4.2.2.1 Trip of one (1) closed cooling water pump. Standby pump starts. The combustion turbine and steam turbine shall maintain their current load. A successful test is demonstrated by maintaining their current load for two (2) hours and all control loops shall remain in automatic during this two (2) hour period.

~~A-3.4.2.2.1~~A-3.4.2.2.2 Not Used

~~A-3.4.2.2.2 Trip of one (1) boiler feedwater pump. Standby pump starts. Combustion turbine and the steam turbine shall maintain their current load. A successful test is demonstrated by maintaining the current load for two (2) hours and all control loops shall remain in automatic during this two (2) hour period.~~

A-3.4.2.2.3 Trip of one (1) condensate pump. Standby pump starts. Combustion turbine and the steam turbine shall maintain their current load. A successful test is demonstrated by maintaining the current load for two (2) hours and all control loops shall remain in automatic during this two (2) hour period.

A-3.4.2.2.4 Trip of the steam turbine while operating at maximum Net Electrical Output defined as the combustion turbine operating at base load and the steam turbine in operation with no bypass. A successful test is demonstrated by the combustion turbine remaining at the combustion turbine's maximum Net Electrical Output, and the steam bypass valves going into service with duct burners off. This operating condition shall be maintained for two (2) hours and all control loops shall remain in automatic during this two (2) hour period.

Formatted: Indent: Left: 0"

A-3.4.3 CTG Islanding Mode Demonstration Test

A-3.4.3.1 The Seller shall perform an Islanding Mode Demonstration Test no later than 12 months after Substantial Completion. This test will demonstrate the CTG control capability for an Islanding Mode event. The Islanding Mode allows the CTG unit to continue operating in the event that the transmission grid (or bulk power system) is lost due to an outage (e.g. blackout). The test shall be considered successful if the event for islanding mode is accomplished and CTG is maintained operational for two (2) hours followed by synchronizing back to the transmission system. During this test, or during islanding mode operation, the emissions are not in compliance with the Guaranteed Emission Limits or Minimum Emission Compliance Limits (MECL)

A-3.4.4 Plant Operating Startup Demonstration Test

Seller shall define and demonstrate plant operating startup times and durations prior to Substantial Completion. Demonstration of tests must be done with all control loops in automatic, the unit shall not runback or trip, and all loops shall remain within the operating parameters of the plant.

A-3.4.4.1 The time limits for each Plant condition from combustion turbine flame on to valves wide open (HP and IP) on the steam turbine at the HRSG maximum condition with steam turbine bypass valves fully closed and duct burners off are as follows:

Hot Startup	Less than two-and-a-half (2.5) hours
Warm Startup	Less than four-and-a-half (4.5) hours
Cold Startup	Less than six-and-a-half (6.5) hours

A-3.4.4.2 The time limits from combustion turbine flame on to the SCR reaching functional temperature for formaldehyde emission mitigation shall be less than three (3) hours.

A-3.4.5 Plant Operating Shutdown Demonstration Test

A-3.4.5.1 Seller shall define and demonstrate lx1 Plant operating shutdown times and durations prior to Substantial Completion. Demonstration of tests must be done with all control loops in automatic, the unit shall not runback or trip, and all loops shall remain within the operating parameters of the Plant.

A-3.4.6 NERC Compliance Testing

A-3.4.6.1 Seller to perform NERC compliance testing to the latest NERC Standards that are in effect at the time of Contract execution. This testing shall include NERC-MOD-025, -026, and -027. Testing documentation in accordance with the NERC standard and test equipment certifications shall be provided to the Buyer.

A-3.4.7 MISO Generation Verification Test Capacity (GVTC)

Formatted: Indent: Left: 0"

A-3.4.7.1 Seller shall perform a four-hour Net Electrical Output test conducted without cycle isolation prior to Substantial Completion. MISO generation capacity and test method shall be mutually agreed upon between Seller and Buyer.

A-3.4.8 MISO Automatic Generation Control (AGC) Closed Loop Demonstration Test

A-3.4.8.1 Seller shall demonstrate ability to follow AGC by conducting a two-hour test with MISO sending the unit dispatched loads prior to Substantial Completion.

END OF ATTACHMENT A-3

BOT Scope Book
Attachment A-4
Project Requirements and Design Criteria

Table of Contents

Formatted: Check spelling and grammar, Not All caps

Formatted: Header, Tab stops: Not at 1.19"

A-4.1 PROJECT REQUIREMENTS

This section describes the scopes of work assigned to the respective Parties, the schedule for performance of the Project, the methods for establishment of detailed construction schedules, and the general requirements of the CCCT Project.

A-4.1.1 The Project is based on the use of air-cooled natural gas fired combustion turbine(s) with the associated heat recovery steam generator(s) with duct firing and an SCR, and one (1) steam turbine generator in a multi-shaft Combined Cycle Combustion Turbine (CCCT) configuration.

A-4.1.2 An air-cooled condenser will be used for steam cycle heat rejection and recovery of condensate. The Facility closed cooling water system will utilize an air-to-water radiator for heat rejection. Local heat rejection will be accomplished via dedicated fin-fan coolers.

A-4.1.3 The Project requires new Administration/Control, Demin/Wastewater Treatment, Steam/Water Sampling, Fire Pump, and Warehouse buildings. New Fire/Service Water and Demineralized Water tanks shall be field erected.

A-4.1.4 The Projects actual Heat Balance load cases be based on meteorological data specified in this attachment. The Seller will be responsible for providing revised heat balance load cases based on site data.

A-4.1.5 Redundancy shall be built into the Facility design. In general, the failure of a single piece of equipment should not cause a reduction in plant electric generation. Major Equipment may be provided without full redundancy based on space availability, functional requirements, and operating experience, in accordance with the OEM's standard package arrangement.

A-4.1.6 The Project shall be designed for local operation as the primary operating method, with capability for remote operation.

Seller's design and engineering shall incorporate the Design for Safety principles. Design for Safety focuses on the early identification of potential construction, maintenance and operating personnel safety and health hazards; and eliminating or reducing these hazards through the design and engineering details. The designs supporting these principles include, but are not limited to:

- Addition of permanent safety eyewash and shower stations
- Use of permanent anti-slip ladder rungs
- Access stairs with a 11" minimum tread depth and 7" maximum riser height
- Locating components and instruments requiring routine access to be accessible from grade or platforms

A key component in Design for Safety includes regularly holding detail design reviews and soliciting input from the Buyer.

A-4.1.7 The Seller shall engineer, procure, design, build, construct, commission and test a complete, fully operational combined cycle generating plant in compliance with the contract requirements, applicable laws and permits. The scope is intended to include all work requirements for the Project except for those expressly stated herein as being completed by Buyer. Seller's complete scope of Work shall include the tasks identified in this specification. A summary of the Seller's scope of Work shall include, but is not to be limited to, the following.

A-4.1.8 Combustion turbine-generator (CTG) unit(s): unit shall be complete with all auxiliary equipment, accessories, and appurtenances (see Section A-17) and shall operate on pipeline natural gas only. The CTG shall be provided with dry low NOx combustors and evaporative inlet air cooling system. The OEM control system shall be provided for the CTG.

A-4.1.9 Heat recovery steam generator (HRSG) unit: three pressure, horizontal gas flow, reheat HRSG with duct firing system, selective catalytic reduction (SCR) system, NO_X/CO catalyst, exhaust stack and all necessary accessories and appurtenances (see Attachment A-18).

A-4.1.10 Steam turbine-generator (STG) unit: reheat, condensing side-exhaust steam turbine unit with all necessary accessories and appurtenances (see Attachment A-19). The OEM control system shall be provided for the STG.

A-4.1.11 Generator step-up transformers: three-phase, two winding, 60 Hz, step- up, outdoor, oil-immersed type, cooling class ONAN/ONAF/ONAF with all necessary accessories and appurtenances (see Attachment A-21).

A-4.1.12 Steam condenser/condensate system: air cooled condenser with all necessary accessories and appurtenances for normal operation and steam turbine bypass conditions. System will include a condensate collection tank and condensate pumps, air ejector system, and a fin cleaning system.

A-4.1.13 Closed Cooling water system: closed cooling water pumps, air cooled fin-fan heat exchangers, and associated chemical feed equipment.

A-4.1.14 Critical piping systems: High Pressure Steam (HPS), Cold Reheat Steam (CRS), Intermediate Pressure Steam (IPS), Hot Reheat Steam (HRS), and Low-Pressure Steam (LPS) piping including safety relief valves, boiler feed piping, boiler feed pump including recirculation system, and steam turbine bypass piping including steam conditioning and pressure reducing valves.

A-4.1.15 Fuel gas supply system includes fuel gas conditioning, metering equipment, filters, drain tanks, strainers, pressure and flow control valves, dewpoint and performance heaters and all interconnecting piping and valves. Fuel gas compression is not included in the scope of work.

A-4.1.16 Aqueous ammonia unloading, storage and distribution including all pumps and interconnecting piping and valves.

A-4.1.17 Raw water source shall be determined by Seller.

A-4.1.18 Potable Water source to be determined by Seller.

A-4.1.19 Balance of mechanical systems for a complete Project.

A-4.1.20 Seller shall provide all hydrogen and carbon dioxide interconnecting piping, valves, electrical and instrumentation.

A-4.1.21 Seller shall provide one (1) Carbon Dioxide Storage Tank along with necessary equipment as outlined in Section A-6.

A-4.1.22 Electrical systems, components, and equipment up to and including the connection to the Termination Points shall be provided, including but not limited to the following:

A-4.1.22.1 Dead-end structures at the GSUs for connection to high voltage transmission lines

A-4.1.22.2 Motorized disconnect and ground switches for both sides of owner supplied high voltage circuit breakers.

A-4.1.22.3 Generator circuit breakers and associated disconnects.

A-4.1.22.4 Generator Step Up and Unit Auxiliary transformers.

A-4.1.22.5 MV/LV switchgear and motor control centers

A-4.1.22.6 Isolated phase bus duct with supports

A-4.1.22.7 Non-segregated bus or cable bus with supports

A-4.1.22.8 Protective relaying and metering

A-4.1.22.9 Lighting

A-4.1.22.10 Batteries, chargers, and Uninterruptible Power Supply (UPS)

A-4.1.22.11 Station Direct Current (DC) distribution system

A-4.1.22.12 Communications between the Facility Switchyard and DCS

A-4.1.22.13 Cathodic protection and grounding systems

A-4.1.22.14 Standby Diesel Generator

A-4.1.22.15 Balance of electrical systems for a complete Project

A-4.1.23 Control and instrumentation systems, components and equipment shall include, but not be limited to, the following:

A-4.1.23.1 Combustion Turbine Generator (CTG) control system

A-4.1.23.2 Steam Turbine Generator (STG) control system

A-4.1.23.3 HRSG direct reading drum level indicators

A-4.1.23.4 Continuous emissions monitoring system (CEMS)

A-4.1.23.5 Facility DCS, including all necessary supervisory, control and data acquisition systems.

A-4.1.23.6 I&C and metering equipment

A-4.1.23.7 Control room equipment including:

A-4.1.23.7.1 Control systems consoles (desks) for separate operator and engineering HMIs associated with the CTG controls, STG controls, BOP DCS controls, CEMS Data Acquisition System (DAS), remote operation communications equipment, select control system servers, etc.

A-4.1.23.7.2 All hard-wired backup systems for CTG and STG emergency trip as required by code.

A-4.1.23.7.3 Main Fire Alarm Control Panel and interconnection with local panels and detectors

A-4.1.23.8 All Facility local instrumentation

A-4.1.23.9 All alarms, sirens, local fire panels and detectors; local and wide area network fiber and raceway extending to all Project buildings and enclosures; telecommunication cable; and Critical Infrastructure interconnecting cable, fiber and raceway to all secure access gates, doors, enclosures, and panels.

A-4.1.23.10 Balance of I&C systems for a complete Project

A-4.1.24 Civil/Structural/Architectural Work shall include, but not be limited to, the following:

A-4.1.24.1 Project site preparation and surveying

A-4.1.24.2 Additional Geotechnical investigation(s) if required.

A-4.1.24.3 Excavation

A-4.1.24.4 Bedding and backfill.

A-4.1.24.5 Sanitary piping and lift stations

A-4.1.24.6 Storm and Plant drainage systems

A-4.1.24.7 Stormwater Layout Plan drawing to be provided by Seller.

A-4.1.24.8 Construction of all temporary roads and hard standings required within the temporary and permanent work areas, and of the permanent roads.

A-4.1.24.9 All piles (if required), rigid inclusions (if required), soil improvements (if required), reinforced concrete slabs and foundations for all Project components and buildings.

A-4.1.24.10 All necessary embedment's, anchor bolts, shear bars, and baseplates

A-4.1.24.11 Pre-engineered buildings, enclosures and HVAC required for compliance with interior temperature and humidity specifications.

A-4.1.24.12 Guard shack and electric power.

A-4.1.24.13 Architectural components and features for all buildings within the scope of supply

A-4.1.24.14 Steel structures including support steel, pipe racks, platforms, handrail, stairs, and ladders.

A-4.1.24.15 Concrete masonry walls.

A-4.1.24.16 Asphalt roads and area surfacing.

A-4.1.24.17 Fencing and gates.

A-4.1.24.18 Road for deliveries.

A-4.1.24.19 Repair of roads, transportation routes, infrastructure, public and private property, and areas on-site and off-site, damaged by the Seller directly or as a result of high usage and excessive shoulder use.

A-4.1.24.20 Balance of civil / structural systems to complete the Project.

A-4.1.24.21 The Process Wastewater discharge location and all required permitting.

A-4.1.25 Project Conditions

A-4.1.25.1 Seller shall not interrupt utilities serving facilities occupied by Buyer or others unless permitted in writing by Buyer and then only after arranging to provide temporary utility services according to requirements indicated.

A-4.1.25.2 If Seller uncovers any unmarked or unknown facilities during excavation, Seller shall report findings to Owner and receive instructions before proceeding.

A-4.1.25.3 The Seller shall make a thorough field check of the affected areas of the Project site for the purposes of verifying existing conditions that may affect the Work, such as possible errors in work done by others, and dimensions and other matters relating to the interconnections of the Work with the work of others.

A-4.1.25.4 The Seller's Work shall include a thorough investigation of the potential interferences and difficulties that it may encounter in the proper and complete execution of the Work, including the field location and identification of underground or embedded utilities within and adjacent to the limits of the construction. The Seller shall advise the Buyer immediately of the discovery of any conditions, including the existence of underground or embedded utilities or structures that may affect the timely and safe execution of the Work.

A-4.1.25.5 When excavated and/or exposed soil is thought to be contaminated, Contactor shall immediately notify the Buyer for resolution prior to proceeding.

A-4.1.26 Construction, Start-Up, and Commissioning Services:

A-4.1.26.1 Permitting and permitting support, including providing to Buyer information, preliminary design data, commissioning, testing, and operating details needed by the agencies to obtain operating permits, including all testing, reporting and verification.

A-4.1.26.2 Distribution of construction power from low-side terminals of Seller's construction power transformer.

A-4.1.26.3 Construction power transformer primary side drop and usage meter by Buyer; primary underground raceway and wire, secondary raceway wiring, and all

secondary equipment, wiring, and raceways by Seller. Transformer, foundation, and containment (if required) to be provided by Seller.

A-4.1.26.4 Seller is responsible for supply of demineralized water to support start-up and commissioning functions. Rental of demineralizer trailers is acceptable.

A-4.1.26.5 All temporary facilities, services, and utilities for staff and construction, including office trailers, remote parking, secure remote laydown, equipment, and facilities. See Section A-10

A-4.1.26.6 Security for construction site

A-4.1.26.7 Temporary security fencing and gates including temporary fencing and gates that will become permanent.

A-4.1.26.8 Tie-ins as noted in Attachment A-11

A-4.1.26.9 Daily Project site clean-up through the Substantial Completion; waste disposal and other services through Final Acceptance

A-4.1.26.10 Maintenance of site safety

A-4.1.26.11 Transport, packing, protection, preservation, customs clearance, unloading handling and storage of materials and equipment, per manufacturer's recommendation and procedures.

A-4.1.26.12 Obtaining construction and transportation related licenses, permits, and authorizations, including those offsite

A-4.1.26.13 Painting and protective coatings, including field finish and touch-up painting.

A-4.1.26.14 Water treatment equipment and rentals needed to support the construction, startup, and commissioning through Substantial Completion.

A-4.1.26.15 Manufacture, fabrication, and factory testing and inspections.

A-4.1.26.16 On-site testing, inspections, and verifications

A-4.1.26.17 Electrical and plumbing connections for Buyer's temporary facilities (installed by Seller)

A-4.1.26.18 Removal of temporary works after main works are completed.

A-4.1.26.19 Operational and maintenance spare parts through the Substantial Completion

A-4.1.26.20 Special tools and equipment for testing and maintenance

A-4.1.26.21 All necessary lifting and handling equipment (including necessary hoists and lifting beams) for operation and maintenance.

A-4.1.26.22 Formal and structured operation and maintenance training services

A-4.1.26.23 Equipment preventive maintenance in accordance with OEM requirements and first fill and topping off of oils, lubricants, gases, and other consumables through Substantial Completion. Seller shall ensure that all gases can be purchased by

Buyer. Seller shall ensure tank levels shall be at least 90% full at Substantial Completion.

A-4.1.26.24 Seller shall provide Buyer with documentation of all preventive maintenance work performed prior to Substantial Completion including preventative maintenance work performed while equipment is in storage or laydown.

A-4.1.26.25 Cleaning, flushing, testing, check-out, pre-commissioning, commissioning, start-up, and performance testing services in accordance with manufacturer's recommendations and test procedures developed for the Project, prior to the Substantial Completion and turnover.

A-4.1.26.26 Construction power transformer as required to support needs. Primary to be supplied from the local distribution system

A-4.1.27 Responsibilities of Buyer:

The services, equipment, system(s), and/or structures listed below shall be excluded from the Seller's Scope of Work and will be provided by Buyer/Others:

A-4.1.27.1 Securing environmental permits, easement approvals, letters of no objection, government approvals, and operating licenses that will be held by the Buyer. Seller shall copy Buyer on all correspondence of site development permit applications (e.g., storm water management), submit corresponding meeting notes to Buyer, and their status within their respective jurisdiction permitting process.

A-4.1.27.2 Buyer provided hydrogen tube trailers.

A-4.1.27.3 Delivery, supply, and management of fuel gas consumed in Commissioning, startup, and operations.

A-4.1.27.4 Buyer shall provide primary side wiring to the metering/dip pole for the construction power transformer.

A-4.1.27.5 Transmission interconnection studies.

A-4.1.27.6 Generator tie lines and any work within existing substations.

A-4.1.27.7 Spare parts for Buyer's inventory

A-4.1.27.8 Coordinating the work activities of Buyer working on Buyer's Site, whether or not related to this Project. NOTE: Seller will be required to participate in the Buyer's interface management program.

A-4.1.27.9 Water rights and consent, connection fees, and water supply metering for the permanent and construction supply of water to the site

A-4.1.27.10 Rights-of-way to the Facility Site

A-4.1.27.11 Furnish and install as part of the telephone/commination system (LAN) telecom racks, electronic equipment, and telephones; servers, switches, and routers; and network cabinet Ethernet and fiber patch cables within cabinets.

A-4.1.27.12 Buyer will provide the remote terminal unit (RTU) cabinets. Seller shall install the cabinets and supply and install all interface cabling with plant equipment. Buyer will provide the RTUs, programming, and make final connections.

A-4.1.27.13 Buyer will provide Seller specifications for the revenue metering cabinets. Seller shall supply and install the cabinets and all interface cabling with plant equipment. Buyer will provide the meters, programming, and make final connections to the metering.

A-4.1.27.14 Buyer will be responsible for the specification of security hardware and software. Buyer will be responsible for the supply and installation of badge readers, cabling, servers, and required software. Buyer will be responsible for the supply and installation of all security cameras, cabling, and associated servers. The Seller shall ensure that all buildings are equipped with the necessary space allocation needs, power supply, conduit, fiber, and power wiring to facilitate the Buyer's installation. The Seller shall supply and install camera poles, foundations, and conduits to these poles as necessary to accommodate the design.

A-4.1.27.15 The Buyer will provide fuel (natural gas, diesel for the permanent diesel generators and fire pump), water, ammonia, CO_2, H_2 and water treatment chemicals through Substantial Completion. The Seller will be responsible for greases, lube oils, hydraulic fluids, calibration gases, demin trailers, N_2, glycol, high voltage breaker SF6 gas, chemicals for the HRSG clean, analyzer reagents and other consumables through Substantial Completion.

A-4.1.28 Abbreviations

AC – Alternating Current

AGC — Automatic Generation Control

AMS — Asset Management System

BFW — Boiler Feedwater

BTU — British Thermal Unit

CEMS — Continuous Emissions Monitoring System

CO — Carbon Monoxide

CO2 — Carbon Dioxide

CPM — Critical Path Method

CQP — Construction Quality Procedure

CRS – Cold Reheat Steam

CSA – Civil, Structural, Architectural

CTG – Combustion Turbine (CT) Generator

CS – Carbon Steel

CSP – Construction and Startup Procedures

CWA – Clean Water Act
DAS – Data Acquisition System
DC – Direct Current
DCS – Distributed Control System
DTN – Design Traffic Number
FTE – Full Time Employees and Equivalent
gpm – Gallons per Minute
GSU – Generator Step-up
H2 – Hydrogen Gas
HHV – Higher Heating Value
HMI – Human Machine Interface
HP – High Pressure
HPS – High Pressure Steam
HRS – Hot Reheat Steam
HRSG – Heat Recovery Steam Generator
HVAC – Heating, Ventilating, and Air Conditioning
I&C – Instrumentation and Controls
IFA – Issued for Approval
IFB – Issued for Bid
IFC – Issued for Construction
IFD – Issued for Design
IFF – Issued for Fabrication
IFI – Issued for Information
IFP – Issued for Purchase
IFR – Issued for Review
IMS – Integrated Master Schedule
IPB – Isolated Phase Bus
IP – Intermediate Pressure
IPS – Intermediate Pressure Steam
kV – Kilovolt
kW – Kilowatt
kWH – Kilowatt Hour

LHV – Lower Heating Value
LNTP – Limited Notice to Proceed
LP – Low Pressure
LPS – Low pressure steam
MCC – Motor Control Center
MECL – Minimum Emission Compliant Load
MW – Megawatt
N2 – Nitrogen
NECF – Net Electrical Capacity Factor
NOx – Nitrogen Oxides
NTSM – Notice to Start Mobilization
OEM – Original Equipment Manufacturer
P&ID – Piping and Instrumentation Diagram
PCV – Pressure Control Valve
PDC – Power Distribution Center
PEP – Project Execution Plan
PMB — Performance Measure Baseline
PM10 — Particulate Matter 10 Microns Diameter and Less
PM2.5 — Particulate Matter 2.5 Microns Diameter and Less
ppmvd — Parts per Million, Volumetric Dry
PRV — Pressure Relief Valve
PLC — Programmable Logic Controller
PSF — Pounds per Square Feet
psia — Pounds per Square Inch Absolute
psig — Pounds per Square Inch Gauge
PTC — Performance Test Code, ASME Publication
QA/QC — Quality Assurance/Quality Control
QMS — Quality Management System
RGS — Rigid Galvanized Steel Conduit
RTD - Resistance Temperature Detector
SCR — Selective Catalytic Reduction for NOx Control
SFC — Static Frequency Converter

SO2 — Sulfur Dioxide

SRV — Safety Relief Valve

ST — Steam Turbine

STG — Steam Turbine Generator

TCS — Turbine Control System

UAT — Unit Auxiliary Transformer

UL — Underwriters Laboratories

UPS — Uninterruptible Power Supply

VOC — Volatile Organic Compounds

WBS — Work Breakdown Structure

A-4.1.29 Definitions:

A-4.1.29.1 Air Emissions Standards — Air Emissions Standards are legal requirements governing air pollutants released into the atmosphere that set quantitative limits on the permissible amount of specific air pollutants that may be released from specific sources over specific timeframes. The Air Emissions Standards for the Project will be set forth in the federal/state air permit(s) issued for the Project.

A-4.1.29.2 Air Emissions Tests (and Air Emissions Testing Procedures) — "Air Emissions Tests" means the testing required to demonstrate that emissions are within the Guaranteed Emission Limits as specified in Attachment A-3 "Air Emissions Testing Procedures" are the Air Emissions Tests procedures to be developed by the Seller.

A-4.1.29.3 Baseline Schedule — The Level III CPM Project Schedule to be prepared by Seller, subject to Approval by Buyer.

A-4.1.29.4 Commissioning — All activities that occur on Project systems after the completion of construction such as equipment checkout, testing, flushes, preliminary and initial operation, and functional testing prior to system turnover to Buyer and prior to the Performance Test.

A-4.1.29.5 Demonstration Test – The tests specified in Section Attachment A-3 to demonstrate the capability and response of the plant. The Demonstration Test consists of the separate and discrete tests that are defined as follows:

A-4.1.29.5.1 Load Demonstration Tests - The tests specified in Attachment A-3,

A-4.1.29.5.2 Turbine Run Back and Trip Testing - The tests specified in Attachment A-3,

A-4.1.29.5.3 CTG Islanding Mode Demonstration Test - The test specified in Attachment A-3,

A-4.1.29.5.4 Plant Operating Startup Demonstration Test - The test specified in Attachment A-3,

A-4.1.29.5.5 Plant Operating Shutdown Demonstration Test - The test specified in Attachment A-3,

A-4.1.29.5.6 NERC Compliance Testing - The test specified in Attachment A-3,

A-4.1.29.5.7 MISO Generation Verification Test Capacity (GVTC) as specified in Attachment A-3,

A-4.1.29.5.8 MISO Automatic Generation Control (AGC) test as specified in Attachment A-3,

A-4.1.29.6 Full Notice to Proceed (FNTP) - Refer to BOT Term Sheet for definition.

A-4.1.29.7 Guaranteed Emission Limits – Refer to BOT Term Sheet for definition.

A-4.1.29.8 Guarantee Test Conditions - The conditions to which the as-tested Net Electrical Output and Net Plant Heat Rate values, determined during the Performance Test, shall be corrected.

A-4.1.29.9 Limited Notice to Proceed (LNTP) – Refer to BOT Term Sheet for definition.

A-4.1.29.10 Mechanical Completion – Refer to BOT Term Sheet for definition.

A-4.1.29.11 Net Electrical Output (NEO) - The net Project electrical output (kW) as measured at the high voltage side of the GSU transformers.

A-4.1.29.12 Net Plant Heat Rate (NPHR) - The net Project heat rate HHV (BTU/kWH) defined as the total fuel heat consumption (HHV) divided by the Net Electrical Output.

A-4.1.29.13 Notice to Start Mobilization (NTSM) – Refer to BOT Term Sheet for definition.

A-4.1.29.14 Performance Guarantee – The guaranteed Net Electrical Output and Net Plant Heat Rate, as specified in Attachment A-3.

A-4.1.29.15 Performance Test – The test to measure Net Electrical Output and Net Plant Heat Rate for purpose of correction to the Guarantee Test Conditions and comparison to the Performance Guarantee

A-4.1.29.16 Project Schedule — Also referred to as the Integrated Master Schedule or IMS, the Project Schedule is a linked network of time phased Project-planned discrete activities keyed to contractual requirements and the Project's statement of Work, and shall contain critical target dates, Project milestones, contractual events, Project decision points, deliverables and their related activities to plan, status, and monitor progress of the Work.

A-4.1.29.17 Qualitative Risk Analysis (QRA) – A project management technique concerned with discovering the probability of a risk event occurring and the impact the risk will have if it does occur.

A-4.1.29.18 Reliability Test - Refer to BOT Term Sheet for definition.

A-4.1.29.19 Reliability Factor (RF) — The calculated reliability factor used to determine the success of the Reliability Test.

A-4.1.29.20 Specifications — Documents providing a detailed and precise description of characteristics and features.

A-4.1.29.21 Start of Commissioning — Date of first turnover by Seller's construction department to Seller's commissioning department for Commissioning

A-4.1.29.22 Substantial Completion - Refer to BOT Term Sheet for definition.

A-4.1.29.23 Water Effluent Discharge Limits - Enforceable parameters that dictate the amount of pollution a facility may discharge on a designated Outfall basis as set forth in the Federal/State Pollutant Discharge Elimination System Permit (NPDES)

A-4.2 GENERAL REQUIREMENTS

A-4.2.1 Responsibilities following LNTP:

A-4.2.1.1 During the LNTP period, Seller shall prepare the overall, comprehensive Project Execution Plan (PEP) and provide to Buyer for review. Seller shall be responsible for establishing the work breakdown structure (WBS), Project Schedule development, Project Controls Systems setup, and engineering activities to support purchase of equipment and early construction activities scheduled to follow FNTP.

A-4.2.1.2 Seller shall implement an enterprise collaboration software package and provide training and access to Buyer and parties designated by the Buyer for generating, managing, and logging Project communication, requests for information, releases of engineering and design deliverables, comments, and resolution of comments on deliverables, etc.

A-4.2.1.3 Seller shall perform a multi-day detailed planning session to further expand the logic of the Project Schedule. The planning session will address Engineering, Procurement, Subcontracts, Construction, Commissioning, Safety, and Project Management. Thereafter, Seller and Buyer shall participate in a Level III Schedule and Schedule Basis QRA.

A-4.2.1.4 Seller shall commence all Engineering, construction planning, and permitting activities as necessary.

A-4.2.1.5 Seller may execute releases to Others, including the Major Equipment manufacturers for engineering, material orders and fabrication, as required to support delivery dates.

A-4.2.1.6 Access to the Site shall be granted by Buyer and Seller shall be allowed to mobilize to site, as necessary, to perform the following activities prior to receipt of NTSM:

A-4.2.1.6.1.a Perform any activities including, but not limited to: geotechnical, geophysical, and site survey work. The Buyer needs to approve activities prior to commencement.

A-4.2.1.7 Seller shall notify Buyer 30-days prior to the planned date of full mobilization. On receipt of a NTSM, Seller shall be permitted to commence full mobilization of

construction personnel to the site and perform clearing and grubbing including tree removal and shredding. Seller shall also be released to begin all major site grading activities.

A-4.2.2 Seller is responsible for developing the construction and design basis arrangements for temporary facilities and the development of a Project laydown area drawing. The Project laydown area drawing shall be based on Plant Arrangement layouts. The Project laydown area drawings shall show fabrication/work areas, temporary parking areas, temporary facility trailers & buildings, temporary fencing and temporary equipment storage based on the conceptual arrangements Changes to the conceptual arrangements shall be mutually agreeable to both Seller and Buyer.

A-4.2.3 Seller is responsible for developing a Project Extents Drawing showing the extent of the Project Work Area. The Project Extents Drawing shall be based on Plant Arrangement Layout.

A-4.2.4 Operating Requirements

A-4.2.4.1 The Facility shall operate reliably, safely, and efficiently during the Facility's design life and in accordance with all terms herein. The adequacy of the overall system design to meet these requirements is the responsibility of the Seller.

A-4.2.4.2 The Facility shall be designed for cycling, partial and baseload operation while maintaining compliance with the Guaranteed Emission Limits. The definition of cycling generally follows industry standards and, as a minimum, includes the following:

A-4.2.4.2.1 Two shifting operation where the Facility experiences daily startup and shutdown

A-4.2.4.2.2 Load following operation where the output of the Facility will vary significantly to provide regulation and other ancillary services.

A-4.2.4.2.3 Sporadic operation where the Facility may be shut down for extended periods, and upon startup, operate for extended periods.

A-4.2.4.3 The Facility shall be capable of operating in all of the above modes while maintaining compliance with the Guaranteed Emission Limits.

A-4.2.4.4 During unit shutdowns, the residual heat within the HRSG shall be used to provide auxiliary steam to maintain condenser vacuum and STG sealing steam for Hot Starts. It is the intent to maintain vacuum and sealing steam as long as possible during Warm Start, limited by residual heat in the HRSG.

A-4.2.4.5 In addition, the Units shall be capable of frequent startups and shutdowns as well as occasional load trips. The intended profile for starts and hours of operation is as follows.

A-4.2.4.5.1 Starts per year:

No. of Cold Starts (for the CTG(s) and the STG): 10/year
Offline > 64 hours, including ambient rotor conditions

No. of Ambient Starts (for the CTG(S) and the STG):
10/year

No. of Warm Starts (for the CTG(s) and the STG): 40/year
Offline > 8 hours and < 64 hours

No. of Hot Starts (for the CTG(s) and the STG): 200/year
Offline < 8 hours

No of combustion turbine(s) starts (CT): 250/year

The HRSG shall accommodate quantity of starts, with HRSG starts defined based upon the HP drum conditions.

A-4.2.4.5.2 Hours of operation: up to 8,760 hrs./yr. for the CTG(s), HRSG(s) and STG

A-4.2.4.6 The Facility will be capable of operating without restriction during winter ambient and summer ambient conditions defined in this Attachment.

A-4.2.4.7 The facility shall be capable of long-term operation at any CTG load condition above MECL, and short-term operation at any CTG load condition below MECL. In addition, the Facility shall be capable of operating over the range of CTG MECL to full load with duct burners(if supplied) in service under AGC in compliance with the Guaranteed Emission Limits herein.

A-4.2.4.8 The Facility shall be capable of safe, reliable, stable, and efficient operation in AGC while in compliance with the Guaranteed Emission Limits and noise limits. Plant design shall take into account the operating modes included in the Preliminary Heat Balances provided by Seller.

A-4.2.4.9 Islanding Mode Operation: in the event of a transmission grid disturbance/blackout, the plant shall automatically isolate from the grid and continue to operate with the CTG unit producing power for house loads on an indefinite basis, as described in Attachment A-7.

A-4.2.5 Engineering and Design

A-4.2.5.1 Seller shall engineer and design the Project in accordance with this specification.

A-4.2.5.2 The intent of this specification is to provide Seller with minimum requirements for plant design. Seller shall optimize the plant during detailed design phase, while meeting the minimum requirements herein.

A-4.2.5.3 Overall facility design shall be optimized for the CTG exhaust gas conditions over the full range of operating conditions. Plant operation mode of 1x0, 1x1, and 2x1 (if applicable) with supplemental firing (if supplied) shall be controllable. This shall include optimization of the HRSG attemperators / desuperheaters.

A-4.2.5.4 Safety shall be a primary and ongoing engineering and design consideration, including attention to the safety of operators, maintenance personnel, and Project and construction staff. Adequate lighting, ventilation and noise dampening shall

be incorporated into operation and maintenance spaces. Seller shall comply with OSHA requirements.

A-4.2.5.5 Overall facility design shall minimize operator surveillance. All systems and equipment shall be operable from the control room under normal operating conditions. This includes daily startups from CTG minimum emissions compliant load to full load, as well as shutdowns. Local operator intervention for extended duration shutdowns is acceptable.

A-4.2.5.6 Seller shall develop overall plant heat balances based upon the site conditions in this Attachment. Seller shall incorporate the CTG, HRSG and STG equipment thermal design characteristics into an overall Plant heat balance model.

A-4.2.5.6.1 Seller shall develop, at minimum, heat balance cases based upon the site conditions in this Attachment for minimum, average, and maximum temperatures and humidity, ISO conditions, MECL and Guarantee (97F / RH56%) cases to establish a basis for plant operation for the various range of ambient conditions, GT load, Evaporative Cooler status, Duct Burner status, and STG on at its maximum capability for each case except for ones that indicate ST Bypass.

A-4.2.5.6.2 Seller shall include an allowance for up to 10 additional heat balance cases.

A-4.2.5.7 Seller shall develop and provide the following four (4) water balance cases based upon the site conditions in this Attachment:

A-4.2.5.7.1 Annual Average

A-4.2.5.7.2 Summer Average

A-4.2.5.7.3 Summer Extreme

A-4.2.5.7.4 Winter Extreme

~~A-4.2.5.7.4~~A-4.2.5.7.5 Min/Max Flow cases for permitting (not time averaged)

A-4.2.5.8 Seller shall be responsible for assuring that any Specifications prepared by Seller for the Project provide adequate and accurate information. Seller is responsible for assuring that its Subcontractors deliver their respective scopes of supply in a manner that will be consistent with Seller's warranty and Project Performance Guarantees.

A-4.2.5.9 All engineering work including studies, reports, designs, calculations, drawings and specifications for procurement and construction shall be sealed in accordance with the regulations of the State in which the Project is located.

A-4.2.5.10 All designs and Specifications prepared by Seller shall be consistent with Seller's warranty and the Project Performance requirements.

A-4.2.5.11 Project 3D Model

A-4.2.5.11.1 Seller's detailed design shall originate in Seller's 3D model of substructures, foundations, structural steel, above and below grade piping, equipment, components, and facilities. The 3D model shall include regularly updated 3D models provided by OEMs and equipment suppliers and shall have sufficient

detail to provide for clearance and interference checking; crane placement for safe construction and maintenance lifts; Seller material take-off; and constructability, access, ergonomic, maintainability and safety reviews.

A-4.2.5.11.2 Seller shall schedule monthly 3D model reviews and provide notification to the Buyer so that the Buyer can attend and/or remotely participate in these reviews. Seller shall maintain and update following each model review a disposition log (i.e., action item list), of Buyer 3D model comments.

A-4.2.5.11.3 The 3D model shall be updated regularly in order to reflect the most recent Seller, OEM and equipment supplier design and shall be made available to the Buyer to review at all times. The 3D model shall reflect the actual design of the Facility.

A-4.2.5.12 Seller shall further optimize the suggested Facility layout, as long as the design proposed is consistent with the requirements of this specification. Seller shall give consideration to constructability and ensuring adequate operability and maintainability of the Facility

A-4.2.5.13 The Seller's scope of work shall terminate at the interface points listed in Section A-11. The Buyer will be responsible for designing and installing any pipe, supports, and piping tie-in beyond the interface point. The Seller shall make all tie-in connections at the interface points.

A-4.2.5.14 The Facility shall be designed with the objective of maintaining high reliability, availability, and the level of automation necessary to minimize operator intervention, and to support remote operations. Ease of trouble shooting, preventative maintenance, and equipment accessibility and removal shall also be included in the design.

A-4.2.5.15 Where required to perform normal maintenance functions, facilities such as equipment removal monorails shall be provided. Wherever practical, meters, valves and instruments shall be located such that they can be operated and easily accessed from grade or local operating platform. Where equipment, meters, valves, and instruments normally requiring operator access must be located in elevated locations, access platforms, handrails, and stairs shall be provided.

A-4.2.5.15.1 Minimum clearance and equipment removal access:

A-4.2.5.15.2 Minimum clearance over walkways and platforms shall be 7'-6".

A-4.2.5.15.3 Minimum clearance under major interconnecting structures shall be 22 ft for truck and crane movement.

A-4.2.5.15.4 Pulling, jacking, and lifting supports and devices shall be provided for removal of the CTG and STG generator rotors. All lifting devices and beams shall be clearly stenciled with rated lifting capacity.

A-4.2.5.15.5 Adequate provisions for removal of major equipment, such as, the generator rotor, turbine, and accessories, for maintenance and laydown must be considered in the general arrangement proposed by the Seller. The proposed layout must

accommodate concurrent maintenance on the steam turbine and the combustion turbine with separate cranes.

A-4.2.5.16 Equipment, valves, instruments, testing devices and other mechanical components shall be designed and installed for ease of operation and maintenance.

A-4.2.5.17 Equipment or other items which contain PCBs (excluding batteries), lead, mercury, ceramic fiber, asbestos, or asbestos bearing materials are prohibited from use.

A-4.2.5.18 Seller shall prepare a complete set of System Descriptions. Each system description shall include the following content:

A-4.2.5.18.1 The design criteria and functions to be satisfied by the system.

A-4.2.5.18.2 A description of the system and its major equipment and components, and the performance characteristics.

A-4.2.5.18.3 A detailed description of system operating limitations and capacities, setpoints, consumables, and precautions which include startup, shutdown, and normal operations.

A-4.2.5.18.4 A description of system safety features and safety precautions for operation or maintenance required to prevent personnel injury.

A-4.2.5.18.5 A description of system boundaries.

A-4.2.5.19 Seller shall develop and coordinate a System Operations / Functionality Review (SOFR) to allow Buyer and Buyer's Representative to review the proposed design for O&M considerations, safe isolation, double block and bleed implementation, etc. The systems shall be mutually agreed upon between Buyer and Seller. Comments and action items developed during this review shall be incorporated into design by Seller.

A-4.2.6 Plant Identification, Numbering and Labelling Conventions

A-4.2.6.1 See Attachment A-13 for equipment, component, pipe, valve and instrumentation identification and numbering.

A-4.2.6.2 Permanent instruction plates, nameplates and labels shall be provided for all items of the Facility giving particulars of duty, size, serial number and full information for identification and operation. Warning labels and emergency equipment shall have red lettering. Labels shall be of sufficient size to carry a full description of the Facility item and a unique item alphanumeric identification, as shown in the Seller's drawings.

A-4.2.6.3 Seller shall be responsible for providing signs, fire extinguishers, marking of high sound areas requiring hearing protection, and other items and signage needed to meet OSHA regulations and otherwise ensure minimal risk to personnel health and safety while at the Project site. Text on signage installed for these purposes shall be in both English and Spanish.

A-4.2.7 Procurement

A-4.2.7.1 The systems, equipment and materials supplied by the Seller and Sub-Sellers shall be new and undamaged from the OEM and suppliers using technology with a proven historical design, performance and reliability record suitable for the environment in which they will be located and shall be designed and manufactured for a Project Design Life of 30 years.

A-4.2.7.2 Seller shall provide a Procurement Plan to outline purchase, transportation including special provisions for heavy haul loads, delivery, unloading and storage of equipment, material and goods and purchase of services needed for the Project. This shall be finalized prior to FNTP.

A-4.2.7.3 Seller's Procurement Plan shall apply to all procurement activities conducted by Seller to fulfill the terms of the specification.

A-4.2.7.4 The Procurement Plan shall be used during the engineering, construction, and Commissioning phases of the Project. Following the guidelines outlined in this Procurement Plan, the Seller's procurement team shall to the maximum extent practicable and in an expedited manner procure equipment, material, goods and services or the type normally specified for heavy industrial applications.

A-4.2.7.5 Seller shall ensure that the specific requirements herein are included in the Seller's specifications and complied with by the selected manufacturer. Seller shall be responsible for obtaining the Buyer's concurrence with resolutions to any exceptions taken by Subcontractors prior to accepting the exceptions, which may be withheld in Buyer's sole discretion. The Buyer's concurrence or comments will be forwarded to the Seller within ten (10) Business Days of the date they are received by Buyer.

A-4.2.7.6 Packing, Handling and Shipping procedures shall describe how equipment, components and materials shall be secured and protected from adverse weather (including salt water intrusion) and transit conditions, including shock and vibration movements. This supplement specific shipping requirements outlined in throughout this specification.

A-4.2.7.7 Seller is responsible for the cost and arrangement of all equipment and material shipping, transportation, and delivery to the site.

A-4.2.7.8 Buyer reserves the right to attend tests of components, equipment, and controls (FAT) at the suppliers' manufacturing/assembly facilities.

A-4.2.7.9 Equipment that requires additional bracing for shipment should have the temporary bracing clearly identified.

A-4.2.8 Sourcing of Materials and Subcontracts

A-4.2.8.1 Steel from China shall not be used without Buyer approval.

A-4.2.8.2 Seller may use foreign vendors or Engineered Equipment Suppliers that use internationally recognized standards in the design and supply of materials or equipment. These standards include but are not limited to DIN, JIS, GB, etc.

A-4.2.8.3 For equipment, components, commodities, and materials whether sourced, milled, cast, fabricated and/or manufactured in the U.S. or outside of the U.S., Seller shall have direct QA/QC oversight and surveillance of its subcontractors so that all requirements, including the technical, Code and Standards and QA/QC requirements, of this Specification are met. Seller shall follow utilize Approved Manufacturers List, Attachment A-16.

A-4.2.9 Lifting Beam and Lifting Facilities

A-4.2.9.1 Lifting and trolley beams shall be provided to facilitate handling of Plant equipment and components that are required to be removed for replacement, maintenance, cleaning, and overhaul.

A-4.2.9.2 The structural integrity of all lifting lugs shall be documented by calculation. Vendor furnished bolt on lifting devices shall be proof tested at the fabrication facility before shipment to the site.

A-4.2.10 Special Tools

A-4.2.10.1 Seller shall supply a complete set of any special tools and other equipment necessary for the dismantling, re-erection, and adjustment of the Plant. This shall include any special lift jigs, frames and stands necessary to remove and support the major items of Plant. The tools provided shall be in new condition, adequately labeled as to their use and contained in stout and suitable padlocked boxes. Any special slings required shall be provided and clearly marked by embossed labels to show safe working loads. Test certificates shall be provided where applicable.

A-4.2.11 Spare Parts

A-4.2.11.1 Seller shall supply Buyer with a priced list with lead time of operational spare parts recommended by Project equipment suppliers to support two (2) years of operation twelve (12) months prior to Substantial Completion Scheduled Date, but no later than six (6) months prior to Start of Commissioning. Seller shall include the OEM part numbers on the operational spare parts list.

A-4.2.11.2 Seller shall provide startup and commissioning spare parts as part of its fixed Contract Price Work as required to achieve Substantial Completion.

A-4.2.11.3 If any equipment fails prior to Substantial Completion, Seller may negotiate with Buyer to obtain spare parts from Buyer's inventory of spares at the Project that have been purchased by Buyer so that the equipment that failed may be returned to operating condition, provided that Seller places a concurrent purchase order for the expedited replacement on behalf of Buyer at Seller's expense of any such spare parts previously purchased by Buyer.

A-4.2.12 DOCUMENT DELIVERABLES AND SUBMITTAL REQUIREMENTS

A-4.2.12.1 Seller's Master Drawing and Document List and Data Schedule (MDL)

A-4.2.12.1.1 Within four weeks after LNTP, the Seller shall provide Buyer with an initial MDL, complete including Seller’s subcontractors and supplier. This document schedule shall be updated and resubmitted on a monthly basis for the duration of the Work

and/or until all drawings have been completed, and shall contain the following information:

A-4.2.12.1.2 Seller or Supplier Name, including all Sub-contractors for the Project, and identified Equipment or Service Provided

A-4.2.12.1.3 Drawing or Document Number, OEM Drawing or Document Number, OEM Company Name, Title, and Revision, Unit Number, System Code, Drawing Type, and Discipline

A-4.2.12.1.4 Purpose of Submittal – For Buyer's Review, For Information, For Record

A-4.2.12.1.5 Drawing or Document First Submittal Scheduled Dates and Actual Dates

A-4.2.12.1.6 Drawing or Document Re-Submittal Scheduled Dates and Actual Dates.

A-4.2.12.1.7 The MDL shall individually list all submittals identified herein and in the referenced standards.

A-4.2.12.1.8 The initial submittal of the MDL shall include as many titles, drawings numbers, etc., as are known at the time of the submittal. For drawings and data where exact titles or numbers are not known, the Seller shall list all the types of drawings or data that will be submitted along with the specified schedule information. In essence, the initial submittal of the list shall be complete in terms of it specifying the type and quantity of documents to be submitted with the only undefined information being the precise document titles or numbers that are not known at the time of the submittal.

A-4.2.12.2 Submittals for Buyer Information, Review and Record (e.g., "as-built" drawings)

A-4.2.12.2.1 A complete list of submittals is presented in Table A.4-4.

A-4.2.13 Software Licenses

A-4.2.13.1 In connection with the permanent equipment provided by Seller, any software license in Seller's possession necessary for the operation and maintenance of such equipment shall be passed on to Buyer on or before Substantial Completion or Seller shall grant Buyer a non-exclusive royalty-free right to use such software license for the operation and maintenance of such equipment.

A-4.2.14 Format and Identification of Documents

A-4.2.14.1 Documents submitted for Buyer information, review and/or approval shall be provided electronically as a PDF or TIF file. Informal native files (Excel, Access) will be provided for the project list per Buyer request.

A-4.2.14.2 Engineering document identification shall be in accordance with the project tagging procedure, see Attachment 13. Major Equipment identification will be per OEM tagging standards.

A-4.2.14.3 Final and For Record ("As-Built") drawings issued to Buyer for record purposes shall be in electronic formats.

A-4.2.14.4 Final record submittals shall be in PDF or TIF file formats. Drawing files shall be submitted electronically with the Project name, station name, station unit number, drawing numbers and revision numbers, and CAD file names, identified in a separate electronic drawing list. The electronic drawing list shall be compatible with Microsoft Access.

A-4.2.15 Document Review Process

A-4.2.15.1 Following the initial release of an engineering document, Seller and its sub-Sellers shall on subsequent revised releases clearly state the purpose and date of the revision and identify the changes made to the document since the previous release by scoping with circumscribed “clouding”, or in the case of text by line markings, notated with the current revision level.

A-4.2.15.2 Drawing and documents submitted for review shall be noted on the transmittal letter "For Review". Buyer shall be given ten (10) working days after receipt by Buyer to return comments. Work will proceed if Buyer has not responded within 10 working days to avoid impact to the Project Schedule. Seller shall provide a written disposition of Buyer's comments within ten (10) working days after receipt by Seller. After the drawings or documents are approved or reviewed by Buyer, the drawings or documents shall be returned to the Seller with one of the following status notations:

A-4.2.15.3 No exception taken: Proceed with fabrication or construction in accordance with the Contract.

A-4.2.15.4 Revise as noted and resubmit: Proceed in accordance with the contract after incorporating noted revisions.

A-4.2.15.5 Revise and resubmit: Does not meet contract requirements. Hold fabrication and/or construction.

A-4.2.15.6 For information only.

A-4.2.15.7 Buyer retains the right to review all documents.

A-4.2.15.8 After the Seller returns any written disposition on the Buyers comments, if there are still any unresolved comments the Buyer and Seller shall work together to resolve the comment(s) within (15) working days.

A-4.2.15.9 Any unresolved comments on any documents shall be resolved and updated prior to Substantial Completion.

A-4.3 GOVERNING CODES, STANDARDS AND REGULATIONS

A-4.3.1 Extent

A-4.3.1.1 In performing the Work, Seller shall comply with the codes and standards set forth herein (the “Codes and Standards”).

A-4.3.1.2 Design specifications and construction of the Facility shall be in accordance with all applicable laws including (1) applicable laws, regulations, codes and standards

of the Federal Government and the State in which the Project is located, including Environmental Laws and those set forth below and, (2) and applicable local (including county and city) laws, regulations, codes, and ordinances, including those set forth below.

A-4.3.1.3 Publications of the nationally recognized organizations listed in this Attachment are applicable to the engineering, design, manufacture, and testing of the Equipment. All references to publications are to the latest issue of each together with all latest addenda, amendments, or additions thereto as of the Effective Date, except as otherwise specified in this specification. References shall be made in accordance with the abbreviations listed below.

A-4.3.1.4 In the event that conflicts arise between the codes, standards of practice, specifications or manufacturer recommendations described herein and codes, laws, rules, decrees, regulations, standards, etc., of the locality where the equipment is to be installed, the more stringent code shall apply. The Seller shall provide a written position of any such conflict clarifications to the Buyer in writing.

A-4.3.1.5 Alternative international codes and standards may be used upon Buyer's approval. The Seller shall supply a hard copy or electronic copy, in English, of each alternative code of practice or design standard that is proposed by the Seller as being appropriate for use on the Project. In general, material to be used for all installations shall meet the requirements of appropriate ASTM standards. Alternative equivalent international or local materials may be proposed for use, but they are subject to approval by the Buyer.

A-4.3.2 Federal and State Codes

CAAA	Clean Air Act and Amendments
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act of 1980
CFR	Code of Federal Regulations
DHS	Department of Homeland Security
EPA	Environmental Protection Agency
FAA	Federal Aviation Administration Regulations
FERC	Federal Energy Regulatory Commission
NERC	North American Electric Reliability Corporation
OSHA	Title 29, Code of Federal Regulations (CFR), Part 1910 Occupational Safety and Health Standards
LDEQ	Louisiana Department of Environmental Quality

A-4.3.3 Industry Codes and Standards

AASHTO	American Association of State Highway and Transportation Officials
ABMA	American Boiler Manufacturers Association
ACI	American Concrete Institute
AGA	American Gas Association
AIA	American Institute of Architects
AISC	American Institute for Steel Construction
AISI	American Iron and Steel Institute
AITC	American Institute of Timber Construction
ANSI	American National Standards Institute
API	American Petroleum Institute
ASCE	American Society of Civil Engineers
ASHRAE	American Society of Heating, Refrigeration and Air Conditioning
ASME	American Society of Mechanical Engineers
ASTM	ASTM International
ASNT	American Society of Nondestructive Testing
AWWA	American Water Works Association
AWS	American Welding Society
CRSI	Concrete Reinforcing Steel Institute
FCI	Fluid Control Institute
FM	Factory Mutual
HEI	Heat Exchange Institute
HI	Hydraulic Institute
IAPWS	International Association for the Properties of Water and Steam
IBC	International Building Code
ICC	International Code Council
IEC	International Electromechanical Commission
IPC	International Plumbing Code
ICEA	Insulated Cable Engineers Association
IEEE	Institute of Electrical and Electronics Engineers
IPC	International Plumbing Code
ISA	International Society of Automation

ISO	International Organization for Standardization
JIS	Japanese Industrial Standard
JEAC	Japan Electric Association Code
JEC	Japanese Electrical Committee
JEM	Standards of The Japan Electrical Manufacturers Association
JCS	Japanese Cable Makers Association Standard
JCMS	Japanese Cable Makers Standard
MIA	Masonry Institute of America
MSS	Manufacturers Standardization Society
NAAMM	National Association of Architectural Metals Manufacturers
NACE	National Association for Corrosion Engineers
NEC	National Electrical Code
NEMA	National Electrical Manufacturers Association
NESC	National Electric Safety Code
NETA	International Electrical Testing Association, Inc.
NFPA	National Fire Protection Association
PCA	Portland Cement Association
PFA	Pipe Fabrication Institute
PCI	Precast/Prestressed Concrete Institute
SDI	Steel Deck Institute
SMACNA	Sheet Metal and Air Conditioner Sellers National Association
SSPC	Society for Protective Coatings
SSPWC	Standard Specifications for Public Works Construction
TEMA	Thermal Insulation Manufacturers Association
UL	Underwriters Laboratories

NERC North American Electric Reliability Corporation

Reliability Standards shall be used in the design of protective relaying, event/disturbance recording, metering, and communication circuits related to the interface between the generators and the Bulk Electrical System (BES). The following NERC Reliability Standards shall include but not limited to:

NERC-COM-001

NERC-EOP-004

NERC-EOP-012

NERC-FAC-002

NERC-FAC-008

NERC-PRC-002

NERC-PRC-005

NERC-PRC-019

NERC-PRC-023

NERC-PRC-024

NERC-PRC-025

NERC-PRC-026

NERC-PRC-027

NERC-MOD-032

NERC-TPL-007

NERC-VAR-002

A-4.4 SITE DESIGN DATA

A-4.4.1 This Section outlines the site conditions used as the basis for Facility Design

A-4.4.2 Site Location and Access

Project Location	At approximate coordinates: Completed by Seller
Main Access Road	Road Access: Rail: Provided by Seller

A-4.4.2.1 The governing code for all Work shall be the International Building Code (IBC) 2021. The IBC establishes minimum requirements for Buyer's acceptance of the totality of the Work performed under this Contract. Adherence to federal and other state regulations is also a requirement of the Work.

A-4.4.3 Where other codes or standards of practice are referenced in this Specification, and IBC is silent as to the provisions established by these referenced codes or standard, the referenced codes and standards shall be to the latest revision.

A-4.4.4 In cases of conflict between the requirements of this Specification and any applicable codes, the more stringent of the requirements shall govern.

A-4.5 FACILITY DESIGN LIFE

A-4.5.1 The Facility shall have a design life of 30 years operation without distress due to cycling loads.

A-4.6 METEOROLOGICAL / WEATHER DATA

A-4.6.1 The table below lists the meteorological data to be completed by the Seller.

A-4.6.2 Table A-4.1 Meteorological Data

Parameter	Value	Units	Reference
Ambient Outside Dry Bulb Temperature (DBT):			
Maximum, Summer Extreme		ºF	ASHRAE (50-year max)
Summer		ºF	ASHRAE 0.4%
Annual Average		ºF	ASHRAE annual dry bulb average
Winter		ºF	ASHRAE 99.6%
Minimum, Winter Extreme		ºF	ASHRAE (50-year min)
Freeze Protection Design Temperature		ºF	
Relative Humidity (RH):			
Summer Extreme		%RH	ASHRAE (50-year max) DBT WB
Summer		%RH	ASHRAE (.4%) DBT MCWB
Annual Average		%RH	NCDC Weather Data, mean coincident to DBT
Winter		%RH	ASHRAE 99.6% DB, DP

Parameter	Value	Units	Reference
Winter Extreme		%RH	ASHRAE (50-year min) DB WB
Site Barometric Pressure:			
Pressure		psia	ASHRAE standard pressure at station elevation
Precipitation and Snow:			
Annual average rain, total		in.	ASHRAE Prec. Average
2-year, 24-hour storm		in.	NOAA Atlas 14
10-year, 24-hour storm		in.	NOAA Atlas 14
25-year, 24-hour storm		in.	NOAA Atlas 14
100-year, 24-hour storm		in.	NOAA Atlas 14

A-4.7 LOADING AND NATURAL PHENOMENA DESIGN DATA

A-4.7.1 Seismic Design Criteria

A-4.7.1.1 Structures, along with non-building structures and components such as tanks, pipe racks, steam turbine supports, combustion turbine supports, heat recovery steam generator (HRSG) supports shall be designed in accordance with the seismic design requirements of IBC 2021 and ASCE 7, using the following parameters:

A-4.7.1.2 Importance Factor (IE) = 1.25

A-4.7.1.3 Risk Category III

A-4.7.1.4 Seismic Design Category C

A-4.7.2 Wind Design Criteria

A-4.7.2.1 Structures, along with non-building structures and components such as tanks, pipe racks, steam turbine supports, combustion turbine supports, heat recovery steam generator (HRSG) supports shall be designed for wind loads in accordance with IBC 2021 and ASCE 7 using the following parameters:

A-4.7.2.2 Ultimate Wind Speed (V): Provided by Seller

A-4.7.2.3 Wind Exposure Category: C

A-4.7.2.4 Risk Category: III

A-4.7.2.5 Per SEI/ASCE 37, for erection and test loads that are less than 6 weeks in duration, the wind velocity can be taken as 75% of the maximum velocity specified, provided erection is planned during non-peak hurricane season.

A-4.7.2.6 Reduction in wind loads due to shielding effects of nearby or adjacent structures shall not be considered.

A-4.7.2.7 Vertical stacks or other similar slender structures, subject to slenderness effects shall be analyzed and designed for oscillation or side sway resulting from wind eddy shedding. Alternately, a means shall be developed to prevent the vortex shedding and its loading.

A-4.7.2.8 Wind loads on steel stacks shall be in accordance with the wind load provisions of ASME STS-1. In addition, stacks shall be analyzed and designed for circumferential bending.

A-4.7.3 Snow Design Criteria

Structures shall be designed for snow loads in accordance with ASCE 7 using the following parameters:

A-4.7.3.1 Risk Category: III

A-4.7.4 Ice Design Criteria

Ice sensitive structures (including ice accumulation on transmission wires and support structures, switchyard structures, etc.) shall be designed for the effects of ice accretions formed by freezing rain, drizzle, snow, and in-cloud icing. Atmospheric ice loads shall be in accordance with ASCE 7 Chapter 10, as applicable, using the following parameters:

A-4.7.4.1 Ice Thickness = 1.00 in

A-4.7.4.2 Ice Wind Gust Speed = 30 mph

A-4.7.4.3 Concurrent Ice Temperature = 15 F

A-4.8 FREEZE PROTECTION

A-4.8.1 Fluid temperature in pipe shall be maintained above 40°F (minimum, unless higher temperature is required due to fluid properties or process)

A-4.8.2 Application of different freeze protection measures shall be based on a time to freeze evaluation such that all piping and components are protected against a 72-hour freeze event with average temperature of 20 deg F.

A-4.8.3 Time to freeze evaluation shall consider a maximum of 25% of pipe cross section freezing, and a 20-mph wind.

A-4.9 HVAC SYSTEM DESIGN

A-4.9.1 The table below lists the HVAC design parameters for various area types defined in Section A-9, Building and Equipment Enclosures.

Table A-4.2 HVAC Design Parameters

OEM Supplied Areas (Ventilated and Heated): Including Combustion Turbine Enclosure, Combustion Turbine Auxiliary Enclosure, Steam Turbine HIP Enclosure, Enclosure between LP Turbine and Generator	
Maximum allowable indoor temperature	140ºF
Minimum allowable indoor temperature	50ºF
General Facility Areas (Ventilated and Heated): Including Warehouse, Water Treatment Building, Fire Pump House Enclosure	
Maximum allowable indoor temperature	20ºF above ambient temperature
Minimum allowable indoor temperature	50ºF
Air Change Rate [1]	15 per hour
Electrical Equipment Areas, Excluding Battery Rooms (Ventilated, Heated and Air Conditioned): Including Water Sample Enclosure, PDC Buildings, Combustion Turbine Control Package, CTG and STG Excitation Equipment Enclosures.	
Maximum allowable indoor temperature	75ºF
Minimum allowable indoor temperature	50ºF
Battery Rooms (Ventilated, Heated and Air Conditioned):	
Maximum allowable indoor temperature	80ºF
Minimum allowable indoor temperature	74ºF
Personnel Areas (Ventilated, Heated and Air Conditioned): Including Admin/Control Room Building, Guard Shack	
Maximum allowable indoor temperature	72ºF
Minimum allowable indoor temperature	70ºF
Personnel Areas (Ventilated, Heated and Air Conditioned): CEMS Enclosure	
Maximum allowable indoor temperature	75ºF
Minimum allowable indoor temperature	65ºF
Maximum allowable indoor relative humidity	60%
Minimum allowable indoor relative humidity	40%

Note 1: Listed numbers are for estimating purposes only.
Note 2: Critical areas (excluding turbine control package battery room) shall have redundant heating, cooling and ventilating equipment. Normally occupied areas

shall have multiplicity of N + 1. Multiplicity indicates that the HVAC system should have multiple units.

A-4.10 FUEL GAS ANALYSIS

A-4.10.1 The fuel is pipeline quality natural gas with the following specifications:

Table A-4.3 Fuel Gas Properties

Fuel	Fuel Properties	Units	Design Range	
			Minimum	Maximum
Natural Gas	Temperature	°F	Provided by Seller	Provided by Seller
	Pressure at fuel gas supplier interface point (station boundary)	psig	Provided by Seller	Provided by Seller

A-4.11 AMMONIA DESIGN DATA

A-4.11.1 29% Aqueous Ammonia solution will be provided for use in the SCR section of the HRSG.

A-4.12 MAKEUP / RAW WATER QUALITY

A-4.12.1 Water parameters are to be determined Seller based on Seller identified source(s).

A-4.13 FILTERED WATER QUALITY

A-4.13.1 Filtered water shall be provided for the CTG evaporative cooler while satisfying OEM requirements and limitations. Based on available water quality data, it is anticipated that the CTG evaporative cooler makeup supply will consist of 100% ultrafiltered water obtained from the UF product tank(s) of the demineralizer system.

A-4.14 POTABLE WATER SYSTEM

A-4.14.1 Potable water drinking water, safety showers, and eye wash stations.

A-4.15 NOISE LEVEL LIMITATIONS

A-4.15.1 Equipment shall not exceed 85 dBA when measured (Near Field) per ASME PTC-36 and ANSI S1.13, or, if not applicable, at 3 feet in the horizontal plane, 5 feet from the ground or personnel platform from any major surface on equipment and referred to 20 micro-Pascals. Noise from intermittent sources (e.g., relief valves, etc.) shall follow requirements specified in Section A-18.

A-4.15.2 During any operating conditions, including, but not limited to, start-up and normal operation, the warranted maximum A-weighted sound level at Buyer's property boundaries, when measured in accordance with ANSI S1.13, shall not exceed Applicable Law/Code for the Project location. After the Applicable Law/Code is determined and the required sound levels are agreed to by Buyer and Seller, based on far field noise study, the Seller shall provide adequate sound attenuation measures to meet good neighbor sound level goal of 63dBA at the Buyer property boundaries. The sound attenuation measures may include, but not be limited to, noise insulation blankets and sound barrier walls. The Seller's scope shall include baseline sound measurements before Facility Performance Tests and final sound testing during Facility Performance Tests to demonstrate the noise limits are not exceeded.

A-4.15.3 A Sound Measurement Protocol shall be developed by the Seller and submitted for approval prior to any measurements occurring. The protocol shall include references to specific methods (ANSI, ASME, ISO, etc.) and indicate specific locations for measurement.

A-4.16 CARBON CAPTURE AND SEQUESTRATION

A-4.16.1 The project shall have adequate space for future expansion of carbon capture facilities and should not be land-locked.

Table A.4-4

LIST OF SUBMITTALS

TECHNICAL & DOCUMENT SUBMITTAL REQUIREMENTS FOR CONTRACTOR AND MANUFACTURER						
Technical Document Type	For Review and Comment	For Information	For Record (" As-Built")	Prior to Substantial Completion	Prior to Final Acceptance	Comments
GENERAL:						
General Arrangement Drawings incl. OEM Equipment GA Drawings	X		X			
Site Arrangement Drawings	X		X			
3D Model File		X	X		X	Only deliverables that are as-built will be updated in the model
3D Model Owner Reviews Action Item (Comment Disposition) List	X					
Layout of Temporary Construction Facilities	X					
Permit Application Correspondence		X				Only as required for EPC Contractor Permits
Construction Lift Plans > 100 Tons per Contractor procedures	X					
Certificates of Completion from Equipment manufacturers (incl. CTG, HRSG & STG)		X		X		
Piping Material Inspection Receipts & Certifications		X		X		
Punch list items	X			X		

TECHNICAL & DOCUMENT SUBMITTAL REQUIREMENTS FOR CONTRACTOR AND MANUFACTURER						
Technical Document Type	For Review and Comment	For Information	For Record (" As-Built")	Prior to Substantial Completion	Prior to Final Acceptance	Comments
List of remaining startup spare parts		X		X		
List of warranties including contact information		X		X		
List of recommended spare parts		X		X		
Equipment calibration list		X		X		
System turnover documentation	X			X	X	Electronic versions will be available prior to Substantial Completion
Scoped Turnover Drawing Packages	X					
Native Engineering Deliverable drawing files		X			X	
Master Document List		X			X	As defined in section A-4
Complete Project Schedule (as defined in Section A.1)	X					-
Notice of Mechanical Completion		X		X		
Notice of Substantial Completion		X		X		
Notice of Final Acceptance		X			X	
Hazardous Area Classification Drawings	X		X			

TECHNICAL & DOCUMENT SUBMITTAL REQUIREMENTS FOR CONTRACTOR AND MANUFACTURER						
Technical Document Type	For Review and Comment	For Information	For Record (" As-Built")	Prior to Substantial Completion	Prior to Final Acceptance	Comments
Maintenance Crane Placement Drawings	X					Including crane placement, reach, capacity, soil conditions, and laydown areas. For future Owner use
Equipment Delivery Plan	X					
CIVIL / STRUCTURAL / ARCHITECTURAL:						
Geotechnical and Foundation Bearing Capacity and Settlement Design Criteria including deep foundations		X				
Civil/Structural/Architectural Design Criteria	X					
Barge Unloading Facility Design Criteria/Heavy Haul Route (As Applicable)	X					
Building Code and Life Safety Analysis		X				
Construction Storm Water calculations		X				
Post-Construction Storm Water calculations		X				

TECHNICAL & DOCUMENT SUBMITTAL REQUIREMENTS FOR CONTRACTOR AND MANUFACTURER						
Technical Document Type	For Review and Comment	For Information	For Record (" As-Built")	Prior to Substantial Completion	Prior to Final Acceptance	Comments
Independent Third Party Examination/Sampling/Testing Specification(s)	X					
Contractor and Independent Third Party Examination/Sample/Test Reports as requested		X				
Civil/Structural/Pre-Engineered Building Procurement Specifications		X				
Civil/Structural/Pre-Engineered Building Installation Specifications		X				
Concrete Mix Designs		X				
Concrete Test Result Reports		X				
Structural Steel Drawings		X	X			
Foundation Drawings		X	X			
Architectural Drawings, including Building Envelope and Interior Architectural Work	X		X			
Site Grading and Drainage Drawings (underground drains)	X		X			
MECHANICAL:						
Water Balance Diagrams	X		X			

TECHNICAL & DOCUMENT SUBMITTAL REQUIREMENTS FOR CONTRACTOR AND MANUFACTURER						
Technical Document Type	For Review and Comment	For Information	For Record (" As-Built")	Prior to Substantial Completion	Prior to Final Acceptance	Comments
Heat Balance Diagrams	X		X			
Piping and Instrumentation Diagrams (P&IDs)	X		X			
List of Critical Systems	X					
Interface Drawings to natural gas and other existing systems	X					
Plant Drains Plans	X		X			
Piping Isometrics		X	X			3D model will be used to perform review
Piping Class Sheets		X	X			
Underground Piping (isometric and orthographic format)		X	X			3D model will be used to perform review
Pipe Rack Plans and Sections		X				
Piping Stress Analyses (HP, CR, HR, LP Steam and BFP)		X				
Pipe Support Drawings		X	X			
Mechanical Equipment List		X	X			
Piping Line List		X	X			
Valve List		X	X			
Safety Relief Valve lists and settings		X	X			

TECHNICAL & DOCUMENT SUBMITTAL REQUIREMENTS FOR CONTRACTOR AND MANUFACTURER						
Technical Document Type	For Review and Comment	For Information	For Record (" As-Built")	Prior to Substantial Completion	Prior to Final Acceptance	Comments
ASME Pressure Vessel certifications		X	X			
Welding WPS and PQR Documentation		X				
FIRE PROTECTION:						Refer to Section A-20 for more details
Underground Fire Protection Piping		X	X			3D model will be used to perform review
Fire Hydrant Layout and Coverage Drawing	X		X			3D model will be used to perform review
Fire Protection Design Basis (or Master Plan)	X		X			
NFPA 850 Design Basis Document	X		X			
Building and Fire Codes and Life Safety Compliance Review Report	X		X			
Hazardous Area Classification Evaluation Drawings	X		X			
Portable Fire Extinguisher Location Drawings	X		X			
Fire Suppression System Layout/Piping Drawings	X		X			
Hydraulic Calculations for all Fire Suppression Systems	X		X			

TECHNICAL & DOCUMENT SUBMITTAL REQUIREMENTS FOR CONTRACTOR AND MANUFACTURER						
Technical Document Type	For Review and Comment	For Information	For Record (" As-Built")	Prior to Substantial Completion	Prior to Final Acceptance	Comments
Fire pump Manufacturer's Performance Curves		X	X			
ELECTRICAL:						
Main One-Line Diagrams	X		X			
Three-Line Diagrams	X		X			
Key Diagrams	X		X			
Overall Relay and Metering Single Line Diagrams	X					
Load Flow Calculation		X				
Short Circuit Calculation		X				
Motor Starting Calculation		X				
Electrical Grounding Calculations		X				
GSU and UAT Sizing Calculations	X					
GCB Transient Recovery Voltage (TRV) Calculation	X					
All Electrical Logic and Flow Diagrams	X					
Zone of Protection Diagram	X					

TECHNICAL & DOCUMENT SUBMITTAL REQUIREMENTS FOR CONTRACTOR AND MANUFACTURER						
Technical Document Type	For Review and Comment	For Information	For Record (" As-Built")	Prior to Substantial Completion	Prior to Final Acceptance	Comments
Protective Relaying Settings and Coordination Study	X		X			
Protective Relaying Schematic Diagrams	X		X			
Protective relay settings list	X			X		
ETAP model files (.OTI and associated files)		X	X			As-built limited to Major Equipment as-commissioned changes
Electrical Grounding Drawings		X	X			
Underground Ductbank and Manhole Drawings		X	X			
Cable Tray Drawings		X				
Cable Tabulations (in Excel or Access format)		X				
Electrical Wiring Diagrams		X	X			
Electrical Master Schematic Diagrams		X	X			
Arc Flash Study	X			X		
Battery & UPS Sizing Calculations	X					
Electrical Equipment Lists	X					
Electrical Load List	X		X			

TECHNICAL & DOCUMENT SUBMITTAL REQUIREMENTS FOR CONTRACTOR AND MANUFACTURER						
Technical Document Type	For Review and Comment	For Information	For Record (" As-Built")	Prior to Substantial Completion	Prior to Final Acceptance	Comments
Battery Load Test Report		X				
INSTRUMENTATION AND CONTROLS:						
Control Logic Diagrams		X				
DCS Cabinet Drawings		X				
Complete Control System Architecture Diagram with all data links	X					
DCS, STG and CTG Graphics and Displays	X					
Instrument List		X				
Instrument Datasheets in ISA format and Calibration Certificates		X				
Instrument Location Drawings		X				
Instrument Installation Detail Drawings	X					
Instrument Wiring Diagrams		X	X			
Distributed Control System (DCS) I/O List	X		X			
Turbine Control System (TCS) I/O list	X		X			

TECHNICAL & DOCUMENT SUBMITTAL REQUIREMENTS FOR CONTRACTOR AND MANUFACTURER						
Technical Document Type	For Review and Comment	For Information	For Record (" As-Built")	Prior to Substantial Completion	Prior to Final Acceptance	Comments
Instrument Loop Diagrams		X				
FAT Procedure - DCS (FAT) (Prior to DCS energization or shipment)	X					
DCS and Controllers (GTG and Remote System Controllers) FAT Procedures	X					Prior to the FAT date
DCS and Controllers (GTG and Remote System Controllers) FAT Acceptance Test Results		X				
EQUIPMENT SPECIFICATIONS & DATA SHEETS:						
Gas Turbine Generators	X					
Steam Turbine Generators	X					
Heat Recovery Steam Generators (including the SCR and ammonia delivery and injection system)	X					
Ammonia Storage and Forwarding System	X					
Generator Step Up Transformer	X					
Unit Auxiliary Transformer	X					
Medium Voltage Switchgear	X					

TECHNICAL & DOCUMENT SUBMITTAL REQUIREMENTS FOR CONTRACTOR AND MANUFACTURER						
Technical Document Type	For Review and Comment	For Information	For Record (" As-Built")	Prior to Substantial Completion	Prior to Final Acceptance	Comments
Demin Water Treatment System	X					
CEMS	X					
Sample Panel and Analyzers	X					
Distributed Control System	X					
Feedwater Pumps	X					
Air Cooled Condenser	X					
Condensate Pumps	X					
Dual Purpose Catalyst	X					
Fuel Gas Compressors (if required)	X					If required
All Specifications not listed above		X				
SYSTEM DESCRIPTIONS:						
Plant Control Philosophy	X					
Makeup Process Water Treatment System	X					
Demineralized Water System	X					
Condensate System	X					
Feedwater System	X					
High Pressure (Main) Steam System	X					

TECHNICAL & DOCUMENT SUBMITTAL REQUIREMENTS FOR CONTRACTOR AND MANUFACTURER						
Technical Document Type	For Review and Comment	For Information	For Record (" As-Built")	Prior to Substantial Completion	Prior to Final Acceptance	Comments
Cold Reheat System	X					
Intermediate Pressure Steam System	X					
Hot Reheat System	X					
Low Pressure Steam System	X					
Auxiliary Steam System	X					
Ammonia Storage and Forwarding System	X					
Chemical Feed Systems	X					
Closed Cooling Water System	X					
Raw Water Makeup and Treatment System	X					
Service Water System	X					
Potable Water System	X					
Fuel Gas System	X					
Fire Protection System	X					
Fire Detection System	X					
Instrument and Service Air Systems	X					
Compressed Gas Systems	X					
Plant Drains System	X					

TECHNICAL & DOCUMENT SUBMITTAL REQUIREMENTS FOR CONTRACTOR AND MANUFACTURER						
Technical Document Type	For Review and Comment	For Information	For Record (" As-Built")	Prior to Substantial Completion	Prior to Final Acceptance	Comments
Waste/Oily Water Collection and Treatment System	X					
Storm Water Drainage	X					
Sanitary Waste and Treatment System	X					
High Voltage System	X					
125 Volt DC Distribution	X					
Medium Voltage Distribution	X					
Low Voltage Distribution	X					
Essential AC Power Distribution	X					
Control System Descriptions	X					
Distributed Control System (DCS)	X					
Islanding Mode Operation Descriptions (if required)	X					If required
System Operating Procedures	X					
Draft Site specific Plant Operating Procedures	X			X		
Final Site-specific Plant Operating Procedures	X				X	
SCR System	X					

TECHNICAL & DOCUMENT SUBMITTAL REQUIREMENTS FOR CONTRACTOR AND MANUFACTURER						
Technical Document Type	For Review and Comment	For Information	For Record (" As-Built")	Prior to Substantial Completion	Prior to Final Acceptance	Comments
OTHER:						
O&M Manuals (Draft & Final)	X			X		Two (2) hard copies for final and electronic format
Emissions Performance and Correction Curves	X				X	
Emissions Certification for equipment not tested in the field		X				
Catalyst Unloading and Loading Procedure	X					
Catalyst Seal Drawings		X				
Project Performance and Emissions Guarantee Test Procedures	X					
Reliability Test Procedure	X					
Project Performance Test results	X				X	
Project performance curves	X				X	
Overall Plant Performance Correction Curves	X				X	
Gas Turbine Generator Performance Correction Curves	X				X	
Project Reliability Test results	X				X	

TECHNICAL & DOCUMENT SUBMITTAL REQUIREMENTS FOR CONTRACTOR AND MANUFACTURER						
Technical Document Type	For Review and Comment	For Information	For Record (" As-Built")	Prior to Substantial Completion	Prior to Final Acceptance	Comments
Project Demonstration Test results	X				X	
Operators and maintenance personnel training records		X			X	
CEMS QA/QC Program		X				
Catalyst Module Drawings		X				Including test coupon location

END OF ATTACHMENT A-4

Table of Contents

A-5.1 GENERAL

A-5.1.1 This Attachment defines the minimum requirements for construction materials and design requirements for structures, foundations, buildings and civil sitework. This Attachment indicates specific information for the design of structures, foundations, and site development Work required for services to engineer, procure, and construct the Facility.

A-5.2 SCOPE OF WORK

A-5.2.1 The scope of Work is summarized in this Attachment and elsewhere in the BOT Scope Book.

A-5.2.2 Seller shall prepare specifications for material testing requirements, which detail the type, frequency, and verification testing to be performed by a third-party Testing Service. The field and laboratory testing requirements shall be performed at sufficient locations and frequency to ensure that specified placement and material requirements conform to IBC and to the requirements specified herein. The material testing specifications shall be reviewed and approved by the Buyer.

A-5.2.3 The Seller shall employ an independent, third-party Testing Service, acceptable to and approved by the Buyer, to perform tests and to submit test reports.

A-5.2.4 The third party Testing Service shall sample, test and certify that the Work and materials are installed as specified to include but not limited to: earthwork materials and compaction, deep foundation installation (e.g. drill or driven piles), asphalt paving compaction, concrete and grout (slump, concrete strength, concrete air entrainment, concrete temperature and placement as applicable), post- installed concrete anchors, structural steel erection, high strength bolting, field welding and coating application.

A-5.2.5 The third-party Testing Service shall submit all reports to the Seller and the Buyer in a timely fashion. Records of third-party Testing Service and all tests and inspections shall be maintained in the Seller's files, available to Buyer on request.

A-5.2.6 Acceptance of Work by the third-party Testing Service shall not relieve the Seller in any manner from full responsibility for the Work.

A-5.2.7 The Seller shall perform and require its Subcontractors to perform sufficient testing and inspections to ensure that the products supplied satisfy specifications.

A-5.2.8 Materials and installed Work may require testing and retesting at any time during progress of Work. Retesting of rejected materials for installed Work shall be done at Buyer's direction and at no expense to Buyer.

A-5.2.9 The Seller shall provide a detailed civil, structural, and architectural design criteria document that elaborates upon and provides implementation of the civil,

structural, architectural requirements and design criteria specified herein to be used for Seller's detailed design and engineering. Seller's design criteria document shall include, but not be limited to, specific design requirements for all elements of the Seller's project Work scope (e.g., structural steel, gallery steel, concrete foundations, anchor rods and masonry). Seller's design criteria document shall be submitted to the Buyer for review and approval prior to implementation by the Seller.

A-5.2.10 Seller is responsible for structural stability of structures and equipment during erection and installation. Design, supply, installation and removal of all temporary bracing, shoring, etc. required to maintain such stability is the Seller's responsibility.

A-5.2.11 All architectural drawings, civil drawings, structural drawings, architectural/civil/structural procurement specifications and architectural/civil/structural installation specifications shall be sealed by Professional Engineer registered in the state that the Project is located.

A-5.2.12 Buyer reserves the right to inspect any part of the Work at any time and to perform tests and prepare test reports. If required, Seller shall provide access for Buyer and testing agency to location where Work is being installed so that Buyer's inspection and testing can be accomplished.

A-5.2.13 Seller shall correct deficiencies in the Work that inspections and laboratory test reports have indicated to be not in compliance with requirements. Seller shall perform additional tests, at no expense to Buyer, as necessary to reconfirm any noncompliance of original Work and to show compliance of corrected Work.

A-5.3 DESIGN PHILOSOPHY, REFERENCE CODES AND STANDARDS

A-5.3.1 General

The overall philosophy for the civil-structural construction activities is to engineer and design structures, foundations and structural components that will be consistent with the scope of Work included herein.

A-5.3.2 Structural Steel

Structural steel shall include access platforms, steel stair towers, pipe racks and individual supports. Structural steel and other outdoor structures shall be procured, shop detailed, fabricated, hot-dipped galvanized and delivered to the site and erected by the Seller. Coating touchup shall be performed on site by the Seller.

Interior structural steel for pre-engineered buildings will be prime coated only.

A-5.3.3 Foundations

A-5.3.3.1 Reinforced concrete foundations for equipment, buildings and other structures shall be by the Seller, including, but not necessarily limited to, material procurement, fabrication, delivery, and erection of formwork, reinforcing steel, embedded items, and placement and finishing of concrete.

A-5.3.3.2 All buildings and various yard structures shall have reinforced concrete foundations with top of concrete elevation set at 6 inches minimum above adjacent final grade elevation. Foundations shall be designed in accordance with the latest design code requirements and geotechnical data.

A-5.3.3.3 Foundations shall be designed and sized to meet the specific site soil conditions and minimize the potential for differential settlement.

A-5.3.4 At Seller discretion, fiber reinforcement can be used in lieu of rebar reinforcement for cable tray support foundations, platform landings, and stair/ladder landings. The Engineer of Record shall specify the fiber reinforcement that is to be used.

A-5.3.5 Grade Slabs

A-5.3.5.1 Concrete slabs in close proximity to one another shall be combined into one slab to the extent practical. Seller shall establish top of concrete at grade to be at the same elevation for the power block for equipment slabs, building foundations, miscellaneous utility support slabs, etc.

A-5.3.5.2 Concrete pads or paved areas shall be designed and provided for equipment maintenance. Slab design shall accommodate pipe trenches and continuous trench floor drains as the mechanical systems dictate.

A-5.3.6 Access Requirements

A-5.3.6.1 Galleries and platforms shall be provided to access all equipment, valves, components, and I&C devices.

A-5.3.6.2 Access shall be in accordance with Attachment A-06 and as otherwise specified herein.

A-5.3.6.3 Adequate space shall be provided for pull-space room and space for maintenance of the items being accessed.

A-5.3.6.4 Adequate space shall be provided to service control valves including their operators.

A-5.3.6.5 Adequate space shall be provided within enclosures, as well as removable enclosure panels, to allow for equipment removal.

A-5.3.6.5.a Access platforms, stairs, ladders, and railings shall conform to IBC or OSHA, and local code requirements. Platforms and galleries shall be grating. Platforms, galleries, and stairways shall have a minimum clear width of 3 feet and minimum clear headroom of 7ft- 6in. Major Equipment platforms and enclosures may be designed for a 28” minimum width, in accordance with IBC Standards. Major Equipment enclosures may have reduced headroom, where limited by standard OEM equipment designs. For commonly accessed areas, stairways shall have a

maximum riser height of 7 inches and a minimum tread depth of 11 inches. In other, infrequently accessed areas, tread depths and risers shall be in accordance with referenced codes, standards, and general industry practice. Handrails shall not protrude into the 3-foot clear width. Ladders shall have minimum clearance as specified by OSHA and shall have slip resistant rungs. Railings shall be all welded construction without fittings. Railing bends shall be smooth without miters and welds shall be ground to provide a smooth rail surface. Indoor and outdoor grating shall be serrated. Openings in grating shall be banded. Abrasive nosing shall be fastened to all stair treads and to grating at floors or landings at the top of all stair runs.

A-5.3.6.6 Walkway gallery platforms shall be located to provide access to all valves, equipment, etc. requiring access as specified herein. Tie-ins to the HRSG stair towers shall be provided.

A-5.3.6.7 Provide ramps at minor differences in floor elevations to facilitate cart access.

A-5.3.6.8 All galleries and platforms shall be accessible by stairs. In certain locations, access to particular platforms by ladder will be considered acceptable if the layout does not allow space for a stair system. The Seller shall obtain Buyer's approval for those locations where a ladder is to be used instead of stairs. Access to the top of field erected tanks will be by ladder.

A-5.3.6.9 Concrete-filled pan treads shall be used in enclosed stairwells provided as required means of egress from enclosed buildings/structures.

A-5.3.6.10 Clearances shall be reflected in the 3D model to demonstrate that the appropriate clearances have been provided. This is subject to review by Buyer for approval.

A-5.3.7 Consideration of the Effects of Settlement

A-5.3.7.1 The design of foundations, as well as the superstructures and equipment supported by them, shall consider the effects of settlement, both total and differential settlements, and include the resulting effects into the design of these elements.

A-5.3.7.2 The settlements to be considered are those occurring within a single foundation or structure and those occurring between multiple foundations or structures that are adjacent to one another. The settlement consideration effects should be consistent with the manner of design for any and all elements that interconnect within or between the foundations and/or structures (e.g., piping, equipment skids, conduit, cable tray).

A-5.3.7.3 The settlements, both total and differential, and their effects, shall satisfy the equipment manufacturer's requirements for settlement limits.

A-5.3.8 Architectural

A-5.3.8.1 The architectural features and accessibility requirements for this Facility shall be designed in accordance with the adopted version of the International Building Code (IBC), the International Energy Conservation Code (IECC) and OSHA. The facility shall conform to NFPA 850 Recommended Practices for Fire

Protection for Electric Generating Plans and High Voltage Direct Current Converter Stations. The Administration/Control Building shall also be designed to meet the requirements of the Americans with Disabilities Act (ADA). Architectural features shall be designed to meet the applicable requirements of the local Zoning Ordinance.

A-5.3.9 Maintenance Crane Requirements

A-5.3.9.1 The Seller's equipment design and layout shall consider access for future mobile cranes for maintenance activities for all large equipment, including but not limited to the CTs, HRSGs, STs, generators, valves, and pumps. The Seller's Equipment design and layout shall provide adequate space for both the maintenance crane and laydown areas for all Equipment and Systems that comprise the Facility. The plan developed by the Seller for future mobile cranes shall be a deliverable to the Buyer.

A-5.3.10 Design Codes, Standards, Laws and Ordinances

A-5.3.10.1 As a minimum, all structures and site improvements shall be designed and constructed in accordance with the requirements or recommendations contained in the following codes, specifications, and standards, except where more stringent requirements are shown or specified. If provisions of these documents conflict, the more stringent requirement shall apply unless otherwise approved by Buyer.

A-5.3.10.2 When an edition date is not indicated in IBC, the latest edition, and addenda in effect as of the date of the Contract shall apply.

A-5.3.10.3 Federal

A-5.3.10.3.a Title 29, Code of Federal Regulations (CFR), Part 1910, Occupational Safety and Health Standards.

A-5.3.10.3.b Title 40, CFR Attachment 112 et seq., US Environmental Protection Agency (EPA), requires a Spill Prevention Control and Countermeasure (SPCC) plan for facilities storing in excess of 1320 gallons in aggregate tanks aboveground and 42,000 gallons below ground. The permanent SPCC plan will be prepared by Buyer. The Construction SPCC plan shall be prepared and maintained by the Seller. Secondary oil containment shall be provided for all equipment containing 55 gallons of oil or more.

A-5.3.10.4 State

A-5.3.10.4.a Louisiana Department of Transportation & Development (DOTD), Standard Specifications for Road and Bridge Construction, along with applicable Special Provisions and Reference Specifications, as last revised.

A-5.3.10.4.b Occupational Safety and Health Act (OSHA)

A-5.3.10.4.c Louisiana Department of Environmental Quality (LDEQ)

A-5.3.10.4.d Accessibility Code (ADA)

A-5.3.10.5 Local County Code(s), as required.

A-5.3.10.6 Industry Codes and Standards

A-5.3.10.6.a The following general design requirements and procedures shall be followed in development of Facility specifications regarding the use of Codes and Industry Standards.

A-5.3.10.6.a.1 Specifications for materials shall follow the standard specifications of the ASTM International (ASTM) and the American National Standards Institute (ANSI).

A-5.3.10.6.a.2 Field and laboratory testing procedures for materials shall follow standard ASTM specifications.

A-5.3.10.6.a.3 Design and placement of structural concrete shall follow the recommended practices, of the American Concrete Institute (ACI), IBC, the Concrete Reinforcing Steel Institute (CRSI), and the Precast/Prestressed Concrete Institute (PCI).

A-5.3.10.6.a.4 Design, fabrication, and erection of structural steel shall follow the recommended practices of the American Institute of Steel Construction (AISC) and IBC.

A-5.3.10.6.a.5 Steel components for metal wall panels and roof decking shall conform to the American Iron and Steel Institute (AISI) "North American Specification for the Design of Cold-Formed Steel Structural Members."

A-5.3.10.6.a.6 Welding procedures and qualifications for welders shall follow the recommended practices and codes of the American Welding Society (AWS).

A-5.3.10.6.a.7 Preparation of metal surfaces for coating systems shall follow the specifications and standard practices of the Society for Protective Coatings (SSPC), National Association for Corrosion Engineers (NACE), and the specific instructions of the coatings manufacturer.

A-5.3.10.6.a.8 Fabrication and erection of grating shall follow applicable standards of the National Association of Architectural Metals Manufacturers (NAAMM).

A-5.3.10.6.a.9 Design and erection of masonry materials shall follow the recommended practices and codes of ACI/ASCE/TMS Masonry Designer's Guide and IBC.

A-5.3.10.6.a.10 Plumbing shall conform to the International Plumbing Code IPC.

A-5.3.10.6.a.11 Design of roof coverings shall conform to the requirements of the National Fire Protection Association (NFPA).

A-5.3.10.6.a.12 Design of roadways shall conform to the Project state's Department of Transportation Standard and Specifications.

A-5.3.10.6.a.13 Design, testing, construction and installation for specialty items, proprietary items, and patented items shall follow International Code Council (ICC) report recommendations, and manufacturer recommendations, where applicable.

A-5.3.10.6.a.14 Product certifications shall be UL listed.

A-5.3.10.6.b The latest revision of the following Codes and Industry Standards shall be used:

A-5.3.10.6.b.1 IBC, International Building Code with all Errata.

A-5.3.10.6.b.2 American Institute of Steel Construction (AISC).

- ANSI/AISC 360 "Specification for Structural Steel Buildings".
- Code of Standard practice for Steel Buildings and Bridges.
- Specification for Structural Joints Using High Strength Bolts.
- Manual of Steel Construction
- AISC 341 "Seismic Provisions for Structural Steel Buildings"
- Design Guide 3 - Serviceability Design Considerations for Steel Buildings

A-5.3.10.6.b.3 American Iron and Steel Institute (AISI) "North American Specification for the Design of Cold-Formed Steel Structural Members"

A-5.3.10.6.b.4 Association for Iron & Steel Technology (AIST) - Technical Report 13: Guide for the Design and Construction of Mill Buildings

A-5.3.10.6.b.5 American Welding Society (AWS)

- D1.1 Structural Welding Code – Steel
- D1.3 Structural Welding Code – Sheet Steel
- D1.4 Structural Welding Code – Reinforced
- D1.6 Structural Welding Code – Stainless Steel

A-5.3.10.6.b.6 American Concrete Institute (ACI)

- ACI 117 "Standard Specification for Tolerances for Concrete Construction Materials"
- ACI 207.1R "Guide to Mass Concrete"
- ACI 211.1 "Recommended Practice for Selecting Proportions for Normal and Heavy Weight Concrete"
- ACI 212.3R "Chemical Admixtures for Concrete"
- ACI 301 "Specification for Structural Concrete for Buildings"
- ACI 302.1R "Guide for Concrete Floor and Slab Construction"
- ACI 305.1 "Specification for Hot Weather Concreting"

- ACI 305R “Guide to Hot Weather Concreting”
- ACI 306.1 “Specification for Cold Weather Concreting”
- ACI 306R “Guide to Cold Weather Concreting”
- ACI 308.1 “Standard Specification for Curing Concrete”
- ACI 309R “Guide for Consolidation of Concrete”
- ACI 315 “Details and Detailing of Concrete Reinforcement”
- ACI 318 “Building Code Requirements for Structural Concrete”
- ACI 350R “Code Requirements for Environmental Engineering Concrete Structures”
- ACI 351.3R “Foundations for Dynamic Equipment”
- ACI 530 “Building Code Requirements for Masonry Structures”
- ACI 530.1 “Specifications for Masonry Structures”
- Other ACI Codes Referenced herein.

A-5.3.10.6.b.7 Concrete Reinforced Steel Institute (CRSI), Design Handbook

A-5.3.10.6.b.8 Precast/Prestressed Concrete Institute, PCI Design Handbook Precast and Prestressed Concrete

A-5.3.10.6.b.9 Masonry Designers Guide

A-5.3.10.6.b.10 American Society of Civil Engineers (ASCE)

- ASCE/SEI (ASCE) 7, Minimum Design Loads for Buildings and Other Structures

A-5.3.10.6.b.11 ASTM International (ASTM). The version of the following codes and standards as listed in IBC shall be included as a minimum:

- ASTM A6 “General Requirements for Delivery of Rolled Steel Plates, Shapes, Sheet Piling and Bars for Structural Use”
- ASTM A36 “Specification for Carbon Structural Steel”
- ASTM A53 “Standard Specification for Pipe, Steel Black and Hot-Dipped, Zinc Coated, Welded and Seamless”
- ASTM A153 “Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware”
- ASTM A276 “Standard Specification for Stainless Steel Bars and Shapes”
- ASTM A283 “Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates”
- ASTM A307 “Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength”

- ASTM A500 “Standard Specification for Cold-forced Welded and Seamless Carbon Steel Structural Tubing in rounds and Shapes”
- ASTM A572 “Standard Specification for High Strength, Low Alloy Columbian-Vanadium Structural Steel”
- ASTM A606 “Standard Specification Steel, Sheet and Strip, High-Strength Low-Alloy, Hot-Rolled and Cold-Rolled, with Improved Atmospheric Corrosion Resistance”
- ASTM A615 “Standard Specification Deformed and Plain Billet Steel Bars for Concrete Reinforcement”
- ASTM A653 “Standard Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Allow-Coated (Galvannealed) by the Hot-Dip Process”
- ASTM A695 “Standard Specification for Steel Bars, Carbon, Hot-Wrought, Special Quality, for Fluid Power Applications”
- ASTM A706 “Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement”
- ASTM A992 “Standard Specification for Steel for Structural Shapes for Use in Building Framing.”
- ASTM A1011 “Standard Specification for Steel, Sheet and Strip, Hot Rolled Carbon, Structural, High Strength Low-Alloy and High Strength Low-Alloy with improved Formability.”
- ASTM A1064 “Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.
- ASTM C94 “Standard Specification for Ready-Mixed Concrete”
- ASTM D422 “Standard Test Method for Particle-Size Analysis of Soils” (Withdrawn 2016)
- ASTM D1143 “Test Methods for Deep Foundations Under Static Axial Compressive Load”
- ASTM D1556/D1556M “Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method”
- ASTM D1557 “Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3))”
- ASTM D2167 “Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method”
- ASTM D2216 “Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass”
- ASTM D2487 “Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)”
- ASTM D2488 “Standard Practice for Description and Identification of Soils (Visual-Manual Procedure)”

- ASTM D3689 “Standard Test Methods for Deep Foundations Under Static Axial Tensile Load”
- ASTM D3966 “Standard Test Methods for Deep Foundations Under Lateral Load”
- ASTM D4318 “Standard Test Methods for Liquid Limit, Plastic Limit and Plasticity Index of Soils”
- ASTM D4945 “Standard Test Method for High-Strain Dynamic Testing of Deep Foundations”
- ASTM D5882 “Standard Test Method for Low Strain Impact Integrity Testing of Deep Foundations”
- ASTM D6938 “Standard Test Methods for In-Place Density and Water Content of Soil and Soil Aggregate by Nuclear Methods (Shallow Depth)”
- ASTM F1136 “Zinc/Aluminum Protective Coatings for Fasteners”
- ASTM F1554 “Standard Specification for Anchor Bolts, Steel, 36, 55 and 105-ksi Yield Strength”
- Other ASTM Standards Referenced herein.

A-5.3.10.6.b.12 NAAMM Manual – Metal Bar Grating Manual

A-5.3.10.6.b.13 SDI Manual of Construction with Steel Deck

A-5.3.10.6.b.14 The Society for Protective Coatings (SSPC)

- SSPC-PA1 “Shop, Field and Maintenance Painting of Steel”
- SSPC-PA2 “Measurement of Dry Coating Thickness with Magnetic Gauges”
- SSPC-SP6/NACE No. 3 “Commercial Blast Cleaning”

A-5.3.10.6.b.15 Aluminum Association, “Aluminum Design Manual”

A-5.3.10.6.b.16 American Water Works Association (AWWA)

- AWWA D100-11 — “Welded Carbon Steel Tanks for Water Storage”
- AWWA D103-19 — “Factory Coated Bolted Carbon Steel Tanks for Water Storage”

A-5.3.10.6.b.17 American Association of State Highway and Transportation Officials (AASHTO) - A Policy on Geometric Design of Highways and Streets

A-5.3.10.6.b.18 Manual on Uniform Traffic Control Devices (MUTCD), Federal Highway Administration (FHA)

A-5.3.10.6.b.19 Asphalt Institute - The Asphalt Handbook (MS-4)

A-5.3.10.6.b.20 Heating, Ventilating, and Air Conditioning Guide by American Society of Heating, Refrigeration, and Air Conditioning engineers (ASHRAE)

A-5.3.10.6.b.21 International Energy Conservation Code (IECC)

A-5.3.10.6.b.22 National Fire Protection Association (NFPA) Standards

A-5.3.10.6.b.23 International Association of Plumbing and Mechanical Officials

A-5.3.10.6.b.24 American Society of Nondestructive Testing Recommended Practice (ASNT-TC-lA)

A-5.3.10.6.b.25 International Organization for Standardization (ISO) 10816-1 "Evaluation of Machine Vibration by Measurements on Non-Rotating Parts"

A-5.3.10.6.b.26 CMAA, Crane Manufacture Association of America

A-5.4 ARCHITECTURAL REQUIREMENTS

A-5.4.1 General architectural requirements including code references are including in Attachment A-5.

A-5.4.2 See Attachment A-5 Surface Preparation and Protective Coatings) for protective coatings of structural steel for buildings, enclosures and canopies.

A-5.4.2.1 All building metal siding, roofing, trim, and accessories with painted finish colors will be selected by Buyer from the manufacturer's standard colors.

A-5.4.2.2 Accessibility (ADA) Requirements. The design and construction of the Facility including, but not limited to toilet facilities, kitchen and breakroom facilities, clearances, doors, hardware, slopes, stairs, and ramps shall comply with the accessibility requirements of the ADA. The accessibility requirements will apply to only regularly occupied facilities such as the Control/Administration Building.

A-5.4.2.3 All exterior doors, except the roll-up type, shall have an exterior awning provided above the door. All exterior doors shall have either concrete stoop or concrete ramp for those buildings required to meet the ADA requirements.

A-5.4.2.4 Interior, exterior and emergency lighting at all buildings, enclosures and canopies shall be LED lighting as specified in Attachment A-7, Electrical Requirements and Design Criteria.

A-5.4.2.5 As a minimum, provide buildings and equipment enclosures as indicated in Attachment A-9, Building and Equipment Enclosure Requirements, with heating, cooling and ventilation systems as indicated.

A-5.4.3 Pre-Engineered Buildings

A-5.4.3.1 Pre-Engineered Buildings shall comply with all Applicable Laws and requirements. Building design, fabrication and erection shall be in accordance with the MBMA Metal Building Systems Manual.

A-5.4.3.2 In general, materials and installation of architectural systems or components shall be as follows:

A-5.4.3.2.a Exterior Walls: Walls shall be metal wall panel systems of the factory assembled or field erected type and minimum thickness of exterior sheet of 22-gauge, minimum, galvanized steel unless greater thickness is required by the design. Steel panels shall be zinc-coated steel conforming to ASTM A653, G 90 coating designation. Wall panels shall have configurations for overlapping sheets or interlocking ribs for securing adjacent sheets. Exterior wall panels shall be fastened to framework using concealed fasteners. Girt system will remain exposed in unoccupied areas. Refer to A-5 for more information.

A-5.4.3.2.b Installed walls shall be weathertight and shall provide a "U" factor in accordance with the ASHRAE Handbook. Thermal transmittance of insulated assemblies shall be not more than 0.052.

A-5.4.3.2.c Non-rated interior partitions: Partitions shall be provided for room separations. Partitions shall be of durable construction in all areas. Occupied areas shall have gypsum board partitions with light gauge metal framing. At occupied areas provide single sided gypsum liner wall at inside of building exterior walls and at building structure.

A-5.4.3.2.d Fire rated Partitions: Partitions shall be provided for area separations, and as required by code. Partitions shall be of durable construction, and all openings and penetrations shall be protected and sealed.

A-5.4.3.2.e Fire Exits: Fire exits shall be provided at outside walls as required by code. Exit signs shall be provided. Fire doors shall bear an Underwriters Laboratory (UL) certification level for class of opening and rating for door, frame, and hardware. Doors shall conform to SDI hollow metal door requirements and have fillers adequate to meet the fire rating.

A-5.4.3.2.f Doors: Doors and frames shall be insulated hollow metal type with weather seals and BHMA Grade 1 hardware. Doors and frames shall be Level 3, Extra Heavy Duty types, and have a minimum 16-gauge face thickness and frames shall have a minimum 14-gauge face thickness. Exterior doors and frames shall be formed from galvanized sheet steel. Hardware components shall have a stainless steel, factory finish. Exterior doors shall be insulated to meet energy code requirements and shall be provided with electrified access hardware. Interior door locations shall be provided with electrified access hardware in accordance with NERC CIP requirements.

A-5.4.3.2.g Roll-Up Doors: Roll-up doors shall be insulated roll-up steel type with weather seals and windlocks. Components shall be formed from galvanized steel, factory assembled, and factory painted. Doors shall be motor operated with manual override operation feature. Exterior doors shall be insulated to meet energy code requirements. Doors shall be designed to accommodate the height and width requirements of the equipment within the building and access for maintenance vehicles. Minimum height of warehouse roll-up door shall be 16 feet.

A-5.4.3.2.h Roofs: Roofs shall be metal roof systems of the factory assembled or field erected type and minimum thickness of exterior sheet 22-gauge sheet steel unless greater thickness is required by the design. Steel panels shall be zinc-coated steel conforming to ASTM A653, G 90 coating designation. Roof panels shall be a minimum 2-inch standing seam with concealed clip. Design provisions shall be made for thermal expansion and contraction consistent (if required) with the type of system to be used. Roof shall not deflect more than 1/240 of span under live load and the roof shall not deflect more under temporary construction load. Roofs shall be sloped to drain into a gutter and downspout system.

A-5.4.3.2.i Installed roofs shall be weathertight and shall provide a "U" factor in accordance with the ASHRAE Handbook. Thermal transmittance of insulated assemblies shall be not more than 0.035.

A-5.4.3.2.j Wall and roof panels shall have a factory applied polyvinylidene fluoride finish (70 percent minimum KYNAR) on the exterior side. The finish shall be a minimum of 1 mil thickness consisting of a baked fluoropolymer enamel topcoat factory applied over an appropriate prime coat. Coating shall have a guarantee against fading, chalking, peeling, cracking, checking, chipping, and corrosion for a minimum of 30 years.

A-5.4.3.2.k Color Schemes: Color schemes shall be selected for overall compatibility, coordinate colors with Buyer standards. All color selections shall be submitted for approval by Buyer.

A-5.4.3.2.l Signage: Signs and graphic designs for identification and directions shall be incorporated into the interior finishes of each area. Signs shall be placed for safety, ease of operation and direction. The sign system shall provide simple and direct indications using both graphics and text as required. All signage shall comply with ADA requirements.

A-5.4.3.2.m Pre-engineered metal buildings (packaged to include exterior doors, wall louvers, windows, and related enclosure components) shall be of manufacturers standard modular rigid frame construction with tapered or uniform depth rafters rigidly connected at ends to pinned base tapered or uniform depth columns. Purlins and girts shall be cold-formed "C" or "Z" Attachments conforming to "North American Specifications for Design of Cold-Formed Steel Structural Members" of American Iron and Steel Institute (AISI). All other members shall be hot rolled shapes conforming to "Specification for Design, Fabrication and Erection of Structural Steel for Buildings" of American Institute of Steel Construction (AISC).

A-5.4.3.3 Architectural Finishes:

A-5.4.3.3.a Architectural finishes in the buildings shall conform to the following table as applicable.

BUILDING	ROOM NAME	FLOOR	WALL	CEILING
Control/Admin Building	Vestibule	WT	GBP*/**	SAT
	Conference Room(s)	CPT	GBP*/**	SAT
	Offices	CPT	GBP*/**	SAT
	Toilets	CT	CWT	SAT
	Lockers	CT	GBP*/**	SAT
	File & Copy	MC	GBP*/**	SAT
	Corridors and Open Office	MC	GBP*/**	SAT
	Reception	CPT	GBP*/**	SAT
	Conference Room/Lunchroom	MC	GBP*/**	SAT
	Control Room	AF**	GBP*/**	SAT
	Simulator Room (if req'd)	CPT	GBP*/**	SAT
	DCS Room	AF**	PFR/MWLP	EX
	Telephone/Communications	MC	GBP */**	EX
	Electrical Equipment Room	MC	GBP/MWLP	EX
	LOTO Room	CPT	GBP*/**	SAT
Warehouse	Warehouse	MC	MWLP/CMUP*	EX
	Warehouse Office (if req'd)	CPT	MWLP/CMUP*	SAT
	Storage Space	MC	MWLP/CMUP*	EX
	Laundry/JC	MC	MWLP/CMUP*	EX
	Climate Controlled Storage	MC	MWLP	EX
	I&C Shop	MC	CMUP*	SAT
	Maintenance Shop*	MC	MWLP/CMUP*	SAT
	Warehouse Toilets	MC	CWT	SAT
Water Treatment Building	-			
	Water Treatment	MC*	MWLP	EX
	Electrical	MC	MWLP/CMUP*	EX
	Lab (if req'd)	MC*	MWLP/CMUP*	SAT

Floor Finishes:

AF	Raised Access Flooring System set into the recessed slab, static dissipative
MC	Cast-in-place concrete with concrete polish system, Retroplate Level 3 Finish
CT	Ceramic tile
CPT	Carpet tile
CHFP	Checkered Floor Plate
WT	Walk-off Tile
*	Specialty coatings will be applied in areas subject to acid or chemical spills
**	Vinyl tile will be static dissipative type

Wall Finishes:

GBP	Painted gypsum board on metal studs
MWLP	Metal wall liner panel at pre-manufactured building exterior

	walls
CMUP	Filled, painted concrete masonry
CWT	Glazed ceramic tile over masonry or gypsum board.
VWC	Vinyl wall covering
PFR	Plywood, fire rated (Provide as needed for mounting equipment and panels)
*	Provide rubber base throughout finish areas.
**	Provide rigid plastic corner guards throughout finish areas
Ceiling Finishes:	
SAT	Suspended acoustical tile (water resistant finish for use in toilet rooms)
EX	Exposed to structure (Wall assemblies and finishes to be installed up to roof at exposed to structure areas)

A-5.4.3.4 Plastic laminate casework, solid surface countertops, toilet room partitions and toilet accessories shall meet IBC and ADA requirements.

A-5.4.3.5 Unless noted office furniture, appliances, cubical walls, and security hardware required in each building will be furnished and installed by Buyer.

A-5.4.3.6 Control Room furniture including operator stations shall be furnished and installed by Seller.

A-5.5 MATERIALS

A-5.5.1 All material for the items listed below shall be new and shall be certified to be in accordance with the applicable specification. Evidence of certification shall be on file in the Seller's office and furnished to Buyer upon request.

A-5.5.2 Certified copies of material test reports shall be available in the Seller's file, showing chemical and mechanical properties and the results of each test required by the material specification, for all steel materials furnished under this specification, unless otherwise noted herein.

A-5.5.3 Certificates of Conformance in lieu of material test reports may be accepted as documentation of the above requirements, only upon the written approval of Buyer.

- Structural Steel (Hot-dipped galvanized per ASTM A123)

Wide flange shapes	ASTM A992
Angles, channels, plates	ASTM A36, A992 or A572 Gr 50
Hollow structural Attachments	ASTM A500 Grade B
Structural pipe	ASTM A53 Grade B
Plate Girders (fabricated from plates)	ASTM A572, Gr 50

- Structural Steel Connections

- High Strength Bolts	ASTM F3125 Grade A325, Type 1, Zinc-Coated (Mechanically galvanized), ASTM B695, Class 12, 3/4" dia. (min). ASTM F3125 Grade F1852, Type 1, Zinc-Coated (Mechanically galvanized), ASTM B695, Class 12, 3/4" dia. (min). ASTM F3125 Grade A490, (zinc/aluminum coated), F1136 Grade 3, 1 1/8-inch dia.
- Nuts	ASTM A563-DH, Grade C Heavy Hex Zinc Coated (Mechanically galvanized), ASTM A153 Class C
- Washers	ASTM F436, Zinc-Coated (Mechanically galvanized), ASTM A153 Class C

- Structural Steel Welding Filler — AWS D1.l and Table 3.2 therein, E70XX

- Concrete

Conforming to ACI 301	Minimum 28-day compressive strengths f'c 2000 psi (lean concrete) 3000 psi (ductbank) 4000 psi (structural concrete) 5000 psi (water retention structures)

Cement	ASTM C150
Fly Ash	ASTM C618, Class F or C
Aggregates	ASTM C33
Water	ASTM C1602
Air-entraining Admixture	ASTM C260
Water-Reducing Admixture	ASTM C494, Type A
Accelerating Admixture	ASTM C494, Type C or E
Retarding Admixture	ASTM C494, Type B or D
Liquid Membrane-Forming Curing Compound	ASTM C309, Type II, Class B

- Non Shrink Grout — ASTM C1107
- Masonry

Concrete Masonry Units	ASTM C90, Type 1, moisture-controlled, medium weight minimum individual unit compressive strength f'm =1,500 psi
Masonry Mortar	ASTM C270, Type S or M
Masonry Grout	ASTM C476, 2000 psi minimum compressive strength

- Reinforcing Steel:

Reinforcing Bars	ASTM A615, GR 60 or ASTM A706 (fy = 60,000 psi)

- Anchor Rods:

Standard:

Rods	ASTM F1554 Gr 36
Nuts	ASTM A563 heavy hex, Zinc-Coated, ASTM Al53 Class C
Washers	ASTM F436, Zinc-Coated, ASTM A153 Class C

High Strength:

Rods	ASTM F1554 Gr 55 or Gr 105
Nuts	ASTM A194, heavy hex
Washers	ASTM F436

Drilled-in Anchors	Hilti Post-Installed anchors or approved equal
Plastic Anchor Bolt Sleeves	Wilson Anchor Bolt Sleeves or approved equal
Headed Concrete Anchors	ASTM Al08

• Guardrail/Handrail	ASTM A500 Grade B, 1-1/2" nominal diameter schedule 40 pipe. Hot-dipped galvanized.
• Toe (Guard) Plate	ASTM A36 ¼" thick, (projecting 4" above platform surface), Hot-dipped galvanized
• Visible Abrasive Nosings: Exterior	Alumalun, Type B as distributed by American Abrasive Metals Co., or approved equal
• Floor Grating and Stair Treads	ASTM A569 steel, Hot-dipped galvanized per ASTM A123
• Checkered Floor Plate	ASTM A36 with a symmetrical raised diamond pattern, ¼" minimum thickness, Hot-dipped galvanized

A-5.6 STRUCTURAL LOADS AND LOAD COMBINATIONS

A-5.6.1 General:

A-5.6.1.1 For the purpose of determining design loads, the Facility shall be considered as an essential facility. Design loads to be applied to the structure and foundations consist of the following:

- Dead load
- Live load
- Snow and Ice load (refer to Attachment A-4)
- Wind loads
- Seismic loads
- Erection loads, including crane loads, shall be temporary loads imposed on structures, foundations, underground piping and utilities, culverts, and manholes during the erection of structures, installation, and maintenance of equipment.
- Operating load shall be dead load plus weight of any fluid or solid present during operating conditions and/or permanently stored materials. Operating load shall have the same load factor as dead load. For load combinations, consideration for both full and empty conditions shall be made. Seller shall determine and use appropriate minimum uniform operating load values for pipe rack, and other structures.
- Maintenance loads shall be temporary loads resulting from repairs or dismantling of equipment. Maintenance loads shall be considered as a live load.
- Vehicle load shall be that load caused by vehicles (forklifts, cranes, trucks; special trucks for heavy hauling) during construction and plant operation.
- Test load shall be dead load plus weight of any fluid or solid necessary to test equipment or piping.
- Rain loads shall be in accordance with ASCE 7-10 Chapter 8.
- Torsional loads shall be loads creating torsion or loads not passing through the shear center of a structure.
- Settlement load shall be the load due to differential settlements of equipment and structure foundations.

Detailed descriptions of design loads being applied to the structure and foundations consist of the following:

A-5.6.2 Dead Load:

A-5.6.2.1 Dead load shall be considered as the weight of all permanent construction, including, but not limited to, framing, walls, floors, platforms, roofs, partitions, stairways, handrails, insulation, lagging and the operating weight of all fixed equipment. Operating weight includes the deadweight of the equipment plus any additional weight of removable portions and any constant horizontal or vertical forces resulting from machine operation. Actual equipment operating loads shall be used whenever they exceed the live load allowance for the area occupied by the equipment.

A-5.6.3 Live Load:

A-5.6.3.1 General:

A-5.6.3.1.a Live load includes any movable load or other load that can vary with intensity or occurrence, such as crane loads and uniform floor live load.

A-5.6.3.1.b The live load to be used is the greater of that specified in ASCE 7-10, given by equipment vendor, or that shown in the Table, Minimum Uniform Live Loads, below. In addition to these loads, other live loads, including erection loads, turbine rotor emergency loads, generator emergency loads, equipment thermal loads, crane loads, and horizontal skidding loads shall be considered where appropriate.

Minimum Uniform Live Loads

Location	Live Load	Remarks
Steam Turbine Ground Floor Slabs	500 psf	Note a
Steam Turbine Mezzanine Floor	200 psf	If applicable
Steam Turbine Operating Floor Deck Slab	300 psf	If applicable
Other Building Ground Floor Slabs	350 psf	Note a
Above Grade Concrete Slabs	200 psf	
Grating floors, access platforms	100 psf	
Stairs, stair landings	100 psf	Note b
Walkways	100 psf	
Roof Live Load	20 psf	Or snow, including drifts, if greater. Also Note e.
Concrete sidewalks, driveways, slabs, or pavement subject to trucks or fire equipment	HS20-44 or HL-93	AASHTO Loading; whichever is more severe
Underground piping, utilities, culverts, manholes	HS20-44 or HL-93	AASHTO Loading and erection loading (including cranes) whichever is more severe
Control/Admin Bldg false floor	200 psf	Or actual equipment load, whichever is greater

Notes Applying to Design Live Loads:

a. A truck may operate over accessible areas. The ground floor slabs and grade slabs including truck aisles and entrances shall be designed to carry an AASHTO truck load plus impact. This load will not be combined with any other live load and should not reduce the strength required by other design parameters.

b. Members will be designed to support safely the uniformly distributed live load, or a concentrated load of 1000 pounds applied at any point on the stairs.

c. Equipment loads shall be used when they exceed the live load stated. Equipment and minimum uniform live loads will not be applied simultaneously.

d. Equipment removal loads shall be considered.

e. Where access to and service of roof-top equipment is required, a minimum live load of 40 psf shall be used over the required roof area.

A-5.6.3.2 Live Load Reduction

A-5.6.3.2.a No reduction of live load is allowed for roofs and storage areas. Likewise, no reduction of live load shall be made in the design of slabs.

A-5.6.3.3 Live Load Posting and Drawing Notation

A-5.6.3.3.a The live load used for design shall be shown on the design drawings. If a special live load applies to a partial area, the limits of the special loading shall be shown on the drawings and the building posted accordingly.

A-5.6.4 Wind Load

A-5.6.4.1 General

A-5.6.4.1.a Design wind pressures shall be determined in accordance with the provisions and design parameters indicated in Attachment A-4 of this document.

A-5.6.5 Seismic Load

A-5.6.5.1 General

A-5.6.5.1.a Seismic loads shall be determined in accordance with the provisions and design parameters indicated in Attachment A-4 of this document.

A-5.6.5.1.b Every building, structure, equipment, and facility, as a minimum requirement, shall be designed and constructed to resist seismic forces determined in accordance with ASCE 7.

A-5.6.5.1.c In addition, Architectural, Mechanical, and Electrical components shall be designed and constructed to resist seismic forces determined in accordance with ASCE 7.

A-5.6.6 Soil and Hydrostatic Pressure Loads

A-5.6.6.1 All below grade and soil retaining structures shall be designed for the applicable soil and hydrostatic pressures. The lateral design pressure shall be determined from the buoyant weight of the soil plus full hydrostatic pressure if/when the adjacent soil is below the water table.

A-5.6.6.2 Appropriate surcharge loading, resulting from adjoining structures and concentrated loads from heavy equipment (e.g., nearby tanks, trucks, concrete trucks, construction cranes, etc.) shall be considered in the lateral design pressures. A minimum uniform surcharge load of 500 psf (at the grade surface) shall be used for the design of all below grade structures and foundations.

A-5.6.7 Excursion Loads

A-5.6.7.1 Excursion conditions (i.e., unusual, or infrequent loadings) shall be considered as a separate loading condition beyond the normal operating load(s).

A-5.6.8 Temporary Load

A-5.6.8.1 Provision shall be made for temporary loads arising from the installation of the heavy machinery and equipment.

A-5.6.9 Equipment Load

A-5.6.9.1 Static and dynamic equipment loads shall be as specified on the Manufacturer's drawings.

A-5.6.10 Impact Load

A-5.6.10.1 Impact loads shall be those loads caused by impact, i.e., crane loads, moving vehicles, water hammer, etc. Where live loads induce impact on the structure, the assumed live load shall be increased to account for the impact as required. Unless specified otherwise, the increase shall be consistent with IBC and ASCE 7.

A-5.6.11 Vibratory, Thermal and Friction Loads

A-5.6.11.1 These loads shall be included in the design and shall include loads as specified by the equipment manufacturers.

A-5.6.12 Load Combinations

A-5.6.12.1 Loads shall be applied and combined in accordance with load combinations given in ASCE 7, and as described herein.

A-5.6.12.2 Load combinations include normal operating, test, excursion, and severe environmental loading conditions, with separate combinations for extraordinary events as given by ASCE 7.

A-5.7 CIVIL DESIGN

A-5.7.1 Nominal Site Grade:

A-5.7.1.1 Top of Concrete: Elevation 6" higher than the Nominal Finish Grade Elevation"

A-5.7.1.2 Nominal Finish Site Grade: Elevation to be higher than a 500-year Flood Site Elevation (high point)

A-5.7.1.3 Plant Coordinate System:

A-5.7.1.3.a All horizontal survey control shall be established to the Louisiana State Plane Coordinate System (NAD 1983, West Zone). Vertical control shall be set to North American Vertical Datum of 1988 (NAVD 1988).

A-5.7.1.3.b A local grid system may be established if Plant North is rotated from State Plane North, and/or out of convenience relative to coordinate size.

A-5.7.2 Description of Civil Site Development Scope

A-5.7.2.1 This Civil scope shall include, but not be limited to the following:

- Temporary and Permanent Soil Erosion and Sediment Control
- Dewatering
- Clearing and Grubbing
- Debris and Offsite Disposal in a Licensed Landfill
- Stripping and Stockpiling of Topsoil
- Subgrade Preparation
- On-site Laydown and Construction Craft Parking Areas
- Onsite Heavy Haul Transport Path
- Excavation, Fill and Backfill
- Grading and Drainage
- Storm Water Drain System and Detention Pond(s), if applicable
- CDS Hydrodynamic Separators for storm water pond effluent
- Sanitary Sewer System, with Lift Station
- Oily Water Sewer System with Below Grade, Double Wall Oil/Water Separator
- Paving
- Chain Link Security Fencing and Gates
- Truck Containment Pad for Ammonia Deliveries
- Construction Storm Water Pollution Prevention Plan

A-5.7.3 Reference Documents

A-5.7.3.1 The design and construction of this Facility shall be in accordance with all Applicable Laws.

A-5.7.3.2 All civil design and construction shall be in accordance with the applicable codes, specifications, and standards, except where more stringent requirements are shown or specified. Where provisions of these conflict, the more stringent shall apply unless otherwise approved by Buyer.

A-5.7.4 Excavation and Backfill

A-5.7.4.1 Quality Assurance

A-5.7.4.1.a During the course of the Work, a third-party Testing Service shall perform inspections and tests to identify materials and to determine characteristics, moisture content, and density of compacted fill. These tests will be used to verify that the fill conforms to the minimum requirements of this Specification.

A-5.7.4.1.b Seller shall perform existing utility identification using geophysical and hydrovac techniques for all excavations within and outside power block area.

A-5.7.4.2 Project Conditions

A-5.7.4.2.a See Attachment A-04 for general project conditions.

A-5.7.4.3 Soil Materials

A-5.7.4.3.a Soil materials that are suitable for use as fill and backfill shall be GW, GP, SW, SP, SM (with less than 20 percent passing the No. 200 sieve) or CL (with Liquid Limit less than 40). These soil classifications noted are in accordance with Unified Soil Classification System (USCS), ASTM D2487. Soils meeting the definitions which require dual symbols composed of the approved list of materials above are also acceptable for use as fill and backfill.

A-5.7.4.3.b Unsuitable material for use in construction for fill and backfill are highly plastic material, silts and organic soils classified in accordance with the USCS, ASTM D2487, as ML, MH, PT, OL and OH. Unsuitable backfill and fill also consists of loose, soft, disturbed, frozen, excessively wet, debris and rubbish materials.

A-5.7.4.3.c Unsuitable subgrade materials are highly plastic soils, silts and organic soils classified in accordance with the USCS, ASTM D2487, as MH, PT, OL, OH and uncontrolled fill or debris. Unsuitable subgrade also consists of loose, soft, disturbed, frozen, excessively wet, non-compacted (minimum required is 95% percent of maximum dry density as determined by the modified Proctor test ASTM D1557) materials consisting of ML, CL, GW, GP, GM, GC, SW, SP, SM, and SC.

A-5.7.4.3.d Utility Bedding and Trench Backfill material shall consist of manufactured angular material including crushed stone, stone screenings, and crushed stone-sand mixtures or sand with little or no fines (material passing the No. 200 sieve) with material quality and placement requirements meeting the more stringent of standard industry practices and the requirements for backfill described herein.

A-5.7.4.4 Storage of Soil Materials

A-5.7.4.4.a Stockpile borrow materials and suitable excavated soil materials in an onsite area acceptable to Buyer and protected with sediment and erosion control devices. Stockpile soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover as necessary to prevent fugitive dust.

A-5.7.4.4.b Stockpile soil materials away from edge of wetlands and excavations per OSHA regulations.

A-5.7.4.5 Excavation

A-5.7.4.5.a Areas designated for excavation or fill shall be stripped of all topsoil and all other organic material. Weeds, small roots, heavy grass, and other vegetation remaining after clearing and grubbing operations shall be removed with the topsoil. Stripped topsoil shall be placed in an onsite topsoil stockpile. Topsoil shall be removed from the stockpile and used to cover finished ditches, slopes, and other designated areas. Tree and shrub landscaping will not be included in the scope of work.

A-5.7.4.5.b Excavations for structures shall meet the applicable safety requirements. Excavate to the required elevations and dimensions within a tolerance of plus or

minus 0.1 feet. Extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for tests and inspections.

A-5.7.4.5.c The bottom of the excavation shall be graded uniformly and free from bumps and hollows, and the sides of the excavation properly sloped per OSHA requirements. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work. All slopes shall be properly maintained during the Work, and slopes shall be inspected and documented per OSHA by Seller's trained, competent personnel. Excavations shall not compromise any existing structures, foundations, or other construction activities.

A-5.7.4.5.d Excavations shall be kept dry by means of preventing surface water runoff from entering and removing any accumulated groundwater or surface water from the excavation.

A-5.7.4.5.e If unsatisfactory material is encountered at the bottom of an excavation, this material shall be removed or mitigated to a depth up to two feet and backfilled to the proper grade with compacted satisfactory fill material at no additional cost to Buyer.

A-5.7.4.6 Subgrade Preparation

A-5.7.4.6.a The subgrade beneath areas to receive fill, foundations or roadways shall be compacted and proofrolled and be visually inspected/approved by the Testing Service prior to proceeding with the Work.

A-5.7.4.6.b Proofrolling shall consist of furnishing and operating heavy equipment for testing the stability of subgrade prior to receiving the fill. The intent is to locate any unstable or soft areas. Proofrolling shall be performed in the presence of the Testing Service to allow for observation of unstable and soft areas.

A-5.7.4.6.c Areas identified as unstable or soft during the proofrolling process shall be mitigated to a depth of up to two feet at no additional cost to the Buyer. Soft or unstable material is defined as obvious pumping action of the subgrade or excessive rutting (greater than 1 inch) during proofrolling.

A-5.7.4.6.d Visual inspection for approval of subgrade consists of an experienced representative from the Testing Service visually verifying that no unsuitable material is present in the subgrade.

A-5.7.4.6.e After reaching the plan subgrade level, the subgrade density will be tested by Seller's third-party Testing Service. The natural subgrade material shall be properly compacted to a minimum of 95 percent of the maximum dry density as determined by ASTM D1557 to a depth of at least 10 inches below the final subgrade level.

A-5.7.4.7 Fill and Backfill General Placement Requirements

A-5.7.4.7.a After placing mats, spread footings and other foundations the Seller shall place backfill to fill all voids between concrete members and bring the excavated area to approved plant grade. Likewise, the backfill material itself shall be clean, without rubbish or debris, and consist of suitable material.

A-5.7.4.7.b Place and compact material in excavations and on subgrade promptly, but not before completing the following:

- Construction of below finish grade structures.
- Surveying locations of underground utilities for record documents.
- Inspecting and testing underground utilities.
- Inspection and testing of subgrade.
- Removing concrete formwork.
- Removing trash and debris.

A-5.7.4.7.c Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 3 horizontal such that the placed materials will bond with existing material.

A-5.7.4.7.d Material shall not be placed upon a porous, wet, spongy, or frozen surfaces, nor shall frozen material be incorporated into the materials.

A-5.7.4.7.e Materials placed by dumping in piles or windows shall be spread uniformly before being compacted.

A-5.7.4.7.f Adjacent to structures, material shall be placed in a manner which will prevent damage to the structures and will allow the structures to assume the loads from the fill gradually and uniformly, if designed for such condition.

A-5.7.4.7.g Material placed against concrete shall not be done until concrete has attained sufficient strength that backfilling will not cause damage.

A-5.7.4.7.h Height of material placed adjacent to a structure shall be increased at approximately the same rate on all sides of the structure simultaneously.

A-5.7.4.7.i Each lift of material placed shall extend the entire length and width of the area being filled when practicable.

A-5.7.4.7.j Compaction methods, equipment, and loose lift thickness shall be included in the detailed specifications.

A-5.7.4.8 Moisture Control of Soil Materials

A-5.7.4.8.a Uniformly moisten, scarify, air-dry, or aerate subgrade and each subsequent fill or backfill layer before compaction to within 2 percent of optimum moisture content.

A-5.7.4.8.b Subgrade shall be within 2 percent of the optimum moisture content to a depth of at least 10 inches below the final subgrade level.

A-5.7.4.8.c Moisture content shall not be an acceptance criterion for purely granular, non-plastic, non-cohesive soil materials – these materials shall be evaluated for acceptance based on the in-place dry density and their constituents. Moisture content shall be an acceptance criterion for cohesive materials in addition to dry density and constituents.

A-5.7.4.9 Compaction of Soil Materials

A-5.7.4.9.a Compaction of all backfill and fill shall achieve a minimum of 95 percent of the maximum dry density as determined by ASTM D1557.

A-5.7.4.10 Grading

A-5.7.4.10.a Areas to be graded shall be cleared of all vegetation. Prior to clearing and grubbing, trees designated for removal shall be identified using plastic tape for Buyer review and acceptance. Trees shall not be removed unless written authorization to proceed is received from Buyer. All stumps and roots larger than 2 inches shall be removed. Debris from clearing and grubbing shall be disposed of in an Buyer-approved landfill.

A-5.7.4.10.b All topsoil and organic materials shall be stripped from areas to be graded prior to starting earthwork. Topsoil shall be placed in a stockpile for later recovery.

A-5.7.4.10.c Uniformly grade areas to a smooth surface, free from irregular surface changes. Comply with compaction requirements and grade to cross Attachments, lines, and elevations as required.

A-5.7.4.10.d Provide a smooth transition between adjacent existing grades and new grades. Remove soft spots, fill low spots, and trim high spots to comply with required surface tolerances.

A-5.7.4.10.e The high point of finished grade shall be set at 6 inches below the top of concrete foundation elevations.

A-5.7.4.10.f Slope grades to direct water away from buildings and to prevent ponding.

A-5.7.4.10.g The maximum permanent slope, without supplemental stabilization through mechanical means, to be provided shall be 3H:1V, unless otherwise approved by Buyer.

A-5.7.4.10.h Where approved by Buyer, permanent slopes steeper than 3H:1V and higher than 4 feet shall be numerically evaluated for stability.

A-5.7.4.10.i Permanent slopes cut into natural or existing soils shall be numerically evaluated for stability.

A-5.7.4.10.j Slope stability analyses shall consider all appropriate loading conditions such as, but not limited to surcharge traffic, structures, and seismic acceleration.

A-5.7.4.10.k The minimum safety factor for slopes immediately after construction is 1.3.

A-5.7.4.10.l The minimum safety factor for slopes for long term stability is 1.5.

A-5.7.4.10.m The minimum safety factor for slopes subjected to seismic acceleration is 1.1.

A-5.7.4.10.n Laydown areas may be improved using geotextile and aggregate surfacing as necessary to support temporary equipment storage and parking. Seller may add aggregate surfacing for vehicle corridors as required for support.

A-5.7.4.10.o Finished area surfacing material shall be approved by Buyer.

A-5.7.4.11 Field Quality Control

A-5.7.4.11.a The density of in-place soils shall be tested by ASTM D6938, ASTM D1556, or ASTM D2167.

A-5.7.4.11.b The moisture content of in-place soils shall be determined in accordance with ASTM D6938 or ASTM D2216.

A-5.7.4.11.c Loose lift thicknesses shall be measured and monitored by the third-party Testing Service.

A-5.7.4.11.d Laboratory testing ASTM D2487, D2488, D4318, D422, and D1557 shall be used to classify, evaluate, and establish field testing datums for soil materials.

A-5.7.4.11.e When subgrades, fills, or backfills are not in conformance with the specification requirements, the Seller shall scarify and moisten or aerate, or remove and replace soil to depth required; recompact; and retest until specified compaction is obtained.

A-5.7.4.12 Clean-Up

A-5.7.4.12.a At the conclusion of all fill and backfill operations, the Seller shall clear away from the Project site as well as from private and public roads, ditches and surrounding areas, all rubbish and construction materials and all Subcontractors tools, equipment, and other property. Material shall be disposed in an Buyer-approved landfill.

A-5.7.4.13 Disposal of Excavated Material

A-5.7.4.13.a The Seller shall stockpile all excess soil material and unused spoil material excavated from the site. All materials shall be handled in accordance with the terms of all Applicable Laws and Buyer's requirements.

A-5.7.5 Dewatering

A-5.7.5.1 Performance Requirements

A-5.7.5.1.a Seller shall review the geotechnical information and determine the appropriate dewatering system for the Work to meet the performance requirements.

A-5.7.5.1.b Seller shall maintain all excavations in a dry condition to facilitate quality construction and backfill activities.

A-5.7.5.1.c Design, provide, test, operate, monitor, and maintain a dewatering system of sufficient scope, size, and capacity to control ground-water flow into excavations and to allow construction to proceed on dry, stable subgrades. Maintain dewatering operations to ensure erosion is controlled, stability of excavations and constructed slopes is maintained, and flooding of excavation and damage to foundation Work, utilities, yard piping and/or other Work improvements are prevented.

A-5.7.5.1.d Prevent surface water from entering the Work area by maintaining grading, dikes, ditches, berms, or other means. Furthermore, prevent surface water and subsurface or groundwater from ponding on prepared subgrades, and from flooding the site and the surrounding area.

A-5.7.5.1.e Accomplish dewatering without damaging structures and improvements adjacent to excavation.

A-5.7.5.1.f If the dewatering requirements and the flooding requirements are not satisfied due to failure or inadequacy of the system, then loosening of the foundation soils, instability of the walls or damage to the structure may occur. The supply of all labor and materials, and the performance of all Work necessary to carry out additional Work for repair of the foundation or structure resulting from such inadequacy or failure shall be undertaken by the Seller to the acceptance of Buyer, at no additional cost to Buyer.

A-5.7.5.1.g Handle and treat the effluent generated by the dewatering process prior to discharge in a manner which meets the requirements of the state regulatory agencies. All water collected from the dewatering process must be treated with applicable BMPs. When possible, treatment of dewatering discharge can be reduced by using the water for dust control or allow water to infiltrate and evaporate.

A-5.7.5.1.h Provide, take measurements, and maintain observation wells and/or piezometers to monitor groundwater levels at nearby critical structures or near the excavation when the excavation extends more than 5 feet below the groundwater table level.

A-5.7.5.1.i The Seller shall obtain permits from the appropriate regulatory agencies for the installation and destruction of all monitoring, observation, and dewatering wells. The Seller shall also obtain all pertinent permits from any other Agency with jurisdictional control over a particular activity involved in the dewatering.

A-5.7.5.1.j The Seller shall prepare a detailed dewatering construction plan and shall submit it to Buyer for review and acceptance one month before the dewatering activity.

A-5.7.5.1.k During the installation and operation of the dewatering system, the Seller shall monitor the operation to ensure that excessive amounts of sand or fines are not removed which could result in voids or undermining the subsurface conditions below concrete structures.

A-5.7.5.1.l The Seller shall establish and perform a movement and settlement survey. The Seller shall employ a Land Surveyor registered in the state the project is located in to establish the exact elevations at fixed points that act as benchmarks. Clearly identify benchmarks and record existing elevations. When the excavation extends greater than 5 feet below the groundwater table, during dewatering, resurvey benchmarks weekly, maintaining an accurate log of surveyed elevations for comparison with original elevations. Seller shall promptly notify Buyer if changes in elevations occur or if cracks, sags, or other damage is evident in adjacent construction or existing improvements.

A-5.7.5.2 Dewatering System

A-5.7.5.2.a Install dewatering system utilizing ditches to sumps, wells, well points, or other methods as appropriate, complete with pump equipment, standby power and pumps, filter material gradation, valves, vacuum gauges, appurtenances, water disposal, and surface-water controls to meet the performance requirements of this specification.

A-5.7.5.2.b Continuously operate system until foundation work, utilities, yard piping and/or other improvement work is completed, and fill materials have been placed, or until dewatering is no longer required.

A-5.7.5.2.c Provide an adequate system to lower and control groundwater as necessary to permit excavation, construction of foundation work, utilities installation, yard piping installation, placement of backfill or fill materials and/or other improvement Work. Install sufficient dewatering equipment to drain water-bearing strata above and below bottom of foundations, drains, sewers, and other excavations.

A-5.7.5.2.d Dispose of water removed from excavations in a manner which meets state and local regulations. Provide sumps, sedimentation tanks, and other flow-control devices as needed to fulfill these requirements.

A-5.7.5.2.e Remove dewatering system from Project site on completion of dewatering. Remove piezometers and other monitoring equipment with Buyer's approval. Before abandonment, observation wells, dewatering wells, and test wells shall be filled with bentonite-cement slurry and capped with a 5-foot-deep concrete plug. All other requirements for well destruction shall be per guidelines and requirements of the Louisiana Department of Environmental Quality (LDEQ).

A-5.7.5.2.f Notify Buyer immediately of and promptly repair damages to adjacent structures, facilities and/or improvements caused by dewatering operations.

A-5.7.5.3 Control of Water

A-5.7.5.3.a Seller shall provide, operate, and maintain all ditches, basins, site grading, and pumping facilities to divert, collect, and remove all water from the work area in compliance with Applicable Laws.

A-5.7.5.3.b All water shall be removed from the immediate site and discharged at approved locations. The Seller shall comply with all Federal, State, and local stormwater laws, regulations, ordinances, and other Applicable Laws. The Seller shall prepare, certify, obtain approval, and implement a National Pollutant Discharge Elimination System (NPDES) Large Construction Storm Water General Permit for storm water discharges from construction and land disturbance activities and shall not begin earth disturbance activities until the NPDES Permit is obtained from the Louisiana Department of Environmental Quality (LDEQ).

A-5.7.5.3.c The Seller shall be responsible for all costs incurred for compliance with the provisions of the NPDES General Permit. Provisions of the NPDES General Permit will include but is not limited to, monitoring, treatment (when necessary), and compliance resolution. The Seller shall conduct all permit required sampling, analysis, and reporting prior to the discharge of any wastewater.

A-5.7.6 Protection of Structures and Utilities

A-5.7.6.1 The existing structures and utilities which are adjacent to and within the limits of the excavation shall be protected against damage. The Seller shall be fully responsible to Buyer in the event of removal or damage of any existing objects which are intended by Buyer to remain in place. In the event the Seller uncovers any unmarked or unknown plant facility during excavation, he shall report his findings to Buyer, and he shall receive instructions from him before proceeding further.

A-5.7.6.2 Protect structures, utilities, sidewalks, pavements, other facilities and/or improvements from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations and construction traffic.

A-5.7.6.3 Compact fill adjacent to structures to a density equivalent to that of the surrounding fill by hand-tamping or hand-power tampers.

A-5.7.6.4 Do not operate heavy equipment within 2 feet of any structure.

A-5.7.6.5 Do not operate heavy vibratory compactors within 5 feet of any structure.

A-5.7.6.6 Do not permit passage of heavy compaction equipment over completed facilities within the following periods: (1) over cast-in-place concrete conduits prior to 14 days after placement of the concrete or until concrete sufficient strength is shown by testing

A-5.7.7 Grading and Drainage

A-5.7.7.1 General

A-5.7.7.1.a The working areas of the site shall be well drained during and after construction. No low-lying areas shall be left where water accumulation could occur. The site drainage plan and discharge from the site shall conform to federal, state, and local laws and regulations. Seller shall obtain all necessary permit approvals, prior to the start of site grading work.

A-5.7.7.1.b Drainage shall be designed to discharge non-contact stormwater to the appropriate, regulated outfalls as specified in the approved NPDES General Permit. Structural pad elevations and site grades shall be established to allow for proper drainage away from foundations and structures, and to prevent ponding anywhere in the Project site.

A-5.7.7.1.c Grading and earthwork performed by the Seller for construction parking areas and laydown yards site shall be as required to support construction operations.

A-5.7.7.1.d Finish site grading shall consist of establishing finished grades and placing surface materials (soil, aggregate, asphalt, concrete, etc.) to the design grades and to facilitate site access and drainage. The targeted minimum slope for unpaved surfaces shall be 0.5 percent. The targeted minimum slope for paved surfaces shall be 0.5 percent. Actual drainage slopes may vary, based on design limitations of a flat site, and will be reviewed with Buyer during detailed design. The maximum slope for seeded areas shall be 3H:1V. Permanent erosion and sedimentation control measures shall be included in the design, as required, to facilitate the overall site drainage plan.

A-5.7.7.2 Erosion Control

A-5.7.7.2.a Proper temporary erosion control measures including but not limited to the use of silt fences, sandbags and seeding shall be employed during construction to control erosion of embankments, temporary material stockpile(s), and to limit sediment runoff.

A-5.7.7.2.b Permanent erosion control for ditches and slopes, such as seeding, riprap, headwalls, rock surfacing, slope pavement, drainage terrace pavement, paved downcomers, etc., shall be installed within 30 days of completion of the ditch or slope.

A-5.7.7.2.c All necessary permitting for pre- and post-construction stormwater management must be obtained by Seller before start of construction activities.

A-5.7.7.3 Stormwater Drainage System

A-5.7.7.3.a A stormwater drainage system consisting of catch basins and underground piping shall collect stormwater runoff in the power block area. All storm water discharge

from the power block area shall meet the requirements of the applicable state and parish ordinances and shall be acceptable by the Buyer.

A-5.7.7.3.b Stormwater runoff from the construction laydown and parking areas shall follow state and local stormwater management criteria, including the LDEQ requirements for Stormwater Discharge for Construction Activities for five acres or more. A construction sediment basin shall be provided to serve a disturbed area of 10 acres at a time. As a minimum, construction sediment basins shall provide at least 3,600 cubic feet of storage per acre drained until final stabilization of the site. Discharge elevations for the sediment basins shall be assumed to be at elevation 6, pending further survey.

A-5.7.7.3.c Materials

A-5.7.7.3.c.1 Storm drainage collection system piping shall generally be constructed of corrugated high-density polyethylene pipe, having a corrugated outer wall and a smooth inner wall, and rated for gravity service. Joints shall be classified as watertight.

A-5.7.7.3.c.2 Storm sewer manholes and catch basins shall be precast reinforced concrete structures, designed for HS20 traffic load with a minimum of 10% impact factor. Manholes and catch basins shall have a cast iron frame and removable solid or grate cover.

A-5.7.7.4 Roof Drains

A-5.7.7.4.a Roof drain downspouts may discharge directly to the ground in areas that are not paved and intended for personnel access/walkways or planned for vehicle access. Personnel safety will be considered in determining which downspouts can discharge directly to the ground. Splash blocks will be used in seeded or graveled areas where downspouts do discharge to grade.

A-5.7.8 Oil Containment Requirements

A-5.7.8.1 Oil Containment

A-5.7.8.1.a As a minimum requirement, oil containment structures shall be designed in accordance with the federal requirements of Title 40 CFR 112 and this Specification for all transformers and lube oil tanks. The Seller shall provide oil containment for all equipment containing 55 gallons or more of oil. Oil containment shall include sufficient freeboard for precipitation. The Seller shall comply with the requirements of NFPA 850 for the layout (e.g., sizing) and design of drainage and firewalls as required to protect equipment and other transformers adjacent to transformers.

A-5.7.8.2 Oily Water System

A-5.7.8.2.a An oily water system shall be provided to collect discharges from all areas which have potential for oil contamination.

A-5.7.8.2.b All gravity piping used in the oily water system shall be either Cast Iron Soil pipe (CISP) or Ductile Iron Water pipe (DIWP) and have a minimum diameter of 4 inches. Piping shall be suitably protected against corrosion and able to withstand higher anticipated temperatures of oily wastewater streams. Pipes used to discharge separated wastewater shall be HDPE.

A-5.7.8.2.c Oil contaminated runoff shall be directed by gravity to a buried oil/water separator. Requirements for the oil separator include the following:

- A dual wall steel tank design, below grade per UL 58 and UL 2215
- Maximum flow rate of 500 gpm
- Monitoring system between tank walls
- Packaged coalescing plate separator providing 15 mg/l effluent quality.
- Integral lift station with 2-50% submersible pumps
- HDPE pressure rated piping to discharge treated effluent to the plant wastewater sump.
- Reinforced concrete hold-down slab and at-grade maintenance slab.

A-5.7.8.2.d The oil separator shall be furnished with an electric control panel housed in a single enclosure type NEMA 4X rated enclosure with mounting post. The control panel shall be equipped with power and sensor cables for each pump, and a set of non-mercury float switches for monitoring the liquid level in the wet well sump.

A-5.7.8.2.e Each oil separator pump shall be furnished with a power disconnect switch, a circuit breaker, a NEMA-rated magnetic motor starter with overload protection, and a heavy-duty end-of-cycle alternator relay to alternate pumps and allow automatic operation of the second pump on failure of the first pump to operate.

A-5.7.8.2.f The oil separator enclosure shall include pump motor running lights and for each pump and local alarm lights for pump failure and high water.

A-5.7.8.2.g Every oil containment area shall have a manual, lockable, isolation post indicator gate valve painted to the Buyer's color choice. Post indicators are only required for valves located underground. The manual valve shall not restrict the flow in its fully opened condition. The function of the manual valve is to stop the flow of oil during catastrophic events. The manual valve shall be located in an area accessible under fire-fighting conditions and outside the containment area.

A-5.7.9 Truck Unloading Containment

A-5.7.9.1 Provide truck unloading containment for aqueous ammonia, with a drain system directed to the storm drain system with a lockable isolation post-indicator valve painted to the Buyer's color choice.

A-5.7.9.2 Provide truck unloading containment for sulfuric acid, with a drain system directed to the storm drain system with a lockable isolation post-indicator valve painted to the Buyer's color choice.

A-5.7.10 Post indicator valves may be painted with a system-unique color code as directed by Buyer.

A-5.7.11 Sanitary Sewage System

A-5.7.11.1 Sanitary sewage discharge from new facilities shall be routed to a lift station and pumped to the local municipal sewer system.

A-5.7.11.2 Seller shall tie into the Municipal Sanitary Sewer line at a manhole outside the Facility boundary. Details are to be provided by Seller as listed on Attachment A-11 Terminal Points.

A-5.7.11.3 Sanitary sewage lift station is required to route new line to the local municipal sanitary sewer. The lift station shall have the following features and components:

A-5.7.11.3.a The wet well sump and valve box shall be pre-cast concrete with hinged aluminum access door frame and covers, and vents. Each cover shall be sized to provide convenient means of equipment removal, rated for 300-pound loading, and be equipped with a weather-proof recessed handles, full-length hinges, a locking latch with a release handle to hold the cover in the open position, and a torsion spring assist for opening and hasp for locking.

A-5.7.11.3.b Two 100 percent submersible grinder pumps rated for sewage duty with hydraulic sealing flanges, each connected to a discharge elbow mounted in the bottom of the wet well.

A-5.7.11.3.c Each pump shall be furnished with two stainless steel guide rails with support brackets and a stainless-steel lifting chain.

A-5.7.11.3.d One set of discharge piping from each pump shall be routed to an external valve box containing a plug valve and a swing check valve per AWWA C508 for each pump.

A-5.7.11.3.e The lift station shall be furnished with an electric control panel housed in a single enclosure type NEMA 4X rated enclosure with mounting post. The control panel shall be equipped with power and sensor cables for each pump, and a set of non-mercury float switches for monitoring the liquid level in the wet well sump.

A-5.7.11.3.f Each pump shall be furnished with a power disconnect switch, a circuit breaker, a NEMA-rated magnetic motor starter with overload protection, and a heavy-duty

end-of-cycle alternator relay to alternate pumps and allow automatic operation of the second pump on failure of the first pump to operate.

A-5.7.11.3.g The enclosure shall include pump motor running lights and for each pump and local alarm lights for pump failure and high water.

A-5.7.11.3.h An elapsed run time meter shall be supplied for each pump, capable of six-digit reading in hours and tenths of an hour.

A-5.7.11.4 Force main piping, if required, shall be pressure rated high density polyethylene with fusion welded joints.

A-5.7.11.5 The maximum velocity through sanitary force main piping is 8 ft/s. Maximum allowable pressure at the connection point to the city sanitary sewer system shall be verified with local authorities and adhered to.

A-5.7.12 Sanitary Sewage Flows

A-5.7.12.1 The system shall be designed for average flows of 35 gallons per person per day. The daily peak flow will be determined using the fixture units and the equivalent water demand obtained from the plumbing codes.

A-5.7.12.2 The system shall consider 21 full time employees per day to support operation of the combined cycle site.

A-5.7.13 Parking and Paving

A-5.7.13.1 Permanent Parking

A-5.7.13.1.a The permanent parking areas shall be paved with asphalt. All parking stalls shall be laid out in a 90-degree pattern with painted striping and concrete wheelstops.

A-5.7.13.1.b The total number of parking stalls shall be 24 stalls, including two ADA stalls. The parking stall criteria are as follows:

Parking Stall Criteria:

Standard stall: 10 feet by 20 feet
Handicap stall: As dictated by ADA
Aisle width: 24 feet

A-5.7.13.2 Paving

A-5.7.13.2.a All site roads and parking areas shall be paved with asphalt. Roads to chemical totes areas which require forklift access shall be paved with asphalt, including forklift access to each major piece of equipment. Any unimproved areas within the power block area bounded by the perimeter roads shall be compacted crushed stone surfacing or concrete paving.

A-5.7.13.2.b The crushed stone surfacing cross-section shall consist of 6 inches of crushed stone (material no larger than 1 ½ inches in size and no more than 10% passing the No. 200 sieve) on a 12-inch minimum compacted subgrade. The crushed stone surfacing for unpaved areas shall facilitate drainage, prevent ponding, and provide a suitable walking surface. Seller shall provide samples of crushed stone surfacing for Buyer's approval.

A-5.7.13.2.c Concrete paving shall be of sufficient thickness to fully support anticipated traffic loads (trucks, forklifts, cranes) and shall not be less than 4 inches in thickness. Concrete paving shall be supported on 4 inches of crushed aggregate base, on a 12-inch minimum compacted subgrade. Concrete paving shall be thickened at all free edges adjacent to roads or vehicle access doors into buildings. The thickened portion of the concrete paving shall be 125 percent of the concrete paving thickness, but not less than the paving thickness plus two (2) inches. Seller shall install contraction joints in the paving at no more than 15 feet on center and at all other areas susceptible to cracking. Isolation joints consisting of ½ inch preformed joint material shall be installed around all foundations, manholes, catch basins or other protrusions through the concrete paving. All contraction and isolation joints shall be sealed with a suitable joint sealant.

A-5.7.13.2.d The road pavement cross-section shall be a minimum of 4 inches of asphalt (consisting of two layers: a wearing course mixture and a base course mixture) on 8 inches of crushed aggregate base, on a 12-inch minimum compacted subgrade. Roads shall be designed for a 20-year service life and account for anticipated HS-20 wheel loads and consider plant operated forklifts and wheel-mounted maintenance cranes. All paving and sidewalks shall be in accordance with Louisiana Department of Transportation and Development DOTD Standard Specifications.

A-5.7.13.2.e Roads shall be designed to accommodate an AASHTO WB-50 design vehicle, and a height clearance of 20 feet, and a width of 8 feet 6 inches as specified by AASHTO (Policy on Geometric Design of Highways and Streets). Minimum intersection radius and minimum curb return radius shall be 50 feet unless Seller

obtained Buyer's approval for areas where the minimum value cannot be met. Minimum paved road width is 20 feet.

A-5.7.13.2.f Driveways at the rolling doors of all buildings shall be a minimum 8-inch-thick reinforced concrete pavement to accommodate HS20/HL-93 trucks and forklifts.

A-5.7.13.2.g Sidewalks shall be concrete with a minimum width of 5 feet and a minimum thickness of 4 inches. Sidewalks will have a maximum cross slope of 2 percent. An accessible route from the ADA parking to any accessible building shall be provided using paved areas and sidewalks with ADA curb cuts and slope requirements.

A-5.7.13.2.h The parking lot and access roads will be provided with the appropriate signs in accordance with OSHA guidelines and striping and the FHWA's Manual on Uniform Traffic Control Devices.

A-5.7.13.2.i Seller shall provide information to support detailed traffic impact study to be performed by Buyer.

A-5.7.14 Fences and Gates

A-5.7.14.1 Open construction areas and laydown yards shall be temporarily enclosed around the perimeter with an eight-foot-high chain link security fence throughout construction. Fences shall be equipped with gates (sizes and locations as required and determined by the Seller). Fence and gate material shall be galvanized steel.

A-5.7.14.2 Work shall also include installation of permanent security fencing. Permanent security fencing shall be seven-foot-high chain link topped by a 45-degree, one piece, and three wire extension arms for barb wire. Barbed wire shall be 2 strand, 12.5 minimum W&M gauge wire with 4-point barbs of 14-gauge wire at 5 inch maximum spacing. Chain link fence shall be zinc coated, class 2, chain link fence fabric, No. 9 gauge wire, 2-inch mesh.

A-5.7.14.3 Where possible, permanent fencing shall be installed in lieu of providing temporary fencing.

A-5.7.14.4 Sliding motorized gate (24 foot wide) with manual override, conduit and cabling for badge access, intercom, and video cameras are required at the new station entrance. The camera and intercom should be received at both the control room and the main reception desk. The Drive gate shall be located such that no access to any part of the facility is allowed prior to the driveway gate. See Attachment A-8 for additional physical security requirements.

A-5.7.14.5 Fence shall have a top rail and bottom tension wire. Top rails shall be 1.63 inches outside diameter (O.D.) pipe minimum. Wire shall be No. 7 gauge zinc coated coil spring wire.

A-5.7.14.6 Line posts shall be as a minimum 2 1/2 inches O.D. schedule 40 hot-dipped galvanized steel pipe. End and corner posts shall be a minimum 3 inches O.D.

Schedule 40 hot-dipped galvanized steel pipe. Terminal posts shall be braced. Maximum spacing of pipeline posts shall be 10'-0" center to center.

A-5.7.14.7 Swing gates shall be internally braced against sagging and furnished with hinges, latches, stops, keepers, etc.

A-5.7.14.8 All posts shall be set in concrete footings having a diameter at least 3 times the post diameter and a depth of 3 feet minimum below grade.

A-5.7.14.9 Fence Grounding Requirements

A-5.7.14.9.a The frame and fabric for fences shall be fully grounded at the time of installation in accordance with the recommendations identified in IEEE 80.

A-5.7.14.9.b Fences shall be isolated per Buyer's isolation criteria.

A-5.7.15 ALTA/ACSM Land Title Survey – Not Used

A-5.7.16 Equipment Delivery Plan

A-5.7.16.1 Seller shall be responsible for all equipment and materials delivery to Project Site. Seller shall develop and submit delivery plan to Buyer for review, comment, and approval. Seller shall supply basis and cost details of their heavy haul transport plan.

A-5.7.17 Construction Laydown

A-5.7.17.1 Laydown areas may be left with the improved stone surfacing.

A-5.8 STEEL DESIGN

A-5.8.1 General

A-5.8.1.1 This Attachment covers the design of structural steel for buildings and other structures.

A-5.8.1.2 All structural steel framing elements and connections shall be designed in accordance with either the Allowable Strength Design (ASD) method or the Load and Resistance Factor Design (LRFD) method in accordance with the ANSI/AISC 360.

A-5.8.1.3 Cold-formed steel components shall conform to the American Iron and Steel Institute specifications for structural members.

A-5.8.2 Deflections

A-5.8.2.1 The maximum lateral deflection of a structure at height H (above the base) shall not exceed 0.005 x H.

A-5.9 FOUNDATION DESIGN

A-5.9.1 General

A-5.9.1.1 This specification covers the design of all reinforced concrete structures, foundations, ground floor slabs, and yard structures.

A-5.9.1.2 Reinforced concrete structures, foundations and ground floor slabs shall be designed by the ultimate strength method in accordance with ACI 318.

A-5.9.1.3 Foundation depth and other foundation design considerations shall be in accordance with the requirements in IBC and take into account the subsurface conditions at the site.

A-5.9.1.4 Foundations for settlement sensitive equipment and structures and major vibratory equipment, including the steam turbine, combustion turbine, and boiler feed pumps, shall be designed to meet equipment supplier settlement/deflection criteria. Soil improvements or deep foundation shall be used if determined to be required by analysis.

A-5.9.1.5 All foundations for structures and major equipment shall be designed using a foundation depth to the frost depth and any applicable code requirements with a minimum of 12 inches below the final grade elevation.

A-5.9.1.6 Concrete elements with a thickness of 4 feet or more shall be considered as mass concrete. Design of mass concrete foundations shall be in accordance with ACI 207-1R.

A-5.9.1.7 For uplift load combinations, only that portion of the dead load permanently present to counteract the uplift condition shall be considered. Consequently, laydown load, contingency load, and other such loads of temporary nature shall not be considered in this equation.

A-5.9.1.8 Equipment or buildings supported on shallow foundations shall be separated by pre-molded joint filler from any deep foundations (foundations supported on piles, caissons, etc.)

A-5.9.1.9 All concrete flat work that is not used for structural purposes shall have its top surfaces sloped a minimum of 1 inch in 20 feet to enable runoff and eliminate ponding. This does not apply to foundation concrete.

A-5.9.1.10 Structural concrete shall be designed to minimize ponding on structural foundations.

A-5.9.2 Rotating Equipment Foundations

A-5.9.2.1 Foundations for rotating equipment shall be designed in accordance with the specific requirements of the equipment manufacturer. In the absence of such specific requirements, these foundations shall be designed in accordance with ACI 351.3R, ASCE guidelines for design of large steam turbine generator foundations, other applicable industry standards and this Attachment.

A-5.9.2.2 For soil supported foundations the ratio of machine concrete foundation mass to equipment mass shall be at least 3:1.

A-5.9.2.3 Equipment foundations shall extend a minimum of 6 in. all around beyond the edge of the equipment.

A-5.9.2.4 The CT, ST and associated generators shall be on a single combined foundation for each unit. The foundation shall be isolated from all other adjacent foundations, pipe rack steel foundations.

A-5.9.3 Factors of Stability

A-5.9.3.1 The overturning moment due to the wind load or seismic load shall not exceed 2/3 of the stabilizing moment of the building or other structure due to dead load only unless the building or other structure is anchored so as to resist the excess overturning moment.

A-5.9.3.2 During construction (empty building enclosed with siding) the above ratio may be increased to 90 percent. The weight of earth superimposed over footings may be used to calculate the dead load resisting moment.

A-5.9.3.3 Other minimum factors of safety for foundations shall be as follows:

A-5.9.3.3.a Sliding, Uplift, and Buoyancy (normal groundwater) shall be 1.5.

A-5.9.3.3.b Buoyancy (flood groundwater) shall be 1.1.

A-5.9.3.4 The minimum factor of safety for retaining structures during service conditions for overturning and sliding shall be 2.0 and 1.5, respectively.

A-5.9.3.5 Passive bearing pressure shall not be considered in the calculation of the stabilizing moment for factor of stability against overturning.

A-5.9.4 Miscellaneous Requirements

A-5.9.4.1 All equipment on ground floor area slabs or building foundations shall be supported on reinforced concrete pads. The pads shall be a minimum of 6 inches high. Equipment supported on the concrete pads shall be grouted as required or recommended by the equipment manufacturers to provide necessary support along the equipment skid and for smooth operation.

A-5.9.4.2 Tank foundations shall be designed in accordance with all tank vendor requirements.

A-5.9.4.3 Pipe supports, platform posts, ladders, etc., may be supported directly on the ground floor slab or building foundation without concrete pads using a minimum of 1 inch of grout.

A-5.9.5 Additional Requirements for Foundations of Vibratory Equipment

A-5.9.5.1 Foundations for vibrating equipment shall meet design requirements specified by the equipment manufacturer and industry standards and be designed to limit vibrations.

A-5.9.5.2 In order to avoid resonant conditions, foundations supporting vibratory equipment shall be designed with natural frequencies removed by at least +/-20% from the operating speed of equipment, unless otherwise specified by the equipment manufacturer.

A-5.9.5.3 Seller shall perform a dynamic analysis of the combustion turbine generator (CTG) and steam turbine generator (STG) foundations to ensure that the natural frequencies and response of the system are within acceptable limits.

A-5.10 GEOTECHNICAL DESIGN

A-5.10.1 General

A-5.10.1.1 Allowable geotechnical loading for foundations shall be determined by taking into account the ultimate limit state (soil bearing capacity) and serviceability limit state (settlement).

A-5.10.1.2 Shallow foundation designs shall limit the total settlement to 1 inch or less unless a more restrictive settlement limit is required by the Equipment Manufacturer.

A-5.10.1.3 Shallow foundation designs shall limit the differential settlement to 0.5 inch or less over 50 feet unless a more restrictive settlement limit is required by the Equipment Manufacturer.

A-5.10.1.4 Shallow foundation designs shall limit the differential settlement between adjacent foundations with shared piping or otherwise connected superstructure elements to within the tolerable limits for the connected elements.

A-5.10.1.5 Allowable capacities for deep foundation elements shall be determined using approved methods in accordance with IBC and industry standards.

A-5.10.1.6 Allowable capacities for deep foundation elements shall take into account effects of pile groups, where appropriate.

A-5.10.1.7 Deep foundation elements designs shall limit the total settlement to 1 inch or less unless a more restrictive settlement limit is required by the equipment manufacturer.

A-5.10.1.8 If applicable, installation of deep foundation elements shall not impact the continued operation of the existing plant facilities.

A-5.10.1.9 Pile foundations, if used, shall be tested in accordance with ASTM Standards D1143, D3689, D3966, D4945 and D5882 and IBC requirements.

A-5.10.2 Groundwater

A-5.10.2.1 The groundwater conditions at the time of the geotechnical exploration for the site shall be depicted in the Geotechnical Report, which is provided by the Seller.

A-5.10.2.2 Seller shall evaluate the observed groundwater conditions at the time of the geotechnical exploration and establish an appropriate design long term groundwater level, which accounts for all seasonal fluctuations of the groundwater table due to the precipitation, runoff, or other factors affecting the level.

A-5.10.3 Subsurface Data and Geotechnical Design

A-5.10.3.1 Geotechnical input and parameters for use in design shall be determined by the Seller from the preliminary geotechnical memo. The design will be updated to reflect a detailed geotechnical investigation performed by Seller.

A-5.11 DESIGN AND WORKMANSHIP

A-5.11.1 Structural Steel – Fabrication

A-5.11.1.1 General

A-5.11.1.1.a The AISC Specification and Code are hereby incorporated into this specification and shall apply except as otherwise specified herein or in related documents or approved in writing by Buyer.

A-5.11.1.2 Design of Connections

A-5.11.1.2.a All connections shall be developed in accordance with ANSI/AISC 360-10 and AISC Manual except as otherwise indicated herein.

A-5.11.1.2.b Connection angles, connection plates and gusset plates shall be 3/8 in. thick, minimum.

A-5.11.1.2.c When beams are coped, all re-entrant corners will be shaped, notch-free, to a radius of approximately ½ in.

A-5.11.1.3 Fabrication Quality

A-5.11.1.3.a Abutting joints shall be cut and finished true and straight. Joints designed for contact bearing shall have the surfaces faced to have even bearing when bolted and aligned.

A-5.11.1.4 High-Strength Bolts

A-5.11.1.4.a General

A-5.11.1.4.a.1 The use of high-strength bolts shall conform to the RCSC Specification.

A-5.11.1.4.a.2 Welding of or to high-strength bolts is prohibited.

A-5.11.1.5 Structural Steel Stair Stringers

A-5.11.1.5.a Stairs shall be constructed of channel stringers.

A-5.11.1.5.b When stringers project above the floor and do not butt against plate curbs, the ends shall be closed with a plate neatly welded and the welds ground smooth.

A-5.11.1.5.c All stairs' stringers shall be hot-dipped galvanized in accordance with ASTM A123.

A-5.11.1.6 Guardrail/Handrail

A-5.11.1.6.a Guardrail/handrail and posts shall be new steel pipe. Posts shall be spaced a maximum of 8 ft-0 in. on center, unless a smaller spacing is required per OSHA.

A-5.11.1.6.b Pipe rails shall be made with complete penetration groove welded connections, without fittings. Bends shall be smooth without miters, kinks, or collapsed wall Attachments, and all welds shall be ground where necessary to provide a smooth handrail surface. Welds shall not have rough surfaces even where all weld reinforcement is not removed. All shop cuts made to facilitate bending shall be seal welded closed and ground smooth. All pipe rails shall have a weep hole on its underside.

A-5.11.1.6.c All guardrails/handrails and accessories shall be hot-dipped galvanized in accordance with ASTM A123.

A-5.11.1.6.d Handrails shall conform to the requirement of OSHA, including requirement for guardrail in addition to graspable handrail at stairs.

A-5.11.1.7 Ladders and Ladder Cages

A-5.11.1.7.a Ladders shall conform to the provisions of OSHA 29 CFR 1910. Ladder rungs shall be non-slip per OSHA 29 CFR 1926. Rungs shall be corrugated, knurled, dimpled, coated with skid-resistant material, or otherwise treated to minimize slipping.

A-5.11.1.7.b Unless specifically designed for longer unbraced lengths, ladders shall have intermediate supports with maximum spacing of 8 ft-0 in and shall be connected at the top and bottom of the ladder.

A-5.11.1.7.c All ladders greater than 24 feet between landings shall be equipped with a personal fall arrest system or ladder safety system per the requirements of OSHA 29 CFR 1910. If ladder cages are provided, they shall be compatible with the fall arrest system or ladder safety system.

A-5.11.1.7.d All ladders and accessories shall be coated per the requirements specified herein.

A-5.11.1.8 Swing Gates

A-5.11.1.8.a Self-closing gates shall be provided at the top of all ladders.

A-5.11.1.8.b Swing gates for ladders, platforms and similar uses shall be manufactured, prefabricated, self-closing gates.

A-5.11.1.8.c Swing gates shall be coated per the requirements specified herein.

A-5.11.1.9 Grating and Stair Treads

A-5.11.1.9.a General

- All grating shall conform to the requirements of NAAMM MBG 531.

- All grating shall be a minimum of 1 1/4 in. deep. Stair treads shall 1 in. deep minimum. Indoor and outdoor grating shall be serrated.

A-5.11.1.9.b Floor Grating

- Floor grating shall be welded construction, rectilinear in pattern, with 3/16 in. thick longitudinal bearing bars 1 3/16 in. on centers and cross members 3/16 in. thick with minimum cross-sectional area of 1/16 sq in., 4 in. on centers. Maximum span of grating is based on limiting the deflection to ¼ inch due to a uniform live load of 100 psf.

- The weight of removable grating sections shall be less than 75 pounds.

- All pieces cut for piping or equipment shall be banded. Grating abutting ductwork or siding shall be banded without regard to opening size. Banding strips shall project 4 in. above the top of the grating to form a curb and be at least the same thickness as the bearing bars to which they are welded.

- Grating shall be fastened to each support beam at two locations. Minimum of 4 attachments for each grating panel.

- Stair treads shall be the same construction as the floor grating. The Seller shall provide special sized treads where they may occur, or otherwise be necessary due to interfaces, notably at the top tread of certain runs.

- 1 1/4 in. abrasive nosing shall be fastened to all stair treads and to grating at floors or landings at the top of all stair runs.

A-5.11.1.10 Checkered Floor Plate

A-5.11.1.10.a Checkered floor plate shall be smooth-cut or finished to provide smooth straight edges. Floor plates shall be bolted to the supporting steel and shall be removable. Holes in the supporting steel shall be drilled in the field after erection, using the shop-drilled countersunk holes in the checkered plate as a template to ensure proper fit. Holes in the supporting steel may be tapped or nuts may be welded under the beam flanges to receive the flathead bolts. An alternate, mechanical, securing system may be used as approved by Buyer. Checkered floor plate shall be stiffened wherever required for the span and loading.

A-5.11.2 Structural Steel - Erection

A-5.11.2.1 General

A-5.11.2.1.a This Attachment covers the erection of structural steel for buildings and other structures.

A-5.11.2.1.b The fabrication and erection tolerances shall conform to those specified in the AISC Steel Construction Manual.

A-5.11.2.1.c Erection shall comply with the provisions of the codes, specifications, and standards listed in this attachment, except where more stringent requirements are shown or specified.

A-5.11.2.1.d All base plates shall be grouted with non-shrink grout as noted.

A-5.11.2.2 Delivery, Storage, and Handling

A-5.11.2.2.a Unload and store materials to permit easy access for inspection and identification. Keep steel members off ground by using pallets, platforms, or other supports. Protect steel members and packaged materials from erosion and deterioration.

A-5.11.2.2.b 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.

A-5.11.2.3 Materials

A-5.11.2.3.a Materials shall conform to the requirements specified herein.

A-5.11.2.4 Erection

A-5.11.2.4.a Surveys: Check elevations of concrete bearing surfaces, and locations of anchor rods and similar devices, before erection Work proceeds, for conformance to the design drawings. Do not proceed with erection until corrections have been made or until compensating adjustments to structural steel Work have been agreed upon with Buyer.

A-5.11.2.4.b Protection of Existing Structures: The existing structures and utilities which are adjacent to and within the limits of the Seller's Work shall be protected against damage. The Seller shall be fully responsible to Buyer in the event of removal or damage of any existing objects which are intended by Buyer to remain in place.

A-5.11.2.4.c Setting Bases and Bearing Plates: Clean concrete and masonry bearing surfaces of bond-reducing materials and roughen to improve bond to surfaces. Clean bottom surface of base and bearing plates.

- Set base plates and bearing plates for structural members on plate or sheet shims using wedges or other adjusting devices as necessary.
- Tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims, but if protruding, cut off flush with edge of base or bearing plate prior to packing with grout.
- Grout solidly between bearing surfaces and bases or plates to ensure that no voids remain. Finish exposed surfaces, protect installed materials, and allow to cure.
- Minimum grout thickness shall be 1 inch.

- For proprietary grout materials, comply with manufacturer's instructions and recommendations.

A-5.11.2.4.d Field Assembly: Set structural frames accurately to lines and elevations indicated. Align and adjust various members forming part of complete frame or structure before permanently fastening. Clean bearing surfaces and other surfaces that will be in permanent contact before assembly. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

A-5.11.2.4.e Level and plumb individual members of structure within specified AISC tolerances.

A-5.11.2.4.f Field Assembly and Erection: Field bolting shall be done to ensure safety and proper alignment during erection. If the erection bolts are not sufficient, the Seller shall add field bolts to the connection.

A-5.11.2.4.g Gas Cutting: Do not use gas cutting torches in field for correcting fabrication errors unless specifically authorized by Buyer. Do not use torches to create holes or to cut members carrying stresses unless specifically authorized by Buyer.

A-5.11.2.4.h Straightening and Cleaning: All material shall be straight, clean, and free from rust and mill scale. If straightening is necessary, such material shall be straightened or flattened as necessary by some process which will not injure the material and approved by Buyer. All material with sharp kinks or bends will be rejected.

A-5.11.2.4.i Installation of Metal Bar Grating: Install grating to comply with recommendations of NAAMM grating standard that applies to the grating types and bar sizes indicated, including installation clearances and standard anchoring details.

A-5.11.2.5 Quality Control

A-5.11.2.5.a Field-Bolted Connections: Inspect in accordance with AISC and RCSC specifications.

A-5.11.2.5.b Field Welding: Inspect and test during erection of structural steel as specified herein.

A-5.11.3 Steel Floor Deck

A-5.11.3.1 Deck General

A-5.11.3.1.a All steel floor deck and accessories shall be hot-dipped galvanized steel and conform to ASTM A653, Structural Grade 33 and ASTM A924. Hot-dip galvanizing shall conform to ASTM A924 with a minimum coating class of G60 as defined in ASTM A653.

A-5.11.3.2 Steel Deck Design

A-5.11.3.2.a Units shall be fabricated from steel conforming to Section A3 of the AISI Specifications for the Design of Cold- Formed Steel Structural Members with not less than 0.034 in. min. (20 gage) sheet steel.

A-5.11.3.2.b Floor decking can be designed as floor formwork, but the composite deck properties shall not be utilized for design.

A-5.11.3.3 Deck Fabrication

A-5.11.3.3.a Form deck units in lengths to span three or more supports, with flush, telescoped, or nested laps at ends centered over supports and interlocking or nested side laps. Provide necessary materials for steel deck that comply with recommendations of the steel deck manufacturer.

A-5.11.3.3.b Deck Openings: Unframed openings and all skew cutting shall be cut and reinforced, if necessary, in the field.

A-5.11.3.4 Deck Welding

A-5.11.3.4.a All field welding, shop welding, weld procedures and weld qualification shall be in accordance with AWS Dl .3.

A-5.11.3.4.b Continuous visual inspection shall be made to ensure that welds are of the correct size, free from cracks, with proper fusion and penetration of the support steel. The acceptance criteria for field weld inspection shall be in accordance with AWS D1.1.

A-5.11.3.4.c Comply with applicable provisions of AWS D1.1 "Structural Welding Code-Steel" and AWS D1.3 "Structural Welding Code-Sheet Steel." Use qualified welding processes and welding operations in accordance with AWS Dl .3.

A-5.11.3.5 Install deck units and accessories in accordance with SDI Manual of Construction with Steel Deck, manufacturer's recommendations, and shop drawings. Seller's procedures shall comply with 29 CFR 1910.

A-5.11.4 Reinforced Concrete

A-5.11.4.1 General

A-5.11.4.1.a Comply with provisions of the following codes, specifications, and standards listed herein. If provisions of these documents conflict, the more stringent shall apply.

A-5.11.4.1.b Where required by the IBC Code, install plastic vapor retarder beneath slabs in contact with the ground, in accordance with the requirements of ASTM E1643. As a minimum, vapor retarder shall be provided beneath the Control/Administration Building foundation and other areas where concrete moisture sensitive coatings are to be installed. Seller shall protect vapor retardant material during erection of forms, reinforcing steel and embedded items.

A-5.11.4.2 Materials

A-5.11.4.2.a Materials shall conform to the requirements specified herein and shall conform to the additional requirements indicated below. Redi-Mix Concrete shall comply with ASTM C94.

A-5.11.4.2.b Cement type shall be in accordance with ACI requirements and appropriate for soil conditions as documented in the geotechnical report.

A-5.11.4.2.c Provide aggregates from a single source. Provide evidence that aggregates are non-reactive with alkalies when tested in accordance with ASTM C289, C227, C1260 or C1567.

A-5.11.4.2.d Changes in cement, flyash, aggregates, etc., will require submittal of trial batch or field experience data for review prior to the changes being made.

A-5.11.4.2.e Admixtures: Non-Chloride type only. The use of calcium chloride is not permitted.

A-5.11.4.2.f Waterstops: Waterstops shall be 6" rubber or PVC, ribbed type with center bulb, capable of resisting 100 ft of head. Waterstops shall be designed and tested in conformance to the requirements of the Army Corps of Engineers CRD-C572.

A-5.11.4.2.g Vapor Retarders: Plastic water vapor retarders used beneath slab in contact with ground shall be per ASTM E1745, Class A, with a minimum thickness of 6 mils.

A-5.11.4.2.h Bonding Agent: Polyvinyl acetate or acrylic base.

A-5.11.4.2.i Joint Sealant: Provide elastomeric joint sealants and backings that have been produced and installed to establish and to maintain watertight and airtight continuous seals without causing staining or deterioration of joint substrates or other as approved by Buyer. Joint sealant and associated materials shall be nonstaining. Joint sealant shall be installed flush with the top of concrete.

A-5.11.4.3 Proportioning and Designing Mixes

A-5.11.4.3.a Prepare design mixes for each type and strength of concrete by either laboratory trial batch or field experience methods as specified in ACI 301. For the trial batch method, use an independent testing agency for preparing and reporting proposed mix designs. The testing agency shall not be the same as used for field quality control testing.

A-5.11.4.3.b Submit written reports including 7- and 28-day compressive strength data to Buyer of each proposed mix for each class of concrete at least 30 days prior to start of Work.

A-5.11.4.3.c Adjustment to Concrete Mixes: Mix design adjustments may be requested by Seller when characteristics of materials, job conditions, weather, test results, or

other circumstances warrant, and as accepted by Buyer. Laboratory test data for revised mix and design and strength results must be submitted to and accepted by Buyer before using in Work. However, no water shall be added to the concrete after the trucks leave the batching facility.

A-5.11.4.4 Admixtures

A-5.11.4.4.a Use admixtures as required for placement, workability, and durability. Admixtures shall be used in strict compliance with manufacturer's directions.

A-5.11.4.4.b Admixtures shall be submitted for Buyer approval as part of the concrete mix design submittal.

A-5.11.4.4.c The use of calcium chloride admixtures is prohibited.

A-5.11.4.5 Concrete Mixing

A-5.11.4.5.a Ready-Mixed Concrete: Comply with requirements of ASTM C 94, and as specified.

A-5.11.4.6 Formwork

A-5.11.4.6.a Design, erect, support, brace, and maintain formwork to support vertical, lateral, static, and dynamic loads that might be applied until concrete structure can support such loads. Construct formwork so concrete members and structures are of correct size, shape, alignment, elevation, and position. Maintain formwork construction tolerances and surface irregularities complying with the ACI 347 limit applicable to Class A tolerances for concrete surfaces.

A-5.11.4.7 Fabricating and Placing Reinforcement

A-5.11.4.7.a Fabricate reinforcement in accordance with ACI 315.

A-5.11.4.7.b Comply with Concrete Reinforcing Steel Institute's recommended practice for "Placing Reinforcing Bars," for details and methods of reinforcement placement and supports and as specified.

A-5.11.4.8 Joints

A-5.11.4.8.a Construction Joints

- Locate and install construction joints so they do not impair strength or appearance of the structure. Major construction joints shall be indicated on the Seller's design drawings.
- Place construction joints perpendicular to main reinforcement. Continue reinforcement across construction joints except as indicated otherwise.

A-5.11.4.8.b Control Joints

- Control joints shall be saw cut as soon as possible, but no later than 12 hours after completion of concrete finishing.

- Control joints saw cut in concrete shall be filled with a pourable, flowable, self-leveling, flexible, non-shrinking and durable joint sealant. Seller shall submit the proposed product for Buyer's approval. Joints shall be filled after a minimum of 60 days after concrete placement. Seller shall vacuum joints prior to sealant installation and follow the sealant manufacturer's requirements.

A-5.11.4.9 Installing Embedded Items

A-5.11.4.9.a The Seller shall properly locate and secure in position before concrete is placed all embedded conduit and piping, anchors, sleeves, inserts, hangers, dowels, sleeves, blocking grounds and other fastening devices required for attachment of other Work. Embedded items shall be sufficiently anchored to maintain their position during concrete placement and prevent their flotation. Maintain items plumb, in alignment and in proper position.

A-5.11.4.10 Concrete Placement

A-5.11.4.10.a Pre-Pour/Placement Meeting and Inspection

- Seller shall have a Pre-Pour/Placement meeting on-site prior to concrete pours for every major foundation, including but not limited to the CTG, STG, HRSG, and Control/Administration/Warehouse/Maintenance Shop Building. Buyer or its designated representative shall be in attendance.
- The Seller shall perform an independent inspection/review prior to concrete placement. Before placing concrete, inspect and complete metal form deck installation, reinforcing steel, and items to be embedded or cast in.

A-5.11.4.10.b General Requirements

- Comply with ACI 304, "Guide for Measuring, Mixing, Transporting, and Placing Concrete," and as specified.
- Deposit and consolidate concrete continuously or in layers of such thickness that no new concrete will be placed on concrete that has hardened sufficiently to cause seams, planes of weakness or voids. If a section cannot be placed continuously, provide construction joints as specified. Deposit concrete to avoid segregation at its final location. Do not drop concrete freely for more than 5 feet. Use a hopper and drop chute where drops are greater than 5 feet.

A-5.11.4.10.c Cold-Weather Placement

Comply with provisions of ACI 306.1 and as follows. Protect concrete Work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures. Place no concrete during rain.

- All methods and materials used for concreting in cold or freezing weather shall be subject to the prior approval of Buyer. Cold weather shall be as defined in ACI 306.1. Chill factor shall be taken into consideration in determining proper protection of the concreting operations.

- Do not use frozen materials or place concrete on frozen subgrade or on subgrade containing frozen materials.
    - The Seller shall be responsible for removing ice and frost from foundations, previously placed concrete, forms, form materials and reinforcing steel, providing heating for water and aggregates, and for protecting the newly placed concrete.
    - Concrete shall have a temperature conforming to Table 2.3.2.1 of ACI 306.1, when placed in the forms and shall be maintained at a temperature conforming to Table 2.3.2.1 of ACI 306.1 for not less than 72 hours after placing.
- Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise accepted in mix designs.

A-5.11.4.10.d Hot-Weather Placement

When hot weather conditions exist that would impair quality and strength of concrete, place concrete complying with ACI 305 and as specified.

- Cool ingredients before mixing to maintain required concrete temperature at time of placement. Mixing water may be chilled or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water.
- Use water-reducing retarding admixture when required by high temperatures, low humidity, or other adverse placing conditions.

A-5.11.4.10.e Mass Concrete Placement

The provisions for placing, curing, and protection of mass concrete shall be in compliance with ACI 301, ACI 207 and as herein specified.

- All concrete structures or foundations larger than 4 feet in thickness shall be treated as mass concrete.
- Foundations for steam and combustion turbines and generators shall be treated as mass concrete.
- Mass concrete center temperature shall not exceed 158°F.
- The maximum allowable difference between the center and surface temperature of mass concrete section shall be 35°F.
- Seller shall supply insulation blankets of sufficient thickness, thermocouples, etc., as required to maintain the surface temperature of the concrete in accordance with ACI 301 provisions for mass concrete and as required in this Attachment.
- Forms shall be left in place for a minimum of 7 days.

A-5.11.4.11 Finishing Concrete

A-5.11.4.11.a Formed Surfaces

- Smooth-Formed Finish: Provide a smooth-formed finish on formed concrete surfaces exposed to view or to be covered with a coating or covering material applied directly to concrete.

A-5.11.4.11.b Concrete Slab Finishes

- Provide a trowel finish for interior slab surfaces exposed to view, slab surfaces to be covered with resilient flooring, carpet, ceramic or quarry tile, paint, or other thin film finish coating system.
- Provide a broom finish for exterior slab surfaces that will have foot traffic during operations. Provide a floated finish for exterior slab surfaces that will not be subject to foot traffic.

A-5.11.4.11.c Concrete Curing and Protection

- Curing of concrete shall be in accordance with the requirements of ACI 301.
- Apply curing compound in accordance with manufacturer's recommendations on concrete surfaces.

A-5.11.4.12 Quality Control Testing During Construction

A-5.11.4.12.a A Compressive Strength Test Report Form shall be provided by the Seller for all test specimens. This form shall accompany all test specimens sent to the laboratory.

A-5.11.4.12.b Test results will be reported in writing to Buyer 24 hours after tests. Reports of compressive strength tests shall contain the Facility identification name and number, date of concrete placement, name of concrete testing service, concrete type and class, location of concrete batch in structure, design compressive strength at 28 days, concrete mix proportions and materials, slump, air content, concrete temperature, compressive breaking strength, and type of break for both 7-day tests and 28-day tests.

A-5.11.4.12.c Concrete testing will be performed by the Seller only for structural concrete as it is defined in ACI 301 Section 1.2. Structural concrete for this project shall have a minimum compressive strength as required per Attachment A-5. Testing shall be performed in accordance with ACI 318 and ACI 350 as applicable. Concrete for ductbank, mudmat and flowable fill will not be tested for strength or other testing required by ACI.

A-5.11.5 Anchorage to Concrete

A-5.11.5.1 Cast-in-Place Anchorage

A-5.11.5.1.a Anchor rods, headed bolts, headed studs, and other steel materials cast in concrete shall be designed in accordance with the provisions of IBC and ACI 318.

A-5.11.5.1.b Column anchor rods shall not be used to resist lateral shear forces greater than 10 kips. When lateral shear force is greater than 10 kips, the shear force shall be transferred to the foundation using shear bars and grouted pockets in the foundation.

A-5.11.5.1.c Vertical uplift forces may be transferred to the foundation by means of column chairs and anchor rods or by welding the column directly to the baseplate

A-5.11.5.1.d All embedded structural shapes and anchor rod assemblies shall be hot-dipped galvanized, unless directed otherwise by the Buyer. Steel elements that are not hot-dipped galvanized and are exposed to soil or atmosphere shall be painted.

A-5.11.5.2 Post-Installed Anchorage

A-5.11.5.2.a All post-installed concrete anchors (e.g., expansion anchors, adhesive anchors, undercut anchors) shall be designed in accordance with the requirements of ACI 318 and the anchor manufacturer.

A-5.11.5.2.b Installation of post-installed anchorage shall conform to anchor manufacturer's instructions and requirements.

A-5.11.6 Concrete Masonry Unit

A-5.11.6.1 General

A-5.11.6.1.a Comply with the provisions of the following codes, specifications and standards listed in Attachment A-5, except where more stringent requirements are shown or specified. Where provisions of these conflict, the more stringent shall apply, unless otherwise approved by Buyer.

A-5.11.6.2 Materials

A-5.11.6.2.a Materials shall conform to the requirements specified in Attachment A-5 herein and shall conform to the additional requirements indicated below.

A-5.11.6.2.b Joint Reinforcement: Steel, heavy duty, or extra heavy continuous truss type, hot-dipped galvanized after fabrication, conforming to ASTM A951, A82 and A153.

A-5.11.6.2.c Tie Bar Anchors: Steel, ASTM A82, hot-dipped galvanized after fabrication with minimum size of 3/16 in. diameter.

A-5.11.6.2.d Corrugated Metal Ties: Steel, 16-gauge, 7/8 in. wide, ASTM A36, A1008 or A109, hot-dipped galvanized per ASTM A153.

A-5.11.6.2.e Dovetail Anchors: Steel, ASTM A1008 or A109, hot-dipped galvanized per ASTM A153.

A-5.11.6.3 Construction:

A-5.11.6.3.a CMU shall be laid in standard running bond. Provide special and solid units as required to form corners, returns, offsets, lintels, control joints, etc., and to maintain proper bond.

A-5.11.6.3.b Provide dry course flashing under exterior masonry walls for enclosed buildings resting on concrete foundations, floors, beams, curbs, etc. Extend flashing full thickness of wall in all cases. Use care not to injure or pierce felt during installation or in subsequent laying of masonry. For flashing at grade floors, cement plies together with cold applied adhesive.

A-5.11.6.3.c Truss-type masonry joint reinforcing shall lap a minimum of six inches at splices. Masonry joint reinforcement shall not pass through vertical pre-molded control joints.

A-5.11.6.3.d Bar reinforcing shall be used as reinforcing in reinforced concrete block walls, with size and spacing as indicated on the design drawings. Fill cores containing reinforcing with grout.

A-5.11.6.4 Cold Weather Construction

A-5.11.6.4.a When the ambient temperature is below 40°F, implement cold weather procedures of ACI 530.1 and as required herein.

- Use of antifreeze liquids, salts or similar materials in mortar is NOT PERMITTED.
- Cold weather construction procedures shall be subject to approval of Buyer.

A-5.11.6.5 Hot Weather Construction:

A-5.11.6.5.a When the ambient air temperature exceeds 90°F, implement the hot weather procedures of ACI 530.1 and as required herein.

- Mortar bed surfaces of CMU shall be lightly wetted with cool water to deter the mortar from moisture loss and from drying too rapidly.
- The mortar shall be kept moist and shall not be strung out more than two lengths ahead of the CMU being placed.
- Mortar joints shall be fog sprayed until damp at least three times per day until the masonry is at least three days old.

A-5.12 STRUCTURAL WELDING

A-5.12.1 General

A-5.12.1.1 All welding, welding procedures, welding qualifications, and welder qualifications shall be in accordance with AWS D1.1 Structural Welding Code - Steel and AWS D1.3 Structural Welding Code - Sheet Steel and the additional

requirements herein. Provide certification that welders and welding operators to be employed in Work have satisfactorily passed AWS qualification tests.

A-5.12.1.2 Welding procedures (WPS) and Procedure Qualification Records (PQR) shall be submitted for approval prior to the start of production welding and shall be maintained in the Seller's file. The Seller shall use AWS pre-qualified weld procedures whenever possible.

A-5.12.1.3 Welders, welding operators and NDT personnel shall be certified by independent testing agencies, of recognized standing, in accordance with the most current SNT-TC-1A, as minimum Level 2. Such certifications shall have been validated within the previous 6 months per AWS D1.1, AWS D1.3 or AWS D1.6 prior to performing the Work.

A-5.12.1.4 Only low hydrogen type covered electrodes shall be used as weld filler metal if shielded metal arc welding (SMAW) is the welding process selected for production welding of carbon steel.

A-5.12.1.5 Weld filler metals shall meet the requirements of the applicable AWS Filler Metal Specification. A Certificate of Compliance shall be available in the Seller's file for each heat, lot, or batch of filler metal.

A-5.12.2 Weld Filler Metal Control

A-5.12.2.1 In addition to the requirements of AWS D1.1, all welding materials shall be stored in a controlled access, clean, dry area that is weathertight and is maintained at a temperature between 40°F and 140°F. The material shall not be in contact with the floor and shall be stored on wooden pallets or cribbing. The materials shall be identifiable at all times during storage, handling, and issuance.

A-5.12.3 Inspection and Repair of Welds

A-5.12.3.1 As a minimum, all welds shall be 100 percent visually inspected by the Seller's third-party Testing Service. Inspection and quality of welds shall conform to the requirements of Sections 6, 8 and 9 of AWS D1.1, AWS D1.3 and AWS D1.6.

A-5.12.3.2 All welds found deficient shall be repaired in accordance with AWS D1.1. Seller shall record types and locations of defects and Work required and performed to correct weld defects and deficiencies.

A-5.12.3.3 The weld inspection shall be by Seller's AWS Certified Inspector, or Assistant Welding Inspector(s), under the supervision of the AWS Certified Inspector. Alternatively, the Seller may implement a program for self-certification of welding inspectors, provided the program is written and is supervised by an AWS Certified Inspector in compliance with the requirements of AWS D1.1, Sections 6 and 8. The Seller's Weld Inspection Program, including the Inspector's certification records, shall be made available to Buyer.

A-5.13 SURFACE PREPARATION AND PROTECTIVE COATINGS

A-5.13.1 General

A-5.13.1.1.a Coatings shall have a minimum design life of 20 years without recoating.

A-5.13.1.1.b Coatings shall comply with the locally adopted EPA Volatile Organic Compound (V.O.C.) limits.

A-5.13.1.1.c All steel material furnished under this Specification, except machined surfaces or as otherwise specified herein, shall be cleaned, primed and top coated and/or hot-dipped galvanized as required herein.

A-5.13.1.1.d A standard coating system is incorporated herein, which includes surface preparation, prime, intermediate (if required) and top coating material, required application procedure, and corrective procedure.

A-5.13.1.1.e Any conflict between this specification and the requirements or instructions of the SSPC, or the coating manufacturers, shall be brought to Buyer's attention in writing.

A-5.13.1.1.f The Seller shall submit the coating manufacturer's standard color charts, chips, or samples for selection of final finish colors by Buyer. Major Equipment supplier shall utilize their standard colors.

A-5.13.1 Coating Application

A-5.13.1.1.a Coatings shall be applied in accordance with the requirements of SSPC PAl, supplemented by requirements of the coating manufacturer and application requirements of this specification.

A-5.13.1.1.b Where abrasive blast cleaning is required, abrasives shall be used that develop a substrate profile per the manufacturer's recommendation, but no less than 1.0 mil.

A-5.13.1.1.c Prevent fallout from cleaning operations from being deposited on adjacent surfaces which are ready for coating and freshly coated surfaces. Where deleterious material may be deposited as a result of normal construction activities, a prepared surface shall either be protected or coated immediately.

A-5.13.1.1.d All coating material containers shall be examined upon delivery. Any evidence of leaks, broken seals, freezing or other damage which may have resulted in any loss of the constituents by volatilization or otherwise shall be cause for rejection. Coating material containers shall be labeled to show the name of the manufacturer, the product trade name or designation, color, and the expiration date. Containers shall have their labels intact and completely legible.

A-5.13.1.1.e Mixing shall conform to the requirements of SSPC PA1 except as otherwise required below. Paint, which has skinned, gelled, separated, or otherwise deteriorated during storage to the extent that normal thinning will not restore the paint to its intended viscosity, uniformity, and consistency, shall not be used. All paint shall be strained after mixing.

A-5.13.1.1.f Only those types and brands of thinner recommended by the coating manufacturer shall be used for thinning. The amount of thinning shall be limited to the amount necessary to facilitate application. Surfaces which have been prepared, as required, and are ready for painting shall be painted as soon as practical.

A-5.13.1.1.g Coatings shall be applied to dry, frost-free surfaces and within the ambient condition parameters established in SSPC PA1, except as otherwise required or permitted herein. Application at temperatures (surface or ambient) in excess of 100°F or per the manufacturer's recommendation shall not be permitted if the resultant film is found to be prone toward bubbling, cratering, or pin holing.

A-5.13.1.1.h Low speed pot agitators shall be used to keep zinc in suspension when applying primers containing zinc dust. Zinc primers shall be properly cured and free from dry spray and mud cracking. Where present, these shall be removed, and the coating repaired.

A-5.13.1.1.i Spot touch up priming shall be accomplished before rust has formed on the cleaned surface. The prepared spot or area shall be cleaned with a cleaning solvent and allowed to dry completely before applying topcoat materials. Touch up materials for spot priming shall be brushed applied.

A-5.13.1.1.j Surfaces which have been prepared and touched up as required and are ready for coating shall be coated as soon as practicable after the spot priming or touch up coating material has thoroughly dried, so as to minimize the chance of recontaminating the prepared surface.

A-5.13.1.1.k The minimum drying time before handling the coated material shall be in accordance with the manufacturer's recommendations. Subsequent finish coats, if required, shall be applied only after the previously applied coat has been allowed to dry for the necessary dry-to-recoat interval as specified by the manufacturer.

A-5.13.1.1.l Where more than one topcoat is applied, the underlying coat(s) shall be tinted a different shade than the required final coat color to facilitate proper coverage and to allow for clear differentiation between coats. Only the specific tinting agents recommended by the coating manufacturer shall be used. Specifically, with urethane coatings, only solvent base universal tints shall be used.

A-5.13.1.1.m Shop welded contact surfaces, such as the faying surfaces between connection angles and beam webs shall be coated with an acceptable product before assembly or completely seal welded prior to coating to prevent rust formation. Inaccessible surfaces, the perimeters of which are continuously seal welded, need not be primed.

A-5.13.1.1.n Milled surfaces shall be coated with a rust-preventative material. Coating shall be applied after the Seller's inspection and prior to being placed outdoors.

A-5.13.2 Standard Coating System

A-5.13.2.1 General

A-5.13.2.1.a Seller shall provide Buyer with a recommended manufacturer's coating system for all supplied equipment (e.g., pumps, valves, etc.) for the environment and intended service of that equipment. The coating system shall include identification of surface preparation, shop prime coating, shop finish coating, shop touch-up coating and coating materials required for the Work. Unless otherwise specified, all external surfaces of machinery and equipment shall be coated as follows:

- Machined surfaces shall not be coated prior to mating.
- Coating the external surfaces of non-ferrous metal castings, piping or other parts is not required unless otherwise specified.
- Galvanized surfaces, stainless steel, nameplates, and smooth aluminum sheet shall not be coated. Perforated and cast aluminum shall be coated. Junction boxes, etc., shall be coated.
- All surfaces that are inaccessible after fabrication shall be completely painted in the manufacturer's factory prior to fabrication.

A-5.13.2.1.b Coating systems shall comply with Table 1 of this attachment.

A-5.13.2.1.c This painting system involves zinc-rich paint, gray in color, with material requirements meeting SSPC PS12, surface preparation meeting SSPC SP6 without appendix.

A-5.13.2.1.d All coating products except zinc rich primers used for this Work shall be certified 100% lead free. Zinc rich primers shall be restricted to ASTM D520 Type 11.

A-5.13.2.2 Coating Schedule

The coating schedule shown in Table 1 summarizes the coating Work anticipated for the Work. Finish colors are to be determined by Buyer.

A-5.13.3 Film Thickness Test

A-5.13.3.1 For film thickness measurement, the requirements, and recommended practices of SSPC-PA2 shall be followed. Testing shall be performed for all of the Work processed during any coating shift for one full day per coating work week for all steel.

A-5.13.4 Hot-Dip Galvanizing

A-5.13.4.1 After fabrication and before assembly, all structural steel framing, grating and stair treads, guardrails, handrails, ladders, and cages shall be degreased, cleaned of rust and scale, prefluxed, and hot-dipped galvanized. The zinc (hot-dipped galvanized) coatings applied to the fabricated products shall be in accordance with ASTM A123 and all of the incorporated specifications and recommended practices of the ASTM referenced therein, except as otherwise required or permitted herein. Additionally, hot-dip galvanizing and fabrication of items for

hot-dip galvanizing should conform to the standards and guidelines set forth in AHDGA/ZI Manual.

A-5.13.4.2 Precautions shall be taken to avoid distortion or warpage of members during hot-dip galvanizing. The procedure suggested in ASTM A384 and on pages 26 and 27 of AHDGA/ZI Manual shall be observed. Material failing to meet the required criteria for straightness and length shall be subject to rejection.

A-5.13.4.3 Seller's fabricator shall determine the size, location, and shape of fill, drain, and vent openings in the product in accordance with the recommendations of ASTM A385 for closed sections such as pipe and structural tubing and open sections such as rolled shapes, plates, and built-up members. Such openings shall be documented on the detailed shop drawings by specifying the size, location, and shape as required on each member.

A-5.13.4.4 Seller's Fabricator shall completely seal the perimeter of overlapped member surfaces that are in contact with continuous welds prior to hot-dip galvanizing. Where design welds are required for overlapped members, then only the balance of the overlapped perimeter shall be sealed. Unsealed overlapping areas may trap hot-dip galvanizing process acids which can escape to discolor or damage the hot-dipped galvanized coating. Seller's fabricator shall determine the venting requirements for sealed overlapping surfaces. Vent holes for such cases shall be provided, if necessary, in only one member of the overlapped area.

A-5.13.4.5 All grating, stair treads, ladders, floor plates, banding bars, and other members shall only be hot-dipped galvanized after all shop fabricator processes have been completed.

A-5.13.4.6 Hot-dipped galvanized faying surfaces of bolted connections using ASTM A325 or A490 bolts slip critical connections shall be roughened by means of hand wire brushing. Hand wired brushing shall achieve visible roughening of the faying surfaces. Hand wire brushing shall be controlled to avoid polished faying surfaces. Polished faying surfaces and power wire brushing of faying surfaces is unacceptable. Faying surfaces are defined in the "Specification for Structural Joints Using ASTM A325 or A490 Bolts."

A-5.13.4.7 Seller shall insure that there are no cracks at re-entrant corners of coped W shapes. If cracks are found, they shall be repaired prior to shipment to the Project Site. Seller's repair procedure shall be submitted to Buyer for review prior to installation. Hot-dipped galvanized material with metal cracks is unacceptable. Seller shall repair or replace unacceptable material at no cost to Buyer.

A-5.13.4.8 Seller shall coat materials with safety colors as specified in this Attachment.

A-5.13.5 Hot-Dip Galvanizing Touch-Up and Repair:

A-5.13.5.1 Uncoated areas of steel after initial hot-dip galvanizing and/or mechanical damage during handling and erection shall be repaired in accordance with the requirements of ASTM A780 and Annex A2 of ASTM A 780 with the following exceptions:

- Areas to be repaired shall be power disk sanded to bright metal. To ensure that a smooth reconditioned coating can be affected, surface preparation shall extend into the undamaged or acceptable hot-dipped galvanized area by not less than one inch all around to ensure continuity of coating.
- Touch-up paint shall be an organic cold galvanizing compound having a minimum of 93% zinc dust by weight in the dry film. Touch-up on hot-dipped galvanized surfaces where hot-dip galvanizing has been removed or otherwise damaged shall be coated per CS-107.
- The paint shall be spray or brush applied until a total dry film thickness of 4 mils minimum has been achieved. Two separate coating applications shall be made with each application achieving a minimum dry film thickness of 2 mils. A finish coat of aluminum paint shall be applied to provide a color blend with the surrounding hot-dip galvanizing.
- Coating thickness exclusive of the finish coat shall be verified by measurements with a magnetic or electromagnetic gauge.

A-5.13.5.2 The use of zinc-based solders or metallizing by zinc spray for touch-up and repairs is not permitted.

A-5.13.5.3 Any wet storage stain shall be removed by the Seller if formed and discovered prior to leaving the hot-dip galvanizing plant. Wet storage stain shall be removed to prevent premature failure of the coating. Wet storage stain shall be removed as follows:

- The objects shall be arranged so that their surfaces dry rapidly.
- Remove light deposits with a stiff bristle (not wire) brush. Heavier deposits are to be removed by brushing with an acidic based metal cleaner. The surfaces cleaned shall be thoroughly rinsed with water.
- A coating thickness check must be made in the affected areas to ensure that the zinc coat remaining after the removal of wet storage stain is sufficient to meet or exceed the requirements of the Specification. Coating thickness shall be verified by measurements with a magnetic or electromagnetic gauge.
- Failure to meet Specifications requirements after removal of wet storage stains shall require that the affected materials be stripped and regalvanized. These same materials are subject to re-inspection and retest.

A-5.13.6 Safety Color Code Coating

A-5.13.6.1 Items indicated below shall be coated with safety colors complying with ANSI/NEMA Z535.1 ISCC-NBS color designations and block numbers and as specified and approved by Buyer. Color coating for safety colors is in addition to hot-dipped galvanized coating. Colors should be non-fading and non-chalking.

A-5.13.6.2 Trolley Beams: Safety Yellow. The design capacity of the trolley beam shall be stenciled on both sides of the web at the approximate midspan of each beam, using the notation "CAPACITY __ TONS" lettered in 3-inch-high block letters with black paint

A-5.13.7 Coating and Finish Systems

A-5.13.7.1 Surface preparation and painting system shall be in accordance with Table 1.

TABLE 1
EXTENT OF COATING AND FINISH SYSTEMS

ITEM	SURFACE PREPARATION	COATING SYSTEM
1. Structural and miscellaneous ferrous steel members, including columns, beams, girders, bracings, girts, hangers, struts, tie rods, plates, anchor bolts, handrail posts, gratings, nosings, etc.:		
a. All surfaces of indoor metals unless otherwise indicated	Per coating manufacturer's requirements.	Hot-dipped galvanized per ASTM A123.
b. All pre-engineered building steel	Per coating manufacturer's requirements.	Prime coat only; Pre-engineered building supplier's standard
c. All surfaces of exterior (outdoor) metals	Per coating manufacturer's requirements.	Hot-dipped galvanized per ASTM A123.
d. Milled, embedded, contact and welded surfaces, etc.	None (unless otherwise indicated).	No painting – milled surfaces protected with lacquer.
e. Safety color coat on surfaces of indoor metals	Per coating manufacturer's recommendations.	1 or 2 - coat epoxy system
f. Touch-up marred painted areas, bolt heads, nuts, washers, unprotected fasteners, field welds, and adjacent unpainted areas and strips, unless otherwise indicated.	SSPC-SP1, SP2, SP3 unless otherwise specified by coating manufacturer.	Same as previously applied coating.
g. Marred hot-dipped galvanized areas and field welds on hot-dipped galvanized surfaces.	Per coating manufacturer.	CS-107
2. Stainless Steel, unless otherwise indicated	None.	No painting.
3. Surfaces to be in contact with aluminum; or aluminum surfaces	Per coating manufacturer's requirements.	Per manufacturer's standard coating.
4. Supplementary steel and associated hardware for pipe supports, cable tray supports, conduit support, and HVAC supports (indoor)	Per coating manufacturer's requirements.	Hot-dipped galvanized per ASTM A123.
5. Exposed (without lagging) steel piping	Per coating manufacturer's requirements.	Per manufacturer's standard coating.
6. All other equipment (e.g., OEM Major Equipment, etc.)	Per coating manufacturer's requirements.	Per manufacturer's standard coating system.
7. Concrete masonry unit walls	Per coating manufacturer's requirements.	CS-123
8. Indoor concrete floors	Per coating manufacturer's requirements.	CS-209
9. Plaster and gypsum board	Per coating manufacturer's requirements.	CS-313
10. Chemical Feed area foundation and sump	Per coating manufacturer's requirements.	CS-316

ITEM	SURFACE PREPARATION	COATING SYSTEM
11. Battery Room concrete floor	Per coating manufacturer's requirements.	CS-238
12. Hollow Metal Doors and Frames	Per coating manufacturer's requirements.	Pre-finished or 2 coat acrylic enamel system

COATING SYSTEM CS-105
1-COAT EPOXY PRIMER FOR PROPERLY PREPARED GALVANIZED STEEL SUBSTRATES

Description	:	1-coat epoxy primer for properly prepared galvanized steel substrates
Uses	:	Primer over galvanized steel
Criteria	:	Application temperature > 50°F; above ground; underground; underwater; embedded; indoors, outdoors; operating temperature ≤ 1;70°F; abrasive; non-abrasive; corrosive, non-corrosive; uninsulated
Surface Preparation	:	SSPC-SP1, SP2, and/or SP3 as required and phosphoric acid etch as recommended by coating manufacturer
Surface Profile	:	Per coating manufacturer
Generic Type Primer	:	Epoxy

Approved Subcontractors	Primer	DFT
Carboline	Carboguard 893	1-2
Keeler & Long PPG	Kolor-Poxy Primer KL3200 Series	2-4
International	Intergard 345	4-6
Sherwin Williams	B67 Series Recoatable Epoxy	3-5
PPG	Pittguard 97-145	2-4
Devoe-International	Devran 205	2-4
Ameron-PPG	Amercoat 385	2-4
Hempel	Hempadur 17630	5-8

Note: Apply mist cost as recommended by coating manufacturer.

COATING SYSTEM CS-107
TOUCH-UP SPRAY APPLIED COATING FOR HOT-DIPPED GALVANIZED STEEL

Description	:	Touch-up spray applied coating for hot-dipped galvanized steel
Uses	:	Surfaces which have been abraded or burned off by welding
Criteria	:	Application temperature > 50°F; above ground; underground; underwater; embedded; indoors, outdoors; operating temperature ≤ 750°F; abrasive; non-abrasive; corrosive; non-corrosive; un-insulated
Surface Preparation	:	Per coating manufacturer
Surface Profile	:	Per coating manufacturer
Generic Type Touch-Up	:	Zinc rich

Acceptable Subcontractors	Touch-up	DFT (mils)
Keeler & Long PPG	Galvanode Primer #6500	2-3
Carboline	carbozinc 859	3-5
Sherwin Williams	Zinc Clad 5	3-4
PPG	UC65383/65384	3
Hempel	Organic Zinc Rich 17360	2-4

COATING SYSTEM CS-123
1-COAT EPOXY SEALER FOR INTERIOR AND EXTERIOR PROPERLY PREPARED CONCRETE SUBSTRATES

Description	:	1-coat, Epoxy sealer for interior and exterior properly prepared concrete substrates
Uses	:	Interior or exterior surfaces of concrete
Criteria	:	Application temperature > 50°F; above ground; indoors, outdoors; temperature below 175°F; non-abrasive; non-corrosive; un-insulated
Surface Preparation	:	Per coating manufacturer
Surface Profile	:	Per coating manufacturer
Generic Type Sealer	:	Epoxy

Acceptable Subcontractors	Touch-up	DFT
Carboline	Carboguard 1340	5 mils
International	Enviroline 57x	1.5-2 mils
Sherwin Williams	Sher-Crete Concrete Hardner	10 mils

COATING SYSTEM CS-209
2-COAT EPOXY-POLYAMINE OR POLYAMIDE SEALER
FOR CONCRETE SURFACES

Description	:	2-coat epoxy-polyamine or polyamide sealer for concrete surfaces
Uses	:	Anti-slip high wear application for floors and bases
Criteria	:	Application temperature > 50°F; above ground; embedded; indoors, operating temperature ≤ 170°F; abrasive; non-abrasive; corrosive, non-corrosive
Surface Preparation	:	Mechanically clean
Surface Profile	:	Obtain a surface resembling 80-120 grit sandpaper
Generic Type Sealer	:	Epoxy
Generic Type Finish	:	Epoxy

Acceptable Subcontractors	**Sealer**	**DFT**
Carboline	Carboguard 1340 HS	2.3
Keeler & Long PPG	Kolor-Poxy Primer/Sealer Coat 5129	2-4
International	Intergard 345 (concrete)	2-4
Sherwin Williams	Amorseal 33	8
Ameron-PPG	Amerlock 400	4-6
PPG	Megaseal WBPG W/30-50 MES H	5-7
Devoe-International	167 Preprime	1.5
Hempel	Sealer Epoxy 553 US	1-2

Acceptable Subcontractors	**Finish**	**DFT**
Carboline	Santile 945 SL	20-25
Keeler & Long PPG	Hi-Solids Epoxy KLN9600N with KL grit	10-16
International	Interzone 954	20-25
Sherwin Williams	Amorseal 650 SL/RC	20-25
Ameron-PPG	Amerlock 400 w/887 Additive	25
PPG	Megaseal SL	10-30
Devoe-International	Devran 124	20-25
Hempel	Hempadur Multi-Strength 35530	8-12

COATING SYSTEM CS-220

2-COAT EPOXY FIELD APPLIED SYSTEM FOR PREVIOUSLY COATED CARBON STEEL EXTERNAL

Description	:	2-coat epoxy field applied system for previously coated carbon steel external surfaces
Uses	:	General purpose
Criteria	:	Application temperature > 50°F; above ground; indoors or outdoors; operating temperature ≤ 170°F; non-abrasive; corrosive and insulated OR non-corrosive and uninsulated
Surface Preparation	:	SSPC-SP2 and SP3 as required
Surface Profile	:	Per coating manufacturer
Generic Type Primer	:	Tie
Generic Type Finish	:	Epoxy

Acceptable Subcontractors	**Primer**	**DFT**
Carboline	Rustbond Penetrating Sealer	1-2
Keeler & Long PPG	3200	3-5
International	Interseal 600	2-3
Sherwin Williams	Macropoxy 920 Preprime	2-3
Ameron-PPG	Amerlock 400	2-3
PPG	UC65357/UC65358	1-1.5
Sigma-PPG	Sigmacover TCP	3-8
Devoe-International	Preprime 167	1.5
Hempel	Hempadur Epoxy 17630	5-8

Acceptable Subcontractors	**Finish**	**DFT**
Carboline	Carboguard 890	3-4
Keeler & Long PPG	9600	4-6
International	Interseal 670 HS	3-4
Sherwin Williams	Macropoxy 646	3-4
Ameron-PPG	Amerlock 400	3-4
PPG	97-145/97-149 Series	3-4
Sigma-PPG	Sigmacover TCP	3-8
Devoe-International	224 HS	3-4
Hempel	Hempadur Epoxy 17630	5-8

COATING SYSTEM CS-238
CHEMICAL RESISTANT COATING SYSTEM FOR SECONDARY CONTAINMENT SURFACES

Description	:	Chemical resistant coating system for secondary containment surfaces.
Uses	:	For interior walls and floors, and concrete supports in acid containment areas. Use also for caustic areas if specifically indicated.
Surface Preparation	:	Concrete Surfaces: Refer to Article 305.3b. Brush blast to remove all dirt, spalled concrete, loose concrete and other foreign matter. Obtain a surface resembling 80 to 120 grit sandpaper.
	:	Carbon Steel: Conform to SSPC-SP5.
	:	Systems and Normal Thickness: As follows:

Location	**Coating System**
Acid Containment Area Interior Walls and concrete supports-1/8 inch	- Protecto-Line 100 by Dudick - Ceilcrete 695 by Ceilcoat
Containment Area Floor and pump area floor - 1/4 inch	- Protecto-Crete 140 by Dudick - Ceilcote 695 by Ceilcote
Containment Area Outside Surfaces of Walls-40 mils DFT	- Protecto Coat 800 by Dudick - Flakeline 232 by Ceilcote

Notes:

(1) Furnish the services of the manufacturer's technical representative to oversee the installation of the coating system.

(2) Expansion joints and grout: Manufacturer's standards as approved by Purchaser.

(3) Cleaning and Curing: In accordance with printed requirements of manufacturer.

COATING SYSTEM CS-313
3-COAT LATEX SEALER AND LATEX FLAT INTERMEDIATE AND FINISH SYSTEM

Description	:	3-coat latex sealer and latex flat intermediate and finish system
Uses	:	Interior surfaces of gypsum board, dry wall, sheetrock, etc.
Criteria	:	Application temperature > 50°F; above ground; underground; underwater; embedded; indoors; outdoors; operating temperature ≤ 150°F; non-abrasive; non-corrosive; uninsulated
Surface Preparation	:	Per coating manufacturer
Surface Profile	:	Per coating manufacturer
Generic Type Sealer	:	Latex
General Type Intermediate	:	Latex Flat
Generic Type Finish	:	Latex Flat

Acceptable Subcontractors	Sealer	DFT
Keeler & Long PPG	Kolor-Tex KLC 4100	1-2
International	Intercryl 530	1-2
Sherwin Williams	ProMar 200 Primer	1-2
PPG	Speedhide 6-2	1-1.5
Devoe-International	Glidden Pro 1000	1.5-2
Sigma-PPG	Sigmatex	1.5-2

Acceptable Subcontractors	Intermediate	DFT
Keeler & Long PPG	Kolor-Tex KLKC310 Series	1-2
International	Intercryl 530	1-2
Sherwin Williams	ProMar 200 Flat	1-2
PPG	Speedhide 6-70	1-2
Devoe-International	Glidden Pro 1210	1-2
Sigma-PPG	Sigmatex	1.5-2

Acceptable Subcontractors	Finish	DFT
Keeler & Long PPG	Kolor-Tex KLKC310 Series	1-2
International	Intercryl 530	1-2
Sherwin Williams	ProMar 200 Flat	1-2
PPG	Speedhide 6-70	1-2
Devoe-International	Glidden Pro 1210	1-2
Sigma-PPG	Sigmatex	1.5-2

COATING SYSTEM CS-316

3-COAT POLYAMINE EPOXY SYSTEM FOR CONCRETE FLOORS AND BASES

Description	:	3-coat polyamine epoxy system for concrete floors and bases
Uses	:	High wear surfaces
Criteria	:	Application temperature > 50°F; above ground; underground; underwater; embedded; indoors; outdoors; operating temperature ≤ 170°F; abrasive; non-abrasive; corrosive; non-corrosive; insulated; uninsulated
Surface Preparation	:	Clean area using vacuum cleaner, etch surface as recommended by coating manufacturer, and thoroughly flush surface clean using water prior to application of surfacer
Surface Profile	:	Per coating manufacturer
Generic Type Surfacer	:	Epoxy
Generic Type Intermediate	:	Epoxy
Generic Type Finish	:	Epoxy

Acceptable Subcontractors	**Surfacer**	**DFT**
Carboline	Semstone 140-SL	10-15
Keeler & Long PPG	3400	10-15
Sherwin Williams	Corobond	4-6
Ameron - PPG	Nu-Klad 114A	15-20
PPG	Megaseal WBPC	2-3
Devoe-International	Devran 126	10-15
Sigma-PPG	Novoguard Caulk	15-20

Acceptable Subcontractors	**Intermediate**	**DFT**
Carboline	Carboguard 890	5-7
Keeler & Long PPG	3500	5-8
Sherwin Williams	Core-Cote HD	8-10
Ameron-PPG	Amerlock 400	5-7
PPG	Megaseal SL	8-10
Devoe-International	Devran 224HS	4-8
Sigma-PPG	Sigmacover TCP	5-7
Ameron-PPG	395 FD	4-5

END OF ATTACHMENT A-5

BOT Scope Book
Attachment A-7
Electrical Requirements and Design Criteria

Table of Contents

Formatted: Font: 12 pt

Formatted: Header, Left, Widow/Orphan control

A-7.1 ELECTRICAL SYSTEMS AND EQUIPMENT

A-7.1.1 This Attachment defines the minimum requirements for design, engineering and material requirements for electrical systems including equipment, raceway, and cabling. This includes specific requirements for the Seller to engineer, design, procure and construct the Facility.

A-7.1.2 In general, the electrical systems and equipment described in this Attachment shall, as a minimum, meet the requirements of, ANSI, NERC, IEEE, NEMA, and NFPA 70E (NESC) and as applicable NFPA 70 (National Electric Code). Where the requirements of these conflict with the requirements of this document, these conflicts shall be referred to Buyer for resolution.

A-7.1.3 All Facility electrical equipment, including bus, breakers, transformers, motor control centers, distribution panels etc., shall be designed to withstand the maximum available fault current from the switchyard and/or generators, as applicable.

A-7.1.4 The failure of any single major piece of electrical equipment, with the exception of the Generator Step-Up (GSU) Transformer, Generator Breakers, Unit Auxiliary Transformer (for single UAT plants), Isolated Phase Bus Duct, and disconnect switches shall not cause a loaded generator to trip.

A-7.1.5 All project electrical system studies shall be performed using ETAP to calculate the available fault values in order to specify continuous, momentary, and interrupting ratings of the electrical equipment, including arc flash incident energy studies. This includes sizing of HV equipment, and connection to the Buyers power grid.

A-7.1.6 Plant auxiliary electrical system shall automatically switch between the normal auxiliary source and the backup or secondary source (when provided) without relying on operator action to maintaining the Unit online. Buses required for safe shutdown shall automatically energize without operator action to transfer or energize buses or loads.

A-7.1.7 During all operating conditions with all electrical power distribution equipment in service other than during the starting of large motors, the voltage at motor terminals shall be maintained between 90% and 110% of motor rated voltage. Temporary voltage drops during a single medium voltage motor start shall not extend below 80% of the motor rated voltage at the terminals of the motor being started, and non-starting motors on the same bus shall not have a voltage of less than 90% of rated voltage at their motor terminals. On normal operation the voltage at motor terminals shall be maintained between 90% and 110% of motor rated voltage.

A-7.1.8 The electrical design criteria shall be used by the Seller during the procurement of all sub-specifications to avoid different subcontractors receiving different electrical requirements.

A-7.1.9 Seller shall provide to the Buyer at the completion of the project an electronic cable database which includes, cable identifier, to/from identifiers, lengths, number of conductors, termination, service, raceway information (tray/conduit/ductbank etc.), reference drawing numbers, startup code, cable numbers, service level, size such that future Facility modifications can be tracked.

A-7.1.1 Vendor supplied equipment is delivered on site and instruments are pre calibrated at factory and calibration records shall be provided.

A-7.2 HAZARDOUS AREA CLASSIFICATION

A-7.2.1 Locations where fire or explosion hazards may exist due to flammable gases or vapors, flammable liquids, combustible dust, or ignitable fibers or fillings shall be defined as classified areas. The Seller and project shall meet NEC requirements regarding hazardous area classifications. Seller shall issue area classification drawings which shall define physical boundaries of these specified areas.

A-7.2.2 Equipment specified for a Class 1 Div 1 or Div 2 area shall be supplied with explosion proof fittings, junction boxes, power panels to meet the requirements of the area classification per NEC.

A-7.3 GENERATION SYSTEM

A-7.3.1 The Generation System shall consist of the generators, generator buses, generator breakers, and the generator step up transformer. Associated with the Generation System is the Automatic Generation Control (AGC). The AGC function shall be part of the Facility DCS and shall interface with the Control System furnished with the Turbine Generators. The Generation System shall be designed to function within NERC Requirements.

A-7.3.2 Seller to provide power and communication to Combustion Turbine and Steam Turbine Remote Monitoring Systems.

A-7.3.3 Generators

A-7.3.3.1. The generator for the combustion turbine and steam turbine will be in accordance with the enclosed combustion and steam turbine generator specifications, Attachments A.17 and A.19 respectively.

A-7.3.3.2. Generator voltage shall be OEM standard.

A-7.3.4 The combustion turbine generator shall have the ability to automatically operate in Island Mode. CTG separation from the grid and activation of Island Mode shall be on an Buyer approved element set in the relaying scheme of the operating Facility without operator intervention. Island Mode shall mean the CTG unit will continue operating providing BOP auxiliary loads (“house loads”) while isolated from the transmission grid (or bulk power system).

A-7.3.5 The STG will trip during an islanding event based on its standard relay settings which shall conform to the grid code requirements. As a result of the STG trip, the process systems required (e.g., Steam Bypass system, ACC, etc.) for the islanded Heat Recovery Steam Generator (HRSG) to dump steam to the condenser will continue to operate.

A-7.3.6 Grid Interconnect Standards Requirements:

A-7.3.6.1. Seller shall meet all NERC requirements and generators shall be capable of compliance specially with NERC PRC 24-2 which defines various operating conditions such as frequency and voltage that shall be maintained in the event the system voltage and

frequency deviations. Seller shall also meet NERC PRC-19 coordination of Generating Unit or Plant limiting and protection capabilities, and voltage regulating controls.

A-7.3.7 In Islanding Mode operation, the CTG will automatically maintain frequency at 60Hz by the CT controller. Any change in load altering the islanding CTG's frequency shall be compensated for by the control unit.

A-7.3.8 Once the transmission grid has been restored after unit Islanding, the Operators will re synchronize the unit to the grid using normal procedure and synch controls in the CTG control system.

A-7.4 HIGH VOLTAGE SYSTEM

A-7.4.1 Basic Insulation Level (BIL) – Seller to determine BIL levels with Buyer approval for HV equipment, CTG, STG and GSU bushings and as specified in relevant equipment specific Attachments of this specification.

A-7.4.2 High Voltage System:

Facility HV system consists of the below equipment provided by the Seller:

- Potential Transformers (PT) and Current Transformers (CT) accuracy shall meet ANSI C12.1 metering accuracy for use with Buyers revenue metering.
- Surge Arrestors
- Gas Insulated Circuit breakers
- Current transformers (CT)
- HV motor disconnects and grounding switches on both sides of the breaker.
- Dead End Structure(s) – including structure foundation and installation for GSUs to Transmission Line Tower connections.
- Buyer provided RTU cabinet and revenue meters to be installed in the Main PDC

A-7.4.3 Seller's scope for the HV conductors and OPGW wire will end at the Seller supplied Dead End structure(s). Seller shall be responsible for the procurement, installation, and termination of the HV conductors from the Dead-End structures, to the disconnect switches, HV circuit breakers and GSU HV bushings and all PTs and CTs.

A-7.4.4 The Seller's Facility protection system design engineer shall interface with the Buyer's Transmission to ensure that selective coordination and inter-trips are NERC compliant.

A-7.4.5 At the time of Facility design, Seller shall obtain current transmission system planning data with respect to transmission system capacity.

A-7.4.6 Gang operated circuit breakers to be included in design.

A-7.4.7 ~~High voltage breakers will be supplied by Owner.~~ High voltage breakers ratings shall provide capacities including maximum fault currents (single line to ground or 3-phase to ground as applicable), X/R rations, and system maximum MVA and Thevenin impedances. Breaker shall include design margin.

A-7.4.8 Grounding Disconnect switches shall be provided on both the upstream and downstream side of the HV breakers.

A-7.4.9 PTs and CTs to be provided by Seller for all protection and control including for Buyer's revenue metering. CT accuracy requirements for revenue metering shall be 0.15B1.8 and PT accuracy 0.3Z. The Seller shall provide the revenue metering cabinet(s) to the Buyer's specifications. Seller shall provide primary and backup metering. The Seller shall design and install all interface wiring needed for revenue metering. The Buyer will make the final connections to the meters.

A-7.4.9.1. Seller is responsible for the design, purchase, and installation of the Facility side line protection relays and cabinets per Buyer's specifications. Facility side line protection relays shall be a replication (copy) of the relays installed in the existing switchyard by Buyer. The Seller shall also be responsible for Facility side line protection relay settings and will coordinate with Buyer to perform testing. The Seller shall be responsible for developing and testing to their own Facility side test procedure. All control and instrument cabling run in the Facility switchyards to be shielded.

A-7.4.9.2. Line protection relays shall, at a minimum, display voltage and current reading on the HV transmission lines.

A-7.5 ISOLATED PHASE BUS DUCT

A-7.5.1 It shall be the responsibility of the Seller to design, manufacture, test, deliver, and install isolated phase bus duct (IPBD) for each generator, as described below.

A-7.5.2 IPBD shall be provided between the combustion turbine generator (CTG) and generator breaker and between the generator breaker and the CTG GSU transformer. IPBD shall be provided between the steam turbine generator (STG) and the STG GSU transformer. ~~IPBD shall be provided between the generator and generator breaker for both the combustion and steam turbine generator units and between the generator's breaker and the GSUs~~. A section of tap bus shall be provided to connect the UAT(s). In the case of multiple combustion turbine generators, ~~R~~removable links shall be provided in the tee-off connections to the UAT to allow continued operation of the associated generator in the event that a UAT is required to be out of service for maintenance. The disconnect links shall preferably be arranged so that they may be used for grounding the UAT side of the connections and the arrangement shall incorporate barriers to prevent access to the live connections after the transformer has been disconnected and the generator returned to service. The links shall be arranged so that the main relay protection can be retained during an outage of the UAT. A section of tap bus shall also be provided, as required, for the generator excitation system and bus neutral grounding.

A-7.5.3 All generator IPBD shall be rated to carry the maximum generator output continuously at 95% of rated voltages and without exceeding the bus design limits of 60°C rise, over the ambient temperature of 40°C per IEEE C37.23.

A-7.5.4 Each section of IPBD shall be self-cooled, isolated phase bus construction.

A-7.5.5 Space heaters shall be supplied on bus sections for condensation control. Expansion joints shall be provided as required to accommodate thermal expansion of the bus.

A-7.5.5.1. Isolated Phase Bus Duct (IPBD) General

A-7.5.5.1.a. Manufacturer of the isolated phase bus duct shall design, manufacture, test and deliver isolated phase bus duct and auxiliary equipment as specified herein.

A-7.5.5.1.b. The isolated phase bus duct shall interconnect the following Equipment:

- Turbine Generators ~~(including the excitation transformer)~~
- Generator Circuit Breakers (when installed adjacent to generator terminals)
- UAT (if applicable)
- GSU Transformers
- Excitation Transformers

A-7.5.5.1.c. The isolated phase bus structure shall consist of rigid aluminum electrical conductors mounted on porcelain insulators. Each phase shall be enclosed in a separate weather and dust-tight nonmagnetic metal enclosure, separated by an air space from the adjacent phases. The three phases shall be securely braced, mounted on, and supported by a substantial hot dipped galvanized steel structure. Where taps are specified from the bus to cubicles housing auxiliary equipment, the tap connections and cubicles shall be of the isolated phase construction. The isolated phase bus enclosures shall have inspection Infra-Red (IR) inspection windows for main runs between the generators, GCBs and GSUs.

A-7.5.5.1.d. The bus shall be suited for outdoor installation and shall include all necessary equipment connections, flanges, seals, taps, elbows, offsets, splicing materials, adapter bars, supporting structure, and any material required to make a complete coordinated bus installation. A complete set of drawings and installation instructions shall be furnished with each run of bus.

A-7.5.5.1.e. All bus conductors and connections, insulators, supports, enclosures and supporting structures, when installed, shall have sufficient mechanical strength to ensure continuous, satisfactory operation under normal operating conditions and shall withstand, without incurring damage, the effect of any momentary current resulting from a three-phase, line-to-line or line-to-ground short circuit. The momentary current shall be of the rms value, including the direct current component, of the maximum cycle that corresponds to the rms asymmetrical currents specified in this specification.

A-7.5.5.1.f. The Steam Turbine Generator IPBD shall also be provided with IPBD taps to feed the VT/SA cubicle ~~or UAT as required by Sellers proposed design~~.

A-7.6 GENERATOR STEP-UP TRANSFORMERS

A-7.6.1 Refer to Attachment A.21 GSU Transformer Specification.

A-7.7 GENERATOR CIRCUIT BREAKER

A-7.7.1 The generator circuit breaker (GCB) shall be SF_6 type and designed, manufactured, and tested in accordance with the latest standards of IEEE, particularly IEEE C37.013, and NEMA. There shall be an access platform and access staircase provided for each. Access to SF_6 gauges and lockout mechanisms, and control panels shall be on the same side of the generator circuit breakers.

A-7.7.2 GCBs shall be sized with a continuous rating which exceeds the maximum generator output current by a minimum 10% at all ambient conditions.

A-7.7.3 Tripping logic and control power circuit shall be independent with two redundant trip coils. GCBs shall each have its own independent breaker failure relay protection scheme.

A-7.7.4 GCBs shall be designed for operation within the TRV values for faults on either side of the breaker.

A-7.7.5 Disconnect and Ground Switches

A-7.7.5.1.a. Each generator circuit breaker shall have two grounding switches and one disconnect switch per pole. One grounding switch shall be installed on each side of the circuit breaker, and the disconnect switch shall be installed on the transformer side of the circuit breaker. The grounding switch on the transformer side of the circuit breaker shall be installed between the disconnect switch and the transformer. Remote breaker operation, (open/close), alarm and trouble input status signals shall be provided to the Control Room

A-7.7.5.2. Grounding and disconnect switches shall be rated for both the continuous current rating and the short time rating of the installed system. Switches shall be interlocked to preclude energization with a ground switch closed.

A-7.8 UNIT AUXILIARY TRANSFORMER (UAT)

A-7.8.1 The UAT shall be designed, constructed, and tested in accordance with IEEE Standard C57.12 series and the applicable National Electrical Manufacturers Association (NEMA) standards. The Seller shall provide guaranteed maximum losses per IEEE standard C57.12 series.

A-7.8.2 One (1) UAT shall be installed per CTG for auxiliary power with a maximum of (2) UATs if more than two (2) CTGs are proposed. The UAT shall be connected at the CTG IPBD.

~~A-7.8.2~~A-7.8.3 The transformers maximum rating shall not limit station generation capacity. The UAT rating shall include margin above the maximum Facility initial design requirement.

~~A-7.8.3~~A-7.8.4 The unit auxiliary transformer shall be three-phase, three-winding, 60 Hz, outdoor, step-down, outdoor mineral oil (non-PCB) immersed type, Class ONAN/ONAF/ONAF. Transformers shall have copper windings. Transformers H-X and H-Y impedances should be the same and -shall be sized to allow across-the-line starting of the largest MV motors with all other motors in the full load and operating mode condition within the specified voltage drop.

~~A-7.8.4~~A-7.8.5 The maximum (hottest spot) winding temperature rise above ambient temperature shall not exceed 80ºC at rated load for the particular combination of connections and taps that give the highest maximum (hottest spot) winding temperature rise. This requirement is the standard allowed maximum (hottest spot) winding temperature rise of 80 ºC in IEEE Std. C57.12.00.

~~A-7.8.5~~A-7.8.6 UATs shall have +/-2 – 2 1/2 % HV taps, manually adjusted (See Electrical Conceptual Single Line Diagram). Taps shall be selectable by an externally mounted, lockable switch handle which shall also function as an indication of the tap position. Neutral shall be resistance grounded.

~~A-7.8.5.1.~~A-7.8.6.1. A manually operated tap changer shall be provided for operation when the transformer is not excited. The tap changer hand wheel shall be between two and four feet above the transformer base. The tap changer shall have a visual indication of tap position with padlocking capabilities at any tap position.

A-7.8.7 Angular Displacement: The transformers shall have a non-standard phase relationship. The angular displacement between the high-voltage and low-voltage phase voltages shall be 30° with the low-voltage leading the high-voltage (Dyn11yn11).

~~A-7.8.6 ngular Displacement: The transformers shall have a standard phase relationship per IEEE Standard C57.116.~~

~~A-7.8.7~~A-7.8.8 Impedance at the rated connections shall be based on the Seller's design base with an IEEE standard ± 7.5% design tolerance. BIL, sound level, and voltage connections shall be in accordance with ANSI, IEEE, and NEMA standards.

~~A-7.8.8~~A-7.8.9 Control Devices and Small Wiring

~~A-7.8.9~~A-7.8.10 Control relays, breakers, contactors, etc., shall be furnished in a NEMA 4 enclosures for outdoor cabinet.

~~A-7.8.10~~A-7.8.11 All small wiring for control or accessory equipment shall be installed in standard galvanized rigid steel conduits or ducts, with watertight joints. Drain holes, 1/4-in. diameter, shall be provided in low points of all conduit runs.

~~A-7.8.11~~A-7.8.12 Short Circuit Capability

~~A-7.8.11.1.~~A-7.8.12.1. The transformers shall be capable of withstanding, without damage, the mechanical and thermal stresses caused by short circuits of the external system of any winding in accordance with IEEE Standard C57.12.00.

~~A-7.8.11.1.a.~~A-7.8.12.1.a. Short circuit values shall be determined during design using ETAP analysis by the Seller.

~~A-7.8.11.2.~~A-7.8.12.2. Available short circuit capabilities shall be considered as well as turbine supplier specific requirements (start-up w/ static start system) when specifying transformer impedances.

~~A-7.8.12~~A-7.8.13 Thermal Connections and Bushings

~~A-7.8.12.1.~~A-7.8.13.1. Transformer leads shall be brought out of the transformer case by means of bushings of the outdoor type. Bushings shall be capable of withstanding the 60 Hz applied potential tests and the lightning impulse tests shall be the responsibility of the Seller. Viton Gaskets shall be used.

~~A-7.8.13~~A-7.8.14 Bushing Current Transformers: The CT quantities and ratios shall be determined by Seller. Bushing Current Transformers shall be factory installed. The quantity and ratings shall be determined by the Seller. The turns shall be equally spaced around the circumference of the core with fully distributed copper windings. The current transformers shall have a minimum thermal rating of 2.0. All leads shall be brought out to shorting-type terminal blocks in the control cabinet. The leads shall be installed in

conduit. Each wire shall be marked to identify the tap and the current transformer. The minimum wire size is #10 AWG and splices are not permitted.

~~A-7.8.14~~A-7.8.15 Project/Site Condition

~~A-7.8.14.1.~~A-7.8.15.1. Refer to Attachment A-4 – Project Requirements and Design Criteria

~~A-7.8.14.2.~~A-7.8.15.2. Transformers shall be suitable for outdoor location.

~~A-7.8.15~~A-7.8.16 Each transformer shall be provided with the following accessories:

~~A-7.8.15.1.~~A-7.8.16.1. Winding temperature indicator

~~A-7.8.15.2.~~A-7.8.16.2. Surge Protection

~~A-7.8.15.3.~~A-7.8.16.3. Liquid temperature indicator

~~A-7.8.15.4.~~A-7.8.16.4. Seller shall provide dry contact outputs for alarm status to BOP DCS

~~A-7.8.15.5.~~A-7.8.16.5. Fiber Optic Temperature Monitoring Sensors

~~A-7.8.15.5.a.~~A-7.8.16.5.a. The transformer shall be provided with a sufficient number of winding embedded fiber optic sensors; at least 3 fibers per phase per winding (HV & LV) for winding temperature monitoring and three fibers for top oil temperature monitoring (a minimum of 30 fibers). The fibers shall be terminated into Qualitrol Neoptix digital temperature monitors located inside the control cabinet. The fiber temperature monitors shall have 4-20ma analog outputs and Modbus capability to connect to other plant devices, DCS and monitors including the transformer on-line monitoring system.

~~A-7.8.15.6.~~A-7.8.16.6. The transformers shall be equipped with an APT TTC-1000 from Advanced Power Technologies or Buyer approved equivalent temperature monitoring system with digital displays easily readable in daylight.

~~A-7.8.15.7.~~A-7.8.16.7. A Schweitzer Engineering Laboratories (SEL) Model 2523 (SEL-2523) annunciator/data logger panel shall be provided in the control cabinet of each transformer to monitor the system health and indicate occurrences of alarms, trips and other general signaling messages.

~~A-7.8.15.8.~~A-7.8.16.8. Ground pads shall be furnished on each transformer tank in accordance with the requirements of IEEE C57.12.10 – 1977, Article 9.2.8.

~~A-7.8.15.9.~~A-7.8.16.9. Transformer tank design shall be such that ventilation is provided between the concrete supporting slab and the bottom of the transformer tank. Only supporting steel beneath the transformer tank may touch the concrete slab. Design of the steel supporting the transformer tank bottom shall be such that the bottom is accessible for inspection after installation.

~~A-7.8.15.10.~~A-7.8.16.10. Transformers shall have online dissolved gas monitoring using a Vaisala OPT-100.

~~A-7.8.15.11.~~A-7.8.16.11. The transformer shall be provided with online monitoring system to continuously monitor the condition of LV and HV bushings, transformer dissolved gases

and temperatures and other transformer parameters, including loss of insulation life. The online monitoring system shall be capable of controlling the coolers' operation in parallel with the conventional cooler controls. The latest DRMCC monitoring system or better system as approved by Entergy shall be provided with the transformer.

~~A-7.8.16~~A-7.8.17 Transformer Losses and Auxiliary Power Requirements

~~A-7.8.16.1.~~A-7.8.17.1. The load losses, efficiency and regulation shall be corrected to a reference temperature according to IEEE C57.12.00.

A-7.9 SYSTEM RELAYING

A-7.9.1 Generator Step Up transformer to Buyer Switchyard Interconnect Transmission Line Protection

Seller is responsible to accommodate the required interface signals in their design. Each GSU transformer will be connected to the local substation breaker. The transmission lines will be protected by separate primary and secondary differential relay circuits. Connection between the Switchyard and Facility differential relay panels shall be via fiber optics. The primary and secondary fiber connections shall be made with separate cables placed in separate conduits. All differential relays, interface devices, lockout relays, cutoff switches and fiber optic cables will be purchased and installed by the Seller. Coordination will be required with the Buyer regarding manufacturer type for relays and interface devices. Wiring from the existing switchyard circuit breakers to the existing switchyard differential relay panels shall be performed by Buyer.

A-7.9.2 Generator Protective Relaying

A-7.9.2.1. See Attachment A.17 and Attachment A.19.

A-7.9.3 Generator Bus and Transformer Protective Relaying

A-7.9.3.1. Protection for the generator bus and generator step up transformers shall be provided by the same relaying systems used to protect the generator against phase faults and ground faults.

- Differential (87B)
- Neutral over voltage (59N)

A-7.9.3.2. An overall unit non-redundant differential relay shall be provided for each unit (CTG and STG) which wrap the HV breaker to generator ground and all devices in between. This shall be an SEL relay.

A-7.9.4 Generator Step Up Transformer Protective Relaying

A-7.9.4.1. The following generator step up transformer relays and protection schemes shall be provided:

Generator Step Up Transformer, generator breaker, and generator bus zone differential relaying.

- Fault pressure relaying, two devices with either device alarming, and two-out-of-two logic to trip
- Mechanical fault pressure relief device
- Lockout relay for generator step up transformer, generator bus, and unit auxiliary transformer trip.
- Transformer shall be protected by transformer differential relays, primary and backup. Primary relay shall be SEL 487 and backup shall be Beckwith M3311A.

A-7.9.5 Auxiliary System Relaying

A-7.9.5.1. The auxiliary system relaying design shall be based on C37.102 and included references.

A-7.9.5.2. The auxiliary system shall be protected as listed and described below:

- Unit auxiliary transformers shall be protected by transformer differential relays, primary (SEL) and backup. Primary relay shall be SEL 487 and backup shall be Beckwith) differential relays.
- Fault pressure relaying, with both alarm and trip
- Unit auxiliary transformer shall be low resistance grounded and provide alarm and trip
- Lockout relay for generator step up transformer, generator bus and unit auxiliary transformer trip
- Unit auxiliary transformer shall have instantaneous and over current protection, as well as differential protection
- Medium-voltage bus supply and tie breakers shall have over current relays.
- Bus transfer synchro-check relaying
- Medium-voltage bus differential
- Unit substation (load center) transformers shall be provided with differential protection.
- Motors greater than 3000 HP shall be provided with differential protection.

A-7.9.6 Lockout Relay Actions

A-7.9.6.1. An independent lockout relay (Device 86) shall be associated with each set of primary and backup generator protection, and all trips requiring the opening of the generator breaker and removing excitation shall operate these lockout relays. The operation of these relays shall not cause the trip of the combustion turbine, which will continue to fire to provide heat and airflow for the HRSG. Each 86 Device shall be powered from independent 125V dc circuits. A second lockout relay shall be provided for the generator to clear the associated substation breakers via a transfer trip. All lockout relays provided must be monitored and alarmed on coil failure, with the monitoring being handled in such a manner that the reliability of the circuit is not compromised. LED indicating lights shall be used to monitor the integrity of the lockout relay power. An alarm shall be provided to alert on loss of power. Primary and secondary protective relays shall each trip separate lockout relays. The GSUs and UATs shall also have independent lockout relays.

A-7.9.6.2. All protective relays shall be provided with external targets to show relay operation to assist operator in determining which relays have operated.

A-7.9.6.3. Protective relaying as described above not provided by generator OEM shall be installed in a protective relay panel(s) provided by Seller.

A-7.9.6.3.a. Protective Relay Panel General

A-7.9.6.3.a.1 The Seller shall procure, design, and determine size length, height, and depth of the protective relay panel. Seller shall provide 20% spare internal mounting capacity. Buyer shall approve final board and instrument arrangement. The protective relay panel shall be arranged to accommodate all controlling and indicating devices, instruments, switches, relays, dials, signal lights and alarms, etc., furnished by Seller. These panels shall include the primary and backup GSU and UAT differential protection relays, IPBD protection, and auxiliary power metering. These relays shall be SEL as the primary relay and backup relays, where required, shall be Beckwith relays. All relays shall be microprocessor based and shall also provide overcurrent protection functions for phase and ground faults in the windings of the transformer, and or backup of other overcurrent relays in the external system.

A-7.10 AUXILIARY POWER SYSTEM

A-7.10.1 The auxiliary power system shall be consistent of the following voltage levels:

MV –	6.9 kV, 3 Phase, 60 Hz, low resistance ground
LV –	480V, 3 Phase, 60 Hz, high resistance ground
Essential Power –	480V ESS (high resistance grounded), 120 VAC UPS (grounded), 125 VDC (ungrounded)

A-7.10.2 Voltage Drop

- 3% for branch circuits and feeder circuits
- Not to exceed 20% voltage drop at the largest motor (terminals) on any given bus during motor start
- Bus voltage drops – 10% normal, 15% during motor starting

A-7.10.3 The auxiliary power system shall be designed to accommodate a minimum 10% future load growth.

A-7.11 POWER DISTRIBUTION CENTER (PDC) BUILDINGS

A-7.11.1 Prefabricated PDC shall contain major electrical distribution equipment including but not limited to MV SWGR, LV SWGR, MCC, Operating Facility DCS cabinets, relay and metering cabinets, AC, DC, and UPS distribution systems at the approval of the Buyers requirements. PDCs shall also include:

- Fire Detection
- Redundant HVAC system (N-1)
- Dedicated climate-controlled battery room
- Interconnecting wire between internal components (coiled during shipping splits)
- Platform and stairways for all access and switchgear maintenance and access to all HVAC equipment located at the exterior of the PDC.
- Remote racking capabilities for LV and MV Switchgear (SWGR) breakers
- Sealed conduits top to bottom to prevent rodents from damaging equipment.
- Reserved space to accommodate two (2) 24”x36”x72” cabinets for Buyer’s locker storage
- Reserved space to permanently store all special tools for operating and testing of the equipment housed in the PDC
- Reserved space and floor/wall openings to accommodate the following: a) Seller provided cabinets - “RTU”, 36”x36”x96” and two “Revenue Metering Panel”, 36”x36”x96”, b) LAN Cabinets, c) Seller shall provide power and communication cabling and conduits to the reserved space.
- Redundant exhaust fans with fan running status switches located in Battery Room.

A-7.12 BALANCE OF PLANT NON-SEGREGATED PHASE BUS DUCT / CABLE BUS

A-7.12.1 Seller shall design, procure, test, deliver, and erect non-segregated phase bus to interconnect the Secondary Unit Substation Transformers to the 480V Switchgear and MCCs. Non-segregated phase bus shall be copper bus insulated with a thermosetting insulation. Non-segregated phase bus duct shall be a self-cooled design.

A-7.12.2 Seller shall design, procure, test, deliver, and erect cable bus to interconnect the UAT(s) with the 6900 V switchgear and the Standby Diesel Generator to the 480V Essential bus. Cable bus conductors shall be rated 90°C, fully insulated and shielded power cables. Conductor ampacities shall be based on full-load application, with consideration given to site conditions and the effects of solar radiation and the raceway or enclosures in which they are installed. The temperature rise of the conductor carrying continuous current shall not exceed 50°C rise over 40°C ambient. Conductors shall be suitable for indoor or outdoor use. Even current distribution between paralleled conductors shall be ensured by proper phasing and spacing arrangements between conductors. Transposition and interleaving of conductors shall be done as required to ensure equal current distribution and impedance. The installation shall be completed with continuous conductors, no splices, running the full length of the system.

A-7.12.3 Space Heaters

A-7.12.3.1. Outdoor bus duct sections shall be furnished with space heaters to prevent condensation of moisture within the bus duct. Space heaters shall be thermostatically controlled.

A-7.12.3.2. The heaters shall be located and thermally insulated such that no painted surface or bus insulation shall be damaged or discolored. Space heater capacity shall be as required to maintain the compartment and the bus duct internal temperature above the dew point. Voltage normally applied to the space heaters will be 120 VAC.

A-7.13 ARC FLASH

A-7.13.1 Arc flash levels on signage shall be posted at all switchgear, motor control centers, 480/240/208/120 VAC and 125 VDC distribution panels and panelboards in accordance with per NFPA 70E and OSHA standards. All switchgears and motor control centers shall be arc resistant.

A-7.13.2 Maximum cal/cm sq for all MV Switchgear, MV MCC, and Low Voltage System equipment (MCCs, distribution panels, switchboards, panelboards, etc.) shall be less than 8 cal/cm sq. Fiber Optic and/or differential protection shall be provided. Bus differential protection shall also be incorporated on the MV switchgear to mitigate incident energy. Maintenance mode switches are not preferred unless absolutely necessary to meet the incident energy requirement with proof accepted by Buyer. This requirement applies to BOP and OEM packaged equipment. Also, this requirement applies to all AC and DC systems with the exception of the battery terminals and main switchboard disconnect switch.

A-7.13.3 Arc flash analysis shall be performed using ETAP.

A-7.14 MEDIUM-VOLTAGE SYSTEM

A-7.14.1 Medium Voltage Requirements General

A-7.14.1.1. A medium-voltage auxiliary system shall be provided by the Seller to feed motors and other medium-voltage loads. This medium-voltage system distributes power to HRSG, STG, and CTG 6900V electrical auxiliaries (including the Combustion Turbine static starter or starting motors) during normal operation, startup, and shutdown. The system shall consist of ~~two~~ 3-winding Unit Auxiliary Transformer(s), and 6900-volt switchgear lineups supplied by the UAT(s).

A-7.14.1.2. Control and monitoring of the aux system shall be via remote I/O input through the Facility DCS. All control and position monitor, as well as relay status/alarms, shall be hardwired from the DCS I/O card to the breaker. Other status data and system parameter information shall be provided via a data link.

A-7.14.1.3. It shall not be possible to operate the breaker from a control switch mounted on the front of the frame while the breaker is in the operate racked-in (engaged) position.

A-7.14.2 Medium Voltage System Configuration

A-7.14.2.1. The Medium Voltage Switchgear and Medium Voltage MCC shall be hard coupled together. The medium-voltage system shall consist of a low resistance grounded system powered through Unit Auxiliary Transformers.

A-7.14.2.2. The medium-voltage system provides power to large motors and load center transformers. Relay protection shall be as specified in this Attachment. All medium-voltage relaying shall be Schweitzer SEL relays. Buyer shall be consulted to specific model types. The Schweitzer relays shall be provided with displays.

A-7.14.3 Medium Voltage 6900V Switchgear and Motor Controllers

A-7.14.3.1. The 6900-Volt Switchgear shall be designed, manufactured, and tested in accordance with the latest standards of ANSI and NEMA. The switchgear shall be arc resistant Type 2B with arc flash monitoring.

A-7.14.3.2. Medium voltage switchgear with tie breakers shall be secondary selective. Seller shall provide automatic bus transfer relays to facilitate fast bus tie closing in the event of loss of voltage source. This function shall be disabled if a fault exists on the load bus.

A-7.14.3.3. MV switchgear/MCC shall be utilized to feed motors greater than 250 HP, CTG starting system, and load center transformers.

A-7.14.3.4. The circuit breakers shall be horizontal draw-out type capable of being withdrawn on extendable rails self-contained in the Switchgear housing. The breakers shall be operated by a remote racking motor charged spring stored energy mechanism. The stored energy mechanism shall be front accessible and will be charged normally by a universal electric motor and in an emergency by a manual handle. The primary disconnecting contacts shall be silver-plated copper. Switchgear and circuit breakers shall be sized such that when one main breaker is out of service and the tie breaker is closed, the equipment can carry full loads.

A-7.14.3.5. Equipment to be supplied with manual transfer scheme with 3 position selector switch, to select which breaker needs to open, or change switch and other opens. The manual transfer scheme shall not allow for continuous parallel operation.

A-7.14.3.5.a. MV motor contactors shall be non-latching type with integrally mounted fuses.

A-7.14.3.5.b. Each MV motor feeder shall be provided with an SEL-710 or SEL-749M type motor protective relay. RTD's and other alarm signals shall be hardwired to the SEL relay. The SEL relays shall transfer this information to the Facility DCS via soft link or serial link I/O.

A-7.14.3.5.b.1 The following functions shall be provided in the digital display by the relays:

Bearing temperature
Line current in each phase – 'rms' amps
Line current in each phase in % of motor full load current
Motor start exceeded
Operation count
Remaining starts
Running time (cumulative) in hours
Winding temperature.

A-7.14.3.5.b.2 Following control and protective devices shall be part of the relaying design in the motor protective relays. Final elements shall be coordinated based on load protection and equipment used to interrupt load currents, with Buyer input.

27 – Under Voltage
37 - Under Power
40 – Loss of Excitation
46 – Phase balance of current unbalance Element
47 – Phase sequence Element
49 – Thermal Element
50 – Overcurrent Element
52 – AC circuit breaker
55 – Power Factor Element
59 – Overvoltage Element
66 – Jogging Device
78 – Out of Step
81 – Frequency Element
87 – Differential Element

A-7.14.3.5.b.3 Metering quality CTs and PTs shall be provided as determined by Seller to feed revenue quality meters located in the protective relay panel. Instrument transformers shall have an accuracy of 0.3% or better. Revenue meters shall have ANSI C12.1 metering accuracy.

A-7.14.3.5.b.4 With each circuit breaker, contactor, isolating device, and grounding device there shall be supplied all necessary auxiliary switches and mechanisms for indication, protection, control, interlocking, supervisory, and other functions to meet the requirements of the Technical Specification. The control shall be arranged to provide local operation at the circuit breaker when in the test position and remote in the control room.

A-7.14.3.5.b.5 All auxiliary switches shall be wired to a terminal board on the fixed portion of the switchgear.

A-7.14.3.5.b.6 Suitable handling equipment shall be provided where necessary for easy handling of circuit breakers. Remote racking devices shall also be provided for the MV breakers. Equipment lifting and racking devices to be provided in each location (PDC) where equipment is located.

A-7.14.3.5.b.7 Safety interlocks to ensure correct system operation, to avoid unsafe switching conditions, and to ensure safe isolation for maintenance shall be provided by mechanical or electrical means.

A-7.14.3.5.b.8 Cable and bus bar grounding facilities shall be provided. The design of any grounding devices shall be such that the device cannot be connected unless the breaker is open and in the isolated position.

A-7.14.3.5.b.9 Each of the switchgear line-ups shall include one spare motor feeder and one spare feeder equipped cubicle and will be installed inside the MV Switchgear complete with all accessories completely wired at the time of handover. Each MV switchgear/MCC shall have provision to add a vertical section at the end of each line-up.

A-7.14.3.5.b.10 The MV switchgear enclosure shall have Infra-Red (IR) inspection windows.

A-7.14.3.5.b.11 Each MV main breaker shall have a microprocessor-based relay with digital displays and be connected to the CT wrapping the supplying UAT and main breaker for the bus differential protection.

A-7.15 LOW VOLTAGE 480 VOLT SYSTEM

A-7.15.1 The low-voltage auxiliary system shall be provided by the Seller distributes power to the Facility electrical auxiliaries during normal operation, startup, and shutdown. The main components are the transformers, switchgear, and motor control centers.

A-7.15.2 The low-voltage system consists of a 480V high resistance grounded system powered from the 6.9 kV – 480V transformers.

A-7.16 480V SWITCHGEAR

A-7.16.1 The 480V Switchgear shall be suitable for indoor installation, shall be arc resistant NEMA 1, Type 2B designed, manufactured, and tested in accordance with the latest edition of ANSI/IEEE C37.20.1 and related standards.

A-7.16.2 480V switchgear with tie breakers shall be secondary selective. Seller shall provide automatic bus transfer relays to facilitate fast bus tie closing in the event of a main breaker trip. This function shall be disabled if a fault exists on the load bus.

A-7.16.3 All 480V switchgear breakers shall be electrically operated air circuit breakers with solid state trip devices with status indication visible at all times while energized. Low-voltage electrically operated breakers shall typically be operated by remote control from the Facility DCS and from control switches or push buttons mounted on the breaker compartment doors. In addition, some motor feeder breakers may also be controlled from local system control panels. Fused breakers are not acceptable.

A-7.16.4 Main breakers, tie breakers, and breakers supplying MCCs or other loads that contain trip devices shall have adjustable long-time and short-time solid state trip device elements for phase protection. The pickup point and time settings shall be adjustable to allow for proper coordination with all upstream and downstream trip devices. Closure of the main breakers and bus tie breaker shall be supervised by synchronism check relay.

A-7.16.5 Local control stations shall be provided at motors which are not controlled from the Facility DCS. Examples of these motors are hoists, cranes, door openers, heaters with fans, etc.

A-7.16.6 Feeder breakers which supply power to motors or other equipment which do not require coordination with downstream protection devices shall have adjustable long time and instantaneous elements for phase protection.

A-7.16.7 Metering shall consist of a voltmeter and ammeter on each 480 V bus. Voltmeter and ammeter shall be monitored by DCS.

A-7.16.8 Upon loss of power on a bus (doubled ended configuration), the main breaker shall open, and the tie shall close automatically. This function shall be disabled if a fault exists on the load bus.

A-7.16.9 Trip units shall be capable of switching from the normal settings to maintenance settings via an input from a downstream selector switch at each MCC. Maintenance mode setting activation shall be alarmed in the DCS. Interposing relays shall be utilized, as necessary,

to ensure the proper functioning of maintenance mode settings when the downstream selector switches at the MCCs are located remotely from the switchgear.

A-7.16.10 The Switchgear main breakers shall include a pad lockable switch and blue LED Armed Status Indicating Light.

A-7.16.11 Seller shall provide a minimum of one spare breaker and one spare cubicle in each 480V Switchgear lineup. 480V switchgear shall be capable of adding additional vertical sections.

A-7.16.12 Low Voltage 480 Volt System Protection

A-7.16.12.1. Overcurrent protection for power center devices shall be provided by solid-state trip relays. At the MCC level, motor circuit protectors shall be used for motor circuits, and non-motor feeder breakers shall be protected by thermal magnetic circuit breakers. The thermal overload relays provided with MCC combination starters shall be wired to trip.

A-7.16.12.2. The 480V system shall be a high resistance grounded. A ground detection scheme shall be provided to alarm when a ground fault is detected.

A-7.16.12.3. Main current carrying parts, insulators, supports and housings shall have sufficient mechanical strength to withstand, without incurring damage, the effect of any momentary current resulting from a three-phase, line-to-line, or line-to-ground short circuit. The current shall be the rms value, including the direct current component, during the maximum cycle corresponding to the rms symmetrical and asymmetrical currents specified.

A-7.16.13 Low Voltage Switchgear Transformers

A-7.16.13.1. The transformers shall be installed indoors or outdoors and be delta-wye connected, with the neutral of the wye high resistance grounded. The transformers may be VPI dry type with fan cooling, or oil immersed type. Oil filled transformers shall be located outdoors only and shall have containments.

A-7.16.13.2. Transformers shall be 6.9 kV delta connected primary and 480 V wye connected secondary, 60 Hz, three-phase, high resistance grounded secondary. Oil-filled transformer shall be built and tested in accordance with IEEE C57.12 (latest revision) and references found within. Transformer shall be constructed with full capacity taps. VPI dry type transformers shall be built and tested in accordance with IEEE C57.12.01 (latest revision) and references found within. Oil-filled transformers shall be designed for an 80 degree C temperature rise and constructed with full capacity taps (± 2 x 2.5%). Dry type transformers shall be designed for a 115 degrees C temperature rise and constructed with full capacity taps (± 2 x 2.5%).

A-7.16.13.3. The transformer windings and all bus material shall be copper.

A-7.16.13.4. The transformer shall be capable of withstanding, without damage, the mechanical and thermal stresses caused by external short circuits in accordance with IEEE Standards C57.12 and C57.12.01.

A-7.16.13.5. The transformer shall be designed and constructed so that the noise level shall not exceed the values listed in ANSI/NEMA Standard ST 20.

A-7.16.13.6. Transformer cooling fan motors shall be totally enclosed with an operating voltage not to exceed 120 Vac. The fan controls shall automatically turn on the fans whenever the transformer temperature rise requires their operation. The controls and 480-120 V transformers for the fans shall be mounted in the switchgear building or in a transformer mounted terminal box and all interconnecting control and power wiring shall be furnished.

A-7.16.13.7. A second ground pad shall be provided and located in the same segment as the high voltage connections. The ground pad shall meet the requirements in IEEE Standard C57.12.51.

A-7.16.13.8. The transformer shall be provided with either a winding temperature simulator or hot spot device and equipped with a dial type temperature indicator and adjustable contacts that close on high temperature for automatic fan control and electrically separate and ungrounded contacts for Buyer's use.

A-7.16.13.9. The VPI dry type transformers shall be furnished in their own weatherproof enclosure with a suitable filter shall be provided to exclude dust. A clogged filter alarm shall be provided for each filter. The transformer secondary shall be connected to the LV switchgear bus with cable bus or non-segregated bus duct through the wall of the switchgear building.

A-7.16.13.10. Fault levels shall be limited by a combination of adjustable grounding resistors to a level just above the charging current of the 480 V system with everything in service. The phase windings shall have full line-to-line voltage rated insulation. The neutral of the transformer shall be connected to a fully rated neutral bushing for connection to the high-resistance grounding resistors. Pulsing ground fault detection system shall be provided. The transformer shall be sized for its normal operating load in the self-cooled condition. The transformer and its impedance shall also be sized to allow across the line starting of the largest 460 V motor with all other motors in the full load condition within specified voltage drop.

A-7.16.13.11. When power is required to two or more identical major equipment items on each generating unit, the power to one of these items shall be supplied from the other bus. Auxiliary equipment shall be fed from the same bus as its associated major equipment.

A-7.16.13.12. Instruments and Meters

A-7.16.13.12.a. All indicating instruments, meters and relays shall have semi-flush mounting cases. The meter dials shall have white backgrounds with black expanded scales, black figures, and black pointers.

A-7.16.13.12.b. Meter potential coils shall be 120-volt, 60 Hz. Meter current coils shall be 5 amperes.

A-7.16.13.12.c. Indicating meters shall be 1 percent accuracy, 4 –1/2-inch square switchboard type, with taut band suspension.

A-7.16.13.12.d. Equipment on each panel shall be arranged with a maximum amount of space allowed for possible future additions.

A-7.16.13.13. Instrument Transformers

A-7.16.13.13.a. Instrument Transformers: Ring type current transformers shall be furnished. The thermal and mechanical ratings of the current transformers shall be coordinated with the circuit breakers. Their accuracy rating shall be equal to or higher than ANSI standard requirements. Instrument transformers shall be insulated for a test voltage corresponding to the insulation level of the switchgear. Current transformers shall have 5 ampere secondary windings. Secondary windings shall terminate at barrier type terminal block suitable for connection to Seller's cables. All current transformer terminal blocks shall be short circuiting type. The standard location for the current transformers on the bus side and line side of the breaker units shall be front accessible to permit adding or changing current transformers without removing high voltage insulated connections.

A-7.16.13.13.b. Each set of voltage transformers and their protective fuses shall be assembled in a separate compartment and shall be arranged so that the unit can be readily withdrawn from the operating position. In the withdrawn position, voltage transformers and fuses shall be completely disconnected from service, with all exposed parts visibly grounded. Fixed type VTs and fuses are acceptable.

A-7.16.13.13.c. The primary and secondary of voltage transformers shall be fused. Voltage transformers shall have a 480-120V ratio. Minimum rating shall be 200 VA (thermal). Voltage transformers shall have ANSI 0.3W, X, Y, and 1.2Z accuracy.

A-7.16.13.13.d. The accuracy rating of current transformers shall be as shown in ANSI/IEEE Standard C37.20.1.

A-7.16.13.13.e. All instrument transformers shall be grounded directly to the ground bus, not to the housing.

A-7.17 480V MOTOR CONTROL CENTER (MCC)

A-7.17.1 480V MCC's shall be arc resistant type 2 in accordance with IEEE C37.20.7. MCCs shall be main lug only when fed directly from LV Switchgear. 480V MCC buckets shall have the ability to be electrically isolated from the vertical bus using retractable stabs (or similar mechanisms based on OEM standard design and as approved by Buyer) prior to opening the compartment door.

A-7.17.2 Enclosures shall be NEMA 12 for indoor applications. All 480V MCCs shall be located indoors.

A-7.17.3 OEM provided distribution equipment (motor control centers) shall have a withstand rating of 65kAIC on the 480V main bus.

A-7.17.4 Each combination starter shall have a three-phase electronic overload relay. Combination starters shall consist of magnetic-only circuit breakers and contactors with thermal overloads. MCC feeder circuits shall have solid state trip devices for protection against sustained short circuit currents.

A-7.17.5 Each magnetic starter in an MCC which provides power to a motor shall be equipped with an adjustable motor circuit protector and an electronic overload in the starter to protect against overload. Seller shall furnish and install overload relay heaters after final motor sizes have been determined.

A-7.17.6 The short circuit withstand capability of the combination of starters and circuit breakers shall equal or exceed 65,000 rms symmetrical amperes in accordance with UL508.

A-7.17.7 Space Heaters:

A-7.17.7.1. Thermostatically controlled space heaters shall be furnished at the bottom of each vertical section of all motor control centers to prevent condensation of moisture within the enclosures. The heaters shall be located and thermally insulated such that no painted surface shall be damaged or discolored. Space heater location shall not interfere with the normal entrance of cables into the sections.

A-7.17.7.2. Space heater capacity shall be as required to maintain the compartment and section internal temperature above the dewpoint.

A-7.17.8 Utility and lighting transformers or panels shall not be located within MCCs.

A-7.17.9 Redundant pumps and other redundant systems shall be fed from independent 480 V MCCs. Loads not fed from the 480 V SWGR shall be fed from MCC feeder circuit breakers. The breakers shall be thermal magnetic molded case breakers sized to protect supply cable and individual loads.

A-7.17.10 Each magnetic starter in an MCC supplying power to a motor shall be equipped with an adjustable motor circuit protector and overload device in the starter.

A-7.17.11 Motors shall be started and stopped via the Facility DCS or appropriate turbine control system. Motor status signal for the Facility DCS shall be included. These described signals shall be hardwired.

A-7.17.12 The numbers of vertical sections and positions available for future components shall be provided by Seller. Future positions shall include all bus work and details required for installation of combination starters and circuit breakers. Seller shall provide minimum 10% spares and 10% spaces in each motor control center lineup.

A-7.18 DISTRIBUTION PANELS

A-7.18.1 LV distribution panels shall be designed and built-in accordance with NEMA ICS standards. Panels for outdoor locations shall be type NEMA 4. Panels for indoor location shall be NEMA type 12

A-7.18.2 Panelboards shall be UL-listed and conform to the latest issues of the National Electrical Code and NEMA Panelboard Standard PB 1. Each panelboard shall be rated for 480/277 VAC service, 208/120 VAC service, or 125/250 VDC service. A minimum of 20% spare breakers shall be provided for each panelboard. A machine printed directory card with protective film and frame shall be provided on the inside of the door.

A-7.19 ESSENTIAL SERVICE AC AND DC SYSTEMS

A-7.19.1 General Requirements for Essential Service System

A-7.19.1.1. The Seller shall design, manufacture, test, deliver, and install an essential service AC and DC systems, as described below:

A-7.19.1.2. 480V AC Essential Bus (SWGR/MCC)

- Essential Bus Loads – including but not limited to:
- Stack Lighting
- PDC battery room exhaust fans per NEC
- Control room lighting and HVAC systems
- HVAC and lighting in PDCs
- Turning Gear
- Instrument Power
- Emergency Shutdown loads for Turbines
- Battery Charger AC supply system
- UPS Supply – AC input

A-7.19.1.2.a. Requirements for 480V switchgear, MCC and distribution panel apply to the AC Essential Bus equipment

A-7.19.1.3. An Emergency Diesel Generator shall be connected to the 480V AC Essential Service Bus to provide power in the event of a Facility blackout. The EDG shall have design provisions such as:

- Online within 10 seconds
- Ability to synchronize with the Facility electrical system.
- Capability of parallel operation for testing purposes
- Generator Circuit Breaker
- 8-hour fuel tank reserve
- Standalone generator control panel

A-7.19.2 UPS System

A-7.19.2.1. UPS shall be fed from a DC bus, which in turn shall be fed from the battery charger system, which is powered from the Essential Service 480V Bus. UPS shall also provide power requirements for safe emergency shutdown.

A-7.19.2.2. Emergency shutdown scenario is defined by a simultaneous trip of the turbine-generator with a simultaneous loss of HV switchyard connection, which would result in total loss of power to the generator bus and consequently to ~~the~~ all UAT~~'~~(s) and Medium Voltage Switchgear.

Commented [TS1]: "…. to all UATs and …"

A-7.19.2.3. The essential-service AC subsystem (UPS) provides 120V AC, single-phase, 60-hertz power to essential control, instrumentation, and equipment loads that require uninterruptible AC power. The UPS shall be 208/120V AC three phase sized to accommodate all loads with a 20% design margin. The following services as a minimum shall be powered from the UPS:

- Facility DCS equipment power supplies
- UPS powered receptacles
- Leak detection gas monitors
- Radio system

- CEMS
- LAN and telecommunication network cabinets
- Control Room operator and engineering workstations
- Printers, disk drives, and printers in the Control Room
- PLCs
- Process analyzers and computer systems
- RTU
- Vibration monitoring systems (except for CTG and STG)
- Fuel Gas Emergency Shutoff Valve and STG reheat non-return valve.
- Security system (including all security devices, badge readers, electronic locks, door sounders, cameras, etc.)
- Steam drum level monitors
- HRSG requirements
- Fire alarm and detection

A-7.20 DC SYSTEM

A-7.20.1 The essential-service DC subsystem provides a reliable source of power for the essential-service AC subsystem and 6900V and 480V switchgear control and power functions during normal and emergency station operating conditions. The following services as a minimum shall be powered from the DC system:

- UPS
- HV breaker control and protection
- MV switchgear control and protection
- LV switchgear control and protection
- Emergency DG switchgear control
- GPS clock for protection relaying
- Each primary and backup protective relay panel
- Emergency lighting system
- Motor loads (STG emergency lube oil and seal oil pumps)
- Turbine Control System

A-7.20.2 A DC system shall be supplied with each CTG sized to provide total DC power requirements of each individual turbine generator see Attachment A.17. The STG DC loads shall be powered from the common balance of plant Essential-Service DC System.

A-7.20.3 Battery room floor shall be treated with an acid-resistant floor sealant. Batteries shall be rated by industry standards on the basis of a nominal 24-hour average temperature of corresponding to the battery room minimum design temperature. Battery Room exhaust vent fans exhausting outdoors shall be provided to avoid a buildup of hydrogen. Curbed areas without drains shall be provided surrounding the battery cells for the containment of acid spills in the event of a cell crack or rupture. In a separate, nearby area of the battery room, an eye wash and shower station shall be located for rinsing eyes and skin in the event of acid contact. A monorail or other means shall be included in the design of the battery rooms to assist in removing or replacing cells. Battery room exhaust vent fans show be monitored for loss of air flow and an hydrogen gas detector shall be installed and hardwired to DCS for monitoring/alarm.

A-7.20.4 Batteries

A-7.20.4.1. Batteries General

A-7.20.4.1.a. Seller shall design, fabricate, test, deliver and install one (1) 125V DC battery system for the Balance of Plant (BOP). The battery shall supply the ST DC auxiliaries, HV breaker control, switchgear control, emergency DC motors, certain alarms, DC essentials auxiliaries as describe in this Attachment A-7.20.1. Each combustion turbine shall have its own dedicated battery and UPS.

A-7.20.4.1.b. Batteries shall be designed to maintain a 2-hour duty cycle.

A-7.20.4.1.c. BOP Batteries shall be installed in a battery room in the main PDC designed in accordance with NEC. Battery system shall be ungrounded and provided with a ground detection scheme.

A-7.20.4.1.d. Batteries shall be load tested based on recommendations from the OEM on approved factory testing methods and IEEE standards.

A-7.20.4.1.e. Batteries shall be rated by industry standards on the basis of minimum allowed battery room temperature.

A-7.20.4.2. Specification for 125V DC Batteries

A-7.20.4.2.a. 125 VDC Batteries Specification General

A-7.20.4.2.a.1 The batteries shall be sized based on the 125 Vdc Battery Load Profile to be determined by Seller. DC battery system voltage range shall be 105V to 140V and all DC load fed from this system shall be specified accordingly.

A-7.20.4.2.a.2 The capacity of the batteries shall be determined by the Seller in accordance with IEEE 485-2020 and these specifications. If two strings are used to achieve the needed capacity, then each string shall be connected to the main switchboard by its own fused disconnect switch.

A-7.20.4.2.a.3 The battery cells shall be lead-acid type with pasted plate grids of lead-calcium alloy contained in transparent plastic jars. The minimum battery terminal voltage shall not drop below 105V.

A-7.20.4.2.a.4 Battery run down testing, load test and documented results shall be performed by the Seller and test reports provided to the Buyer.

A-7.20.4.2.a.5 Battery service life shall be 20 years.

A-7.20.5 Battery Chargers Specification

A-7.20.5.1. General

A-7.20.5.1.a. A total of two (2) battery chargers per system are to be furnished. The battery chargers shall be connected to the 125 VDC main distribution panel. Each battery charger shall be sized in accordance with IEEE Std. 946 and based on a discharge rate determined by Seller. Each battery charger shall be sized to furnish 100 percent of the current required to recharge the battery from discharge condition to the fully charged condition in 12 hours while maintaining the continuous normal steady state loads

A-7.20.5.1.b. In the event of a battery charger malfunction, an alarm shall be sent to the control system. Chargers shall be solid state. Chargers shall provide adjustable equalizing and float

voltage and shall include standard alarms, meters, controls, paralleling circuit abilities and filtering to allow battery elimination under steady state.

A-7.20.6 125V DC Distribution Panel Specification General

A-7.20.6.1. The distribution panelboard covered by this specification shall provide centralized switching and circuit protection of dc power for auxiliaries, control, and lighting. The DC source will be supplied from the BOP 125 VDC battery and battery chargers.

A-7.20.6.2. The panelboard shall consist of one or more vertical sections bolted together to form a rigid, free-standing assembly. All bare bus (except the ground bus) and power connections shall be covered to prevent accidental contact by personnel. Panelboards shall be designed so as to permit future additions of vertical sections and the interchanging of units by Buyer. The incoming cables will enter the panel from the top or bottom. Removable cover plates shall be provided for drilling in the field.

A-7.20.6.2.a. The panelboard shall be UL-listed, where applicable, and conform to the latest issue of the National Electric Code (NEC) and NEMA Panelboard Standard PB 1.

A-7.21 DC MOTOR CONTROLS

A-7.21.1 DC motor starters shall be across-the-line type with start/stop and reverse controls as required by the application. Each starter shall be rated for the horsepower of the motor being controlled, the line voltage applied, motor amps per nameplate of the motor, and field type. Motor starters shall be specified to contain necessary resistors and shall have stepped starting as required by the motor acceleration time and the armature current. The enclosures shall be NEMA Type 12 for indoor and NEMA 4 for outdoor applications. The enclosure shall include an externally mounted overload reset push button.

A-7.21.2 Controls shall operate from line voltage (125 VDC). Control circuits shall provide for local and/or remote start/stop operation, field protective devices and overloads as required and shall provide an automatic mode, which does not bypass any protective devices.

A-7.22 UNINTERRUPTIBLE POWER SUPPLY (UPS)

A-7.22.1 Specifications for the Uninterruptible Power Supply

A-7.22.1.1. Uninterruptible Power Supply System (UPS) Specification General

A-7.22.1.1.a. One (1) UPS system is to be furnished by Seller. The UPS system shall be supplied with 20% spare capacity above calculated requirements.

A-7.22.2 Each power supply shall consist of an Integrated UPS System three phase 208/120 volt, four-wire, 60Hz static inverter with a static switch, DC circuit breaker, a manual bypass switch for AC circuits, solid state rectifier, auctioneering input, AC circuit breaker, one alternate supply voltage regulating transformer, and AC distribution panel. The power source for the alternate supply shall not be the same MCC/Switchgear as the Battery Chargers.

A-7.22.3 Distribution Panelboard

A-7.22.3.1. Panelboards shall be rated 120VAC, single-phase, two-wire, or 208/120, three-phase, four-wire, as required to support power distribution as designed by the Seller. Distribution panelboard shall include main breaker and neutral buses. The rating of the main bus and interconnections at the UPS shall be equal to the rated continuous full load current of the inverter without exceeding 65°C rise. The main bus shall have a minimum interrupting rating of 10 kA.

A-7.22.3.2. The panelboard(s) shall have forty-two (42), single pole, thirty (30) ampere frame, branch circuit devices.

A-7.22.3.3. The main panelboard shall be furnished with a single hinged door with lock and key, cardholders for circuit identification and trim over the entire panel. The panelboard shall be flush mounted within a freestanding enclosure that matches and is aligned on a common base with the other UPS System panels. Also, the same requirements apply to UPS distribution sub-panels.

A-7.22.3.4. The panelboard shall be UL-listed and conform to the latest issues of the National Electric Code and NEMA Panelboard Standard PB 1

A-7.23 MOTORS

A-7.23.1 General Requirements for Motors

A-7.23.2 The Seller shall design, manufacture, test, deliver, and install all motors to comply with the following criteria.

A-7.23.2.1. All AC motors shall be designed for direct across the line starting (except for OEM Turning Gear motor) and shall not exceed a class B insulation system temperature rise as defined by ANSI C50.41. For large inertia driven loads, soft start or VFDs may be used. Softstart or VFDs may be used in other process application or for specific equipment (e.g., turning gear) as appropriate with Buyer approval. Motors shall be of the highest efficiency available for the specified application. Motors shall be NEMA MG-1 compliant unless otherwise stated. All stator windings and rotor squirrel cage shall be copper.

A-7.23.2.2. All motors supplied by VFDs shall be inverter rated.

A-7.23.2.3. Single terminal box shall be provided for the motor leads. Motor pigtails shall be supplied with Raychem or 3M kits for motor connections.

A-7.23.3 Medium Voltage Motors

A-7.23.3.1. MV Motors shall be provided as follows: MV motors shall be in accordance with ANSI C50.41

A-7.23.3.2. For MV motors, a separate box shall be provided for equipment, i.e., space heaters and instruments.

Type:	Single-speed, squirrel-cage, induction in accordance with ANSI Standard C50.41.

Voltage rating, phase, frequency	6600 volt, three phase, 60 Hz, rated above 250 HP.
Horsepower rating:	The horsepower nameplate rating shall not be less than 110% of the brake horsepower required by the driven equipment to operate at its maximum requirements.
Service Factor:	1.0
Nameplate:	Shall state the service factor, maximum number of starts per hour and comply with ANSI C50.41.
Enclosure:	Outdoor: WPII or TEFC
	Indoor: WPI or TEFC
Class of insulation:	Class "F" vacuum pressure impregnated. Insulation system shall be sealed in accordance with NEMA MG-1-20.49.
Temperature rise of windings (maximum by resistance):	In conformance with ANSI C50.41 standards for Class B insulation.
Bearings:	Horizontal motors - split sleeve bearings of the oil ring type. A sample drain line shall be provided for obtaining bearing oil samples.
	Vertical motors - sleeve guide and thrust
Ambient temperature range:	Per Project site design conditions.
Limitations on starts:	In accordance with ANSI C50.41, a nameplate shall designate the maximum permissible number of starts and the required cooling period when motor is started under conditions of (a) cold rotor and (b) warm rotor (after running continuously at full load for a period of one hour).
Locked rotor (starting) torque at rated voltage and frequency:	Not less than 80% of full-load torque.
Pull-up and breakdown torque:	The torque of the motor shall be 15% above the load torque requirement throughout the entire speed range at 85% of motor-rated voltage with 80% pull-up torque as a minimum.
Locked rotor current:	Not to exceed 650% of full load.
Base:	Soleplates shall be provided if required by Seller design.
Sight glasses:	Sight glasses shall be furnished in place of oil cups on all oil-filled bearings.

Preparation of storage:	Motors shall be prepared for extended outdoor storage by protecting the motor bearings with either a protective grease covering or liquid preservative. The motors shall be tagged to show that a preservative has been used. The procedure to be followed before motors are placed in operation shall also be indicated on that tag.
Partial discharge	Provide partial discharge monitoring in accordance with ANSI C50.41.
Heaters:	Heaters shall be included. Heaters which total more than 1200 watts in capacity shall be rated for 480 volt AC three-phase and heaters totaling less than 1200 watts in capacity shall be rated for 240 volt ac, single phase and operated at 120 V ac. They shall be derated for extended life and shall be sized to prevent condensation at the lowest Project site design temperature. 120Vac heater circuit shall be powered from a single circuit or utilize 2-pole breakers to preclude a common neutral potential.
Grounding:	Seller shall provide two copper ground pads, one on each side of the motor with drilled and tapped holes suitable for attaching two-hole NEMA grounding lugs. Motors shall have grounding provisions inside termination enclosure
Direction of rotation:	Motors shall have the direction of rotation marked on a nameplate for the supply voltage sequence of T_1 - T_2 - T_3.
Magnetic center:	The magnetic center at rated load shall be marked on all motors.
Motor test:	Motor tests shall be performed with motor terminal housing installed on motor and in accordance with ANSI C50.41.
Air filters:	Removable dry type complete with stainless steel filter screens.
Lifting lugs:	Suitable lifting lugs shall be provided for hoisting motors during installation and for maintenance purposes.
Sound levels:	Warranted maximum A-weighted sound level shall not exceed 85 dBA re: 0.0002 microbar at any point one meter from motor when tested as per IEEE Standard 85.
Instrumentation:	Motor winding temperature(s) shall be provided using 100 OHM platinum RTD's only. External junction box shall be provided for easy termination of these motor winding temperature(s) which will be connected to the Facility control system for monitoring. There shall be 2 RTD's per phase. Motors with sleeve and plate type thrust bearings shall have Type E bearing thermocouple (TC). External junction box shall be provided as per above. There shall be two TC's per bearing installed per API 670.

For motors having a nameplate of a 1,000 rev/min or more proximity probes shall be used to monitor all bearings for radial shaft vibration or axial position.

For motors having a nameplate rpm less than a 1,000 rev/min. bearing case vibration monitors shall be used to measure vibration.

Installation shall be in accordance NEMA MG-1-2009; Revision 2010; Part 7. All conditioned signals shall be compatible with BOP Bently Nevada 3500 vibration monitoring equipment with exception of ECA compressor motor which is monitored in the Turbine Control System.

A-7.23.4 Low-Voltage Motors

A-7.23.4.1. 480V & 115V Motors shall be provided as follows:

Type:	Horizontal or vertical as required, single-speed, squirrel-cage induction, energy efficient, mill and chemical dry type. Cast iron frames and copper windings only per IEEE 841 requirements.
Voltage rating, phase, frequency:	460 volts, three-phase, 60 Hz, for all motors rated at ½ hp through 250 hp, 115 volts, single-phase, 60 Hz, for all motors below ½ hp.
Horsepower rating:	The horsepower nameplate rating shall not be less than 110% of the brake horsepower required by the driven equipment to operate at its maximum requirements.
Service factor:	1.15.
Ambient temperature range:	Per Project site design conditions in Attachment A-4.
Nameplate:	Shall state the service factor and comply with NEMA MG-1.
Enclosure:	TEFC or TENV
Class of Insulation:	Class F
Temperature rise of winding (maximum by resistance):	In conformance with ANSI C50.41 standards for Class B insulation.
Heaters:	Motors 25 hp or greater shall be supplied with heaters. The heaters shall be rated 240VAC for operation at 120V AC. Heaters rated above 1200 W shall by 480VAC, 3 phase.

A-7.23.4.2. All LV motors shall be designed for operations on a high resistance grounded system where voltages may equal to the line-to-line effective to ground during fault conditions and continue until the fault is cleared.

A-7.23.5 Additional Motor Requirements:

A-7.23.5.1. Motors shall be rated on a continuous duty basis.

A-7.23.5.2. Motors shall be sized such that continuous operation above a 1.0 service factor is not required. Applications where a temporary overload such as shutoff or runout, and a 1.15 service factor can provide such rating, a 1.15 service factor motor may be used.

A-7.23.5.3. LV Motors shall have an internal ground conductor installed with the power conductors. Motors shall also be independently grounded from separate power or ground source installed and connected to outer frame. Minimum ground conductor size shall be #4 AWG.

A-7.23.5.4. MV motors shall have an independent ground conductor separate from the power cable but routed in same conduit can be used. MV motors and transformers shall have 2 #4/0 grid stub ups, pigtails, installed in mounting pad, typically at opposite corners, for frame connections to the grid.

A-7.23.5.5. DC motors shall be designed for continuous operation at any voltage between ±10% of nominal voltage without exceeding permitted temperatures and without injurious sparking at the commutator.

A-7.23.5.6. All enclosures shall be corrosion resistant and provided with galvanized screens over all openings to prevent debris and animals from entering.

A-7.23.5.7. Hazardous location specified motors shall meet NFPA 70 and UL 674 for the specified class, division, and group.

A-7.24 COMMUNICATIONS

A-7.24.1 Seller shall furnish and install the communications system as described below.

A-7.24.2 Seller shall furnish equipment per the Buyer's specifications including but not limited to fiber patch panels, Ethernet patch panels, cabling, network cabinets, server cabinets, connectors, etc.

A-7.24.3 Network and server cabinets shall be electrically insulated from their mounting surface.

A-7.24.4 Voice over Internet Protocol (VOIP) telephone shall be single-mode fiber cables. Fiber terminations shall not be made in Junction Boxes.

A-7.24.5 Local Area Network (LAN) and Wide Area Network (WAN) data system shall be provided for communication for on-site, between the Control room, CEMS Buildings, PDC's, electrical buildings, exciter buildings, thyristor buildings, administration building, warehouse, water plant building, control packages, operating areas, with Buyer input. The buildings shall be provided with VOIP LAN/Ethernet connections.

A-7.24.6 A minimum of a 24 strand (12 pair) single-mode fiber optic cable to each building with the main fiber feeds into the facility being a minimum of 96 strand (48 pair) single mode fiber cable. All communications fiber cabling shall be single-mode fiber cabling with LC connectors and shall not be used for any other purpose except for the project LAN and WAN network and VOIP telephones. Outdoor fiber cabling shall be orange armored cabling and the armor shall be grounded. The armor shall be discontinued at the entrance

to each building or when exiting the ground to go up a pole. Orange fiber inner duct shall be utilized when armor is discontinued and inside of buildings.

A-7.24.7 Seller shall provide redundant power sources to each network cabinet with one source being uninterruptible power supply (UPS) and the other being generator backed power supply (essential power). Seller shall provide redundant generator backed power supplies to the telecom racks. Buyer shall provide the voltage and amperage ratings for the circuits.

A-7.25 GROUNDING AND LIGHTNING PROTECTION SYSTEM

A-7.25.1 Grounding

A-7.25.1.1. The outdoor station grounding system shall be an interconnected network of bare copper conductors and copper-clad ground rods installed throughout the facility including the turbine-generators areas, around buildings, structures, and major electrical equipment.

A-7.25.1.2. The system shall protect Facility personnel and Equipment from the hazards, which can occur during power system line to ground faults and lightning strikes.

A-7.25.1.3. The Facility grounding system shall be interconnected with the switchyard grounding system. The new grounding system shall be designed by calculation in accordance with IEEE 80, NEC, NFPA and NESC requirements.

A-7.25.1.4. The outdoor station grounding grid shall be designed to ensure that safe step and touch voltage gradients are maintained in the Facility. Seller shall, after ground grid system is installed and complete, ensure an overall fall of potential test of the ground grid is conducted within the Facility grid, including switchyard portion of the Facility.

A-7.25.1.5. Size of conductors and ground grid layout shall be determined by the Grounding calculation. Overall grid resistance shall be less than 1 OHM and shall be verified by test by the Seller.

A-7.25.1.6. Isolation hardware shall be installed on the telephone circuits, railroad tracks, steel pipelines and fences leaving the Facility ground grid area to ensure safe conditions outside the Facility area. All fencing on site shall be grounded at appropriate intervals but not exceeding 300 ft. and at all gateways. Gate posts which form part of the switchyard fence shall be bonded together with below ground connections. The movable portion of each gate is to be grounded via a flexible copper connection to the gate stanchion or perimeter fence.

A-7.25.1.7. Bare conductors shall be installed 18 inches below grade and shall be spaced in a grid pattern. Each junction of the grid shall be bonded together by compression fittings (UL 467 listed). In the Facility area, grounding conductors shall be brought through the ground slab and weld connected to the building steel and selected Equipment. The grounding pigtails shall not be run exposed over finished concrete slabs.

A-7.25.2 The grounding system shall be extended, by way of conductors through the floor and conductor installed in raceways, to the remaining Facility Equipment. Stub-up connections from the ground grid to building steel columns shall be exothermically welded. Building structural members shall be electrically continuous. Bonding jumpers

are required across building expansion joints and across steel members that are painted or coated with fireproofing material. Structural steel members which will be isolated from ground because of the specific building design shall also be connected to the nearest grounded structural steel member or directly to the grounding system by bonding jumpers.

A-7.25.3 Major building and transformer foundation rebar shall be connected to the main grounding grid using approved compression fittings or ufer (exothermic) type connections. Connections to rebar shall be made around the perimeter of the foundation with a minimum of two connections per isolated foundation.

A-7.25.4 MV motors and transformers shall have 2 #4/0 grid stub ups, pigtails, installed in mounting pad, at opposite corners, for frame connections to the grid. All vendor supplied skids should be equipped with a minimum of 2 ground connections generally opposite corners of skids.

A-7.25.5 Fencing under HV transmission lines and adjacent to transformers (areas susceptible to high fault currents) shall be connected to the grounding system. Fence posts shall be connected at intervals of approximately 50 feet to a parallel copper ground conductor buried 3 feet outside the fence. Posts on each side of a gate or removable fence section shall be bonded together below grade.

A-7.25.6 Underground duct bank installation shall include at least one #4/0 AWG ground cable routed above or along the side, for connection to the grid at each end of the duct bank. At manhole locations these duct bank ground cables shall be tapped with minimum one #1/0 lead routed to the interior of the manhole. All underground connections shall be compression fittings (UL 467 listed).

A-7.25.7 Each end of a continuous cable tray or metallic conduit run shall be connected to the grid. At any installation discontinuities of a continuous run (expansion joints, hinged fittings, etc.) bonding jumpers shall be installed. The sizing of the jumpers shall be as required by the NEC for the tray application.

A-7.25.8 All power and control cable trays shall have a bare copper ground conductor, sized as required and bolted to the outside of the tray at a maximum of every 10 feet. Cable trays shall be connected to the ground grid at each end and at 50-foot intervals. Trays shall be rated as an earth return path. Where dissimilar metals are in contact, measures shall be taken to mitigate galvanic reaction.

A-7.25.9 Non-metallic flexible conduit shall have a ground wire bridging from last rigid conduit/tray to the equipment.

A-7.25.9.1. Individual equipment grounding shall be as follows:

A-7.25.9.1.a. Major items of Equipment, such as MV & LV switchgear, MCCs, relay panels, and control panels, shall have integral ground buses connected to the station grounding system.

A-7.25.9.1.b. Electronic panels and Equipment, Sensitive Equipment (including, but not limited to: vibration monitoring, Facility DCS), shall be grounded utilizing a separate isolated and insulated ground cables. The ground cable shall take the most direct route in non-

metallic conduit with minimal bends. For instrumentation circuits routed to the Facility DCS, the cable shields shall be connected to an independent ground bus in the Facility DCS cabinet and cut and taped at the field end.

A-7.25.9.1.c. Facility DCS cabinets shall have 2 grounds, cabinet ground connected to grid, and clean ground from isolated ground rod system. Typical configuration of isolated ground system consists of 3 rods in a triangular form installed into the ground that does not connect to the Facility grid.

A-7.25.9.1.d. For low and medium voltage power supply circuits, which utilize ground conductors or connections, the ground conductors shall be sized in accordance with the National Electric Code (NEC).

A-7.25.9.1.e. Remote buildings and outlying areas with electrical equipment shall be grounded by establishing local ground grids and equipment grounding systems in a manner similar to the Facility area. All buildings within the grounding system shall be connected to the grounding system.

A-7.25.9.1.f. All underground metal pipes, including the bell and spigot pipe joints, shall be electrically continuous. Reinforcement of any concrete pipes shall be electrically continuous and connected to the station grounding system.

A-7.25.9.2. Grounding materials shall be as follows:

A-7.25.9.2.a. The buried grounding cable size shall be bare copper conductor minimum 4/0 awg and the minimum conductor for above ground primary stub ups from the grid shall be 2 awg. Seller shall provide and install PVC conduit to protect riser conduits.

A-7.25.9.2.b. Ground rods shall be copper-clad and shall be installed throughout the project including CTG and STG areas, PDCs, Control Room, GSU/ UAT / HV equipment areas connected to the facility ground grid.

A-7.25.9.2.c. Ground rod lengths shall be minimum 10’ and shall be installed throughout the Facility with Buyer review and approval prior to releasing grounding drawings ‘Issue for Construction’.

A-7.25.9.2.d. Ground protection calculations shall be based on actual measured soil conditions including project fill material.

A-7.25.9.2.e. Cable shall be soft-drawn copper with Class B stranding.

A-7.25.9.2.f. Exothermic welds shall use molds, cartridges, and materials as manufactured by Cadweld.

A-7.25.9.2.g. Clamps, connectors, and other hardware used with the grounding system shall be made of copper.

A-7.25.10 Lightning Protection

A-7.25.10.1. Lightning Protection System shall be designed and constructed as follows:

A-7.25.10.2. Not used

A-7.25.10.3. The Project site is subject to frequent lightning strikes thus the new Facility shall be designed accordingly. Lightning protection for buildings and structures shall consist of air terminals installed around the top of the structure. Air terminals shall be arranged to provide protection for roof penetrating devices, such as piping and air handling equipment.

A-7.25.10.4. A complete lightning protection system shall be designed, furnished, and installed for the HRGS stacks, on-site buildings, roofs, structures, switchyard, and other important areas of the Facility in accordance with NFPA 780.

A-7.25.10.5. The air terminals shall be connected together with copper cable and connected to the Facility ground grid with copper down conductors.

A-7.25.10.6. The lightning protection system design shall be designed to NFPA 780. The lightning protection system installation shall be master labeled by UL with the exception of the HV Switchyard.

A-7.26 LIGHTING

A-7.26.1 All lighting fixtures for the Facility shall be LED type including roadway.

A-7.26.2 Average lighting levels shall be in accordance with the latest issue of the Illuminating Engineering Society (IES) Handbook recommendations for luminary values for an electric generating station. Lighting design shall follow IES RP-7. Lighting levels (foot candles) shall be measured as average levels from IES RP-7.

A-7.26.2.1. Control rooms shall be maintained at 30 foot-candles from bottom of drop ceiling to top of finished floor.

A-7.26.2.2. Lighting intensities shall be appropriate for each area of the facility and the work functions to be performed in the area.

A-7.26.3 Lighting power supply shall be three phase, four wire, 120/208 V. Roadway lighting power supply shall be three phase, four wire, 277/480 V. Lighting and power distribution panels shall have 20% spare load capacity for future load additions. Lighting transformers shall be dry type and shall have 20% spare capacity for future load additions. Panel boards fed from a circuit breaker in an MCC or another panel board can be furnished with incoming main lugs only if the circuit breaker trip rating does not exceed the panel board rating. Branch circuit breakers shall be "bolt-on" and shall be thermal-magnetic.

A-7.26.4 LED lights shall be used for high bay lighting applications. Reflectors or other means shall be used to limit lighting effects outside the Project. In general, photocell controlled lighting contactors shall be used for general outdoor areas; however, circuit arrangement shall permit selective on/off switching of lights in areas where personnel are absent.

A-7.26.5 In areas of the Project that contain display screens for programmable controllers and computers, glare can be a nuisance. In these areas, consideration should be given to

control schemes which allow operators to switch selected groups of luminaires on and off as needed using dimmers or various light switches.

A-7.26.6 INDOOR

A-7.26.6.1. LED lamps shall be used indoors in all areas. Protective lenses shall be provided. Lights shall be placed as close as practical to the center of aisle-ways. Interior lighting in structures shall be operated by three way switches located inside and next to each man-door.

A-7.26.7 OUTDOOR

A-7.26.7.1. LED fixtures shall be used outdoors and controlled by photoelectric cells using contactors with manual overrides in general equipment areas, power block and fuel receiving areas. Exterior area lighting shall be mounted either on poles or building structures.

A-7.26.7.2. Outdoor lighting shall comply with dark sky initiative.

A-7.26.8 Emergency

A-7.26.8.1. Indoor paths of egress shall be illuminated as required by NFPA 101. LED emergency units with integral battery shall be used. Emergency lighting shall provide sufficient emergency lighting in equipment areas to allow safe movement of personnel on loss of station power.

A-7.26.8.2. Emergency lighting and exit lights shall be provided by self-contained battery packs capable of maintaining rated output for two hours. Emergency lighting and exit sign power shall be sourced from the non-essential source except for those in the Control Room & PDC which should be from the essential source since the normal lighting in these areas is from the essential source. Emergency lights and exit signs will be located in the control room, PDCs, STG enclosure, elevated areas, and any areas that will be needed to allow someone to egress safely per OSHA.

A-7.26.9 Receptacles

A-7.26.9.1. 480 VAC, 3 phase, 60A welding receptacles with integral disconnect switches shall be located, as a minimum, at the heat recovery steam generator (HRSG), each turbine, maintenance shop (2) and shall not be located in classified areas. There shall be a minimum of one receptacle on each HRSG platform level.

A-7.26.9.2. 120 VAC, single-phase duplex convenience outlets shall be located for convenient access in all buildings, control cubicles, and not located in classified areas. “GFCI” outlet ground fault interrupter type, with watertight covers are required for all outdoor locations. Convenience receptacles outdoors shall be installed such that a 75-foot extension cord will reach all areas. Indoors receptacles shall be located in accordance with the NEC.

A-7.26.9.3. Equipment designated receptacle outlets shall be routed with a separate neutral, rated for the Equipment connected load which shall not exceed 80% of the breaker rating.

A-7.27 CABLE AND RACEWAY SYSTEMS

A-7.27.1 Materials of Construction

A-7.27.2 All cable insulation (including cable furnished with equipment) shall be cross-linked polyethylene or ethylene propylene rubber (XLPE or EPR). All cable jackets shall be Polyvinyl Chloride (PVC) or Chlorinated Polyethylene (CPE) cable jacket unless Vendor's standard cable must be installed in which case the Vendor cable will be accepted after evaluated by Buyer for site installation. The outer protection cover for all cable (the jacket in the case of multiconductor cable and the insulation in the case of non-jacketed single conductor cable) will be officially designated by the manufacturer as flame retardant.

A-7.27.2.1. All cables shall meet UL 1685 and the IEEE 1202 flame exposure standard and tests.

A-7.27.3 Cable Service Classifications

A-7.27.4 Cables shall be classified by voltage level and circuit function. Letters shall be assigned to the different application to indicate service designation and shall be part of the unique identifying number for a given cable. Table 1 – Cable Service, Construction, and Installation Method in Tray, below, summarizes these service designations. This requirement is not applicable to OEM wire/cables completely contained or routed completely within a cabinet, panel, on a skid, or completely within an OEM equipment enclosure.

A-7.27.5 To enable complete redundancy to be maintained, two separate routes shall be used for the data highway, communication, and all other redundant circuits. Redundant cables shall take two distinct paths, when not routed in ductbanks. Two separate conduits will be used when run in duct bank.

A-7.27.6 Cable tabulation report from Excel spreadsheet or Access database including pertinent information such as terminations, cable routing and drawing references shall be submitted to client prior to cable pull. Cable bending radius should be maintained at least 12 times the outside diameter of the cable. During cable pulling, a tension meter, potentiometer shall be on tuggers to for monitoring cable pulling tension. Subsequent data shall be part of the system turnover packages along with cable pulling and route sheets, termination sheets (each end of the cable), continuity checks, megger/hi-pot, and torque sheet.

Table 1

Cable Service Letter	Cable Type & Rated Cable Voltage (ICEA)[4]	Circuit Voltage	Special Conductor Configuration	Method of Installation in Tray
J	25 kV Power	23.5kV 21kV 18kV	None.	1 layer maintained spacing or touching[3]
H	15 kV Power 8 kV Power 5 kV Power	13,800 V 6,900 V 4,160 V	None.	1 layer maintained spacing or touching[3]
L	600V Power	480V	For 4/0 AWG and larger 1/C or Triplex shall be used.	1 layer maintained spacing or touching[3]
K	600 V Power	480 V, 120 VAC and 125 VDC	3/C for 3/0 AWG and smaller.	Random Fill – 40%[2]
C	600 V Control	120 VAC or 125 VDC	None.	Random fill – 50%[2]
X	300 V Instrument, RTD, and Communication	Max 50 V	None.	Random Fill – 50%[2]
Z	Fiber optic	n/a	Armored (outdoor) Jacketed (indoor)	Random Fill – 50%[2]

Notes for Table 1:

1. Control cable in K tray shall be permitted where small quantities of C cables are installed along the route and a separate C raceway is not available
2. K-Tray fill area shall be calculated on the basis of using a 3-inch-deep tray (inside dimension) which is in agreement with NFPA-70 (NEC). When deeper trays are used, tray fill shall be based on a 3-inch tray, resulting in reduced percentage fill. Per the NEC, the maximum conductor size permitted in random filled tray installation is 3/0. Maximum fill for C and X adder type tray shall be 50% and 40% for solid bottom tray.
3. One layer touching installation method for tray shall be acceptable. Per NEC the single conductor power cable and triplex power cable shall be a minimum of 1/0 AWG for installation in tray.
4. Insulated Cable Engineers Association (ICEA) nominal line-line voltage rating for cable.
5. Orange Innerduct shall be used for fiber optic cables when used indoors and armored cables are not required.

A-7.27.7 Medium Voltage Cable (Service Level J and H)

A-7.27.7.1. MV Cable shall be shielded, jacketed, single conductor or triplexed construction with XLP or EPR insulation cable rated at the 133% Level. Triplex or multi-conductor shall be allowed for short pulls and tray installations. Minimum conductor size shall be 4/0 AWG Copper (to be confirmed for project specific conditions using conductor or fault current sizing criteria).

A-7.27.8 Low Voltage Power Cable (Service Level L and K)

A-7.27.8.1. Cable rated 600 V with XLPE or EPR insulation shall be used to supply power to low voltage equipment. Service designation shall be L for large power cable used for 480V

MCC feeders and transformer secondary leads (typical size shall be 1/0 AWG and larger). Service designation shall be K for all other power cable application including 480V, 120VAC, and 125 VDC (sizes ranging from 12 AWG to 3/0 AWG).

A-7.27.8.2. Cable shall be multiple conductor with an overall jacket up to 2/0 AWG and triplex or multiple single conductor insulated/jacketed conductors shall be used for 3/0 AWG and larger.

A-7.27.8.3. Minimum conductor size shall be #12 AWG for low voltage power and #14 AWG for control unless specified otherwise. Cables for CT circuits shall be #10 AWG minimum.

A-7.27.8.4. 600 Volt control cable shall be used for 120VAC and 125 VDC circuits unless otherwise specified.

A-7.27.8.5. Cables completely within an occupied building such as a control room shall be low smoke, flame retardant.

A-7.27.8.6. Above ground lighting cable may utilize Teck cable.

A-7.27.9 Control Cable (Service Level C)

A-7.27.9.1. Multi-conductor cable rated 600V and sized 12 AWG and smaller shall be used for 120VAC and 125 VDC control applications (the exception is current transformer leads which shall be minimum 10 AWG). Service designation shall be C.

A-7.27.9.2. Color coding shall be per NEC.

A-7.27.10 Instrument Cable (Service Level X)

A-7.27.10.1. Multiple pair and multiple triad cable rated 600V or 300V shall be used for analog signals. Service designation shall be X for instrument, thermocouple, and RTD applications. Minimum conductor size shall be 18 AWG for multi-pair cables.

A-7.27.10.2. Shrink tube should be installed on shield wires of all instrument wiring at termination points.

A-7.27.11 Communication Cable (Service Level X)

A-7.27.11.1. Phones, Ethernet, and Network Switches

A-7.27.11.1.a. Telecom cables shall be low smoke zero halogen, Cat 6e, XLPE jacketed cable.

A-7.27.12 Fiber Optic (Service Level Z)

A-7.27.12.1. Unless otherwise approved by Buyer, armored single mode fiber cable shall be used in telecommunication systems.

A-7.27.12.2. Facility DCS networks are typically multimode fiber cables, unless the supplied equipment design or the length of cable dictates use of single mode fiber optic cable. Multimode fiber optic cables shall be armored cables when routed outside. The armor shall be terminated and grounded as close as practical to the building entrance. Armored

fiber optic cable can be used for cable runs within a building; however, it is not required. Orange fiber inner duct shall be utilized when armor is discontinued.

A-7.27.12.3. Fiber-optic patch-panels shall be provided in or adjacent to all cabinets that have a fiber-optic cable in it. Prefabricated cables from patch panel to the appropriate equipment shall be provided.

A-7.27.12.4. Fiber optic cables shall not occupy the same raceway as other cable services; in ductbank these shall be routed in separate conduit cells; in cable tray, they shall be routed with dividers.

A-7.27.13 COAXIAL SIGNAL CABLE (Service Level X with Exceptions)

A-7.27.13.1. Coaxial cable is a specialty cable construction designed to achieve specific attenuation and impedance characteristics and generally has lower signal losses than standard twisted pair cables. Coaxial cables shall be used when specified by equipment and shall be designated as X.

A-7.27.14 AMPACITY/CABLE SIZING

A-7.27.14.1. Overload protective devices shall be set to disconnect the load at less than 125% of the nameplate current in the case of transformers, and 125% of the continuous duty rating for motors. Settings subject to NERC review, if any, shall be approved by Buyer. Therefore, cable ampacity shall be a minimum of 125% of the load rating.

A-7.27.14.2. All cables connected to buses shall be sized to withstand a fault at the load terminals that are subsequently cleared by the feeder breaker.

A-7.27.14.3. Feeder cables for 125 VDC loads that have overload protective devices shall have an ampacity rating that is equal to or greater than the trip device setting. For those motor loads that have only fault current protection, the cable ampacity shall be equal to or greater than the locked-rotor current of the motor. Cable for DC loads without overload protection shall be installed in a dedicated steel conduit.

A-7.27.14.4. Derating of cable due to installation in the various types of raceways shall be in accordance with IEEE 835, and NEC.

A-7.27.14.5. Underground cable derating calculations shall be performed using actual measured soil conditions.

A-7.27.14.6. All wires and cables shall be continuous without splices, but, if necessary, splices shall be made in accordance with cable manufacturer's recommendations and located in approved pull boxes. Prior to performing any splice, it shall be brought to the attention of Buyer for approval.

A-7.27.14.7. Terminating control wiring for relays and other terminations should be made using ring lugs only. Ferrules are also used in terminations.

A-7.28 RACEWAY SYSTEM REQUIREMENTS

A-7.28.1 All raceways, cable tray, cable trench, conduit, and ductbank shall be tagged or labeled and listed in the raceway schedule.

A-7.28.2 All Seller installed cables shall have cable tags (ferrules) or identifiers, per the Sellers wiring diagrams. All Individual wires shall be labeled with tags (ferrules) as identifiers.

A-7.29 CABLE TRAY

A-7.29.1.1. The Seller shall design, furnish, and install a cable tray system as required for a complete installation.

A-7.29.1.2. The cable tray system shall be designed, fabricated, and installed in accordance with the latest edition of NEMA Standard Publication No. VE-l - Cable Tray Systems, load/span class designation NEMA Class 20C.

A-7.29.1.3. All metallic cable tray shall be rated as a earth return path.

A-7.29.1.4. Aluminum ladder type tray shall be used unless required otherwise by a specific Supplier. Tray inside the PDCs shall be manufacturer's standard.

A-7.29.1.5. The cable tray system shall be designed using tray manufacturer's standard sizes, lengths, fittings, tees, elbows, risers, covers, cable dropouts, splice plates, and connection hardware. Expansion joints shall be provided as required when the tray system is subjected to temperature variations or movement. The tray shall be continuous by the use of standard manufacture fittings. Cables shall enter/exit trays through conduits that are attached to the top tray rails or through cable dropouts. Deviation from this requirement will require approval from the Buyer. Tray locations shall be installed per engineering locations/dimensions provided on the IFC drawings. Tray dividers must be continuous, at least as all as utilized fill depth or same as rail height and securely fastened in place before installing cables. Where cable tray ends, Seller shall utilize means and methods to prevent sharp edges from damaging cables or injuring personnel.

A-7.29.2 Cables shall be installed per engineering design including single layer or random fill. Cables shall be installed evenly within the full width of the tray to avoid bunching of cables. Cables shall be properly trained within all fittings such that cables follow the curvature of the tray. Excess coiled cable shall not be left in the tray and should be fed through/out of trays. Cables shall be secured in the tray with clamps or cable tie wraps. All upper layer outdoor cable trays and trays passing under gratings shall have vented cable tray covers to protect cables from UV and falling foreign objects. Cable Trays under Electrical PDCs shall be excluded from this requirement. Cable trays running vertically near walkways shall be covered for a distance of 8 feet minimum above grade. In addition, cable trays installed horizontally in close proximity to high personnel traffic areas shall have covers installed to protect cables from physical damage.

A-7.30 JUNCTION BOXES

A-7.30.1 Junction and pull boxes shall conform to UL Standard UL 50. Galvanized coatings for steel boxes shall conform to ASTM A 525 designation G90 for dry locations and G210 for wet and outdoor locations. Seller shall be responsible for pull box dividers to prevent signal interference between various voltage levels.

A-7.31 CONDUITS, DUCTBANKS, AND MANHOLES

A-7.31.1 The Seller shall furnish and install all conduit required for the Facility in accordance with this Attachment. It shall be the Seller's responsibility to determine the most efficient routing of all conduit runs. It shall be the Seller's responsibility to determine the proper size of all conduits in accordance with the NEC.

A-7.31.2 All conduits shall be sized in accordance with the number and total area of cables that they contain using the National Electric Code.

A-7.31.3 All outdoor exposed conduits shall be rigid galvanized steel.

A-7.31.4 All outdoor exposed conduits shall have low point conduit drains.

A-7.31.5 All underground conduit, with the exception of vertical risers and vertical elbows, will be Schedule 40 PVC.

A-7.31.6 Use of thinwall EMT conduit shall be limited to indoor concealed areas in walls and ceilings typically for lighting and convenience outlets. Outdoor and Indoor minimum conduit size is 3/4 inch (diameter)

A-7.31.7 Seller shall furnish raceways for Seller located telephone, LAN, PA, and communication circuits.

A-7.31.8 PVC conduits shall be Schedule 40 for use in concrete encased duct banks. The conduits shall be supported by prefabricated spacers.

A-7.31.9 Ductbanks shall provide for additional separation of the control and instrumentation cables routed though the raceway system to avoid signal interference during commissioning and Facility operation. This additional separation shall be the equivalent of standard conduit row with the control and instrumentation cables routing in the lowest level conduits. Seller to maintain separation in manholes, and where cables exit ductbank raceway systems into PDCs.

A-7.31.10 Uni-strut shall be inserted into manhole cast embedded for tray support racks. Cables shall be installed neatly, separated voltage classes, and secured with cable ties securely. Conduits shall be identified in the raceway schedule.

A-7.31.11 Flexible conduit shall be installed from the last rigid conduit to the equipment connection point per the NEC with external copper ground conductor where required. Seller to ensure if conduit is to be installed inside the combustion turbine compartments, appropriate high temp flex conduit is used.

A-7.31.12 Concrete encased duct banks shall be reinforced under roadways and other areas to withstand heavy Equipment forces (H-20 / HS-20 rated) over the duct during construction and operations. Reinforcement of duct banks is not required for areas that will not experience heavy loads during construction (e.g., cranes, heavy haul paths) and have sufficient cover (burial depth) such that the H-20 / H-S20 loading is not exceeded. Seller shall provide analysis demonstrating acceptable depth and loading acceptability for ductbanks which are not reinforced.

A-7.31.13 All duct banks terminating at manholes shall have a minimum slope of 0.25 percent and arranged to drain toward manholes.

A-7.31.14 Manholes and Handholes: Manholes and handholes shall be placed at distances that facilitate cable pulling without exceeding permissible tensions and/or side wall pressures. Sump areas shall be provided in each manhole, either in a corner or in the middle for a portable pump.

A-7.31.15 Conduits and duct banks shall be installed as required to complete the raceway system. Duct banks shall use bends with large radius sweeps to minimize pulling tensions. The main duct bank runs shall be designed with margin. Underground duct bank installation shall include one #4/0 AWG ground cable routed above or along the side, for connection to the grid at each end of the duct bank. At manhole locations these duct bank ground cables shall be tapped with minimum one #1/0 lead routed to the interior of the manhole. All underground connections shall be compression fittings (UL 467 listed).

A-7.31.16 Duct bank risers shall be hot dipped galvanized, rigid steel conduit, duct bank sweeps shall be fiberglass, and long radius 90's shall be used.

A-7.31.16.1.a. Seller shall provide all electrical conduit and fittings, built in, concealed or a part of the concrete work.

A-7.31.16.1.b. All conduits embedded in floors, walls, foundations, duct, etc., shall be PVC conduit. Bends and sweeps shall be fiberglass. Conduit stub ups shall be under the Equipment intended.

A-7.31.16.1.c. Conduit terminations to motors and equipment subject to vibration shall be made with flexible conduit and maximum of 6 feet length.

A-7.31.16.1.d. Conduit in hazardous areas shall be supplied with fittings and seals suitable for the hazard encountered.

A-7.32 HEAT TRACING

A-7.32.1 The Facility shall be designed to operate in freezing weather as defined below and to go through periods of freezing weather while shut down, without damage. The freeze protection system shall be designed to maintain fluid temperatures (in pipes, tubing, valves, vessels, etc.) at 40°F. Heat loss calculations will be based on an outdoor installation, per Attachment A-4 freeze protection temperature and wind requirements.

A-7.32.2 Freeze protection power will be supplied from motor control centers through dry type transformers to freeze protection distribution panels containing thermostatically controlled contactors. The contactor will energize the branch circuits within the freeze protection panel.

A-7.32.3 The heat tracing system shall consist of self-limiting resistance type or mineral insulated type cables when higher exposure temperature ratings are required.

A-7.32.4 When used for temperature control of a process, the heat trace system will be designed to maintain the process fluid at the desired temperature. Heat loss calculations will be based on the conditions of the specific installation.

A-7.32.5 All equipment shall be capable of being operated at ± 10 percent of rated voltage without damage.

A-7.32.6 The heat trace system shall be designed from off-the-shelf components to ensure availability.

A-7.32.7 Heat trace sensors.

A-7.32.7.1. Electric heat tracing for freeze protection shall be controlled by ambient air temperature sensors, each sensor shall energize the heat tracing circuits.

A-7.32.7.1.a. All instrument sensing lines, which upon loss of function can initiate a unit trip, runback, or are redundant, shall have freeze protection heat trace and shall have temperature monitoring using wired RTDs.

A-7.32.7.1.b. Monitoring RTDs shall be located within the portion of tubing that is field insulated and shall be placed on bare tubing opposite of the heat trace cable and away from process line to prevent influence from these heat sources.

A-7.32.7.1.c. Each freeze protection circuit using SR Cable shall include an end-of-circuit LED light to provide visual indication of circuit continuity. For MI cable the visual indication is located at the junction box.

A-7.32.7.1.d. Separate heat trace circuits shall be provided for sensing lines which upon loss of function can initiate a unit trip, runback, or are redundant.

A-7.32.7.2. Electric heat trace to maintain process piping temperatures shall be controlled by individual line sensing RTDs.

A-7.32.8 Electric heat tracing located on skid packages shall be the responsibility of the skid vendors. A feeder cable shall be provided by the Seller shall be connected to the vendor provided skid mounted junction box for heat tract power.

A-7.32.9 Heat Trace Panels and Alarms.

A-7.32.9.1. Heat trace circuits shall be designed for connection to 120 VAC, single phase, 60 Hertz Power. Power circuits shall be connected to obtain a balanced load on the three-phase power supply panels.

A-7.32.9.2. Heat Trace Panels shall be Smart Panels (Thermon Genesis or similar) with ability to monitor individual heat trace circuit current in real time and receive temperature monitoring signals from the protected/heated piping and process RTD signals.

A-7.32.9.3. Heat Trace panels shall have audible and visible alarms and shall transmit all monitored parameter information and alarm information to the DCS.

A-7.32.9.3.a. All temperature monitoring RTD signals shall be provided to the DCS via the Smart Panels. These RTDs shall provide input for multi-point alarms in the DCS including a low priority alarm set point of 38°F and a high priority alarm setpoint of 34°F.

A-7.32.9.3.b. DCS screens shall be developed to display temperature, current, etc. readings by heat trace panel.

A-7.32.9.3.c. Transmitter sensor temperatures shall be brought into the DCS screens and alarming shall include setpoints as described in this Attachment.

A-7.32.10 The installation of the heater shall not require the use of heat transfer cement or compounds in any form.

A-7.32.11 The heater shall be flexible (capable of bending and spiraling). It shall be jacketed with a material which will protect it from its working environment.

A-7.32.12 As-built Heat Tracing drawings shall show the approximate location of heaters, thermostats and any other equipment installed.

A-7.32.13 Drawings should include:

- Isometric drawings showing the heat tracing system over the piping layout.
- Layout drawings showing the physical position of the panels and transformers with approximate coordinates.
- Freeze protection circuit design and loading schedule including circuit numbering.
- Panel elementary wiring diagrams of the power, control, and alarm circuits.
- Panel outline and assembly drawings.
- General panel arrangement drawings.
- Equipment interconnection wiring diagrams.

A-7.32.14 Power supply to space heaters for instrument enclosures shall be supplied such that there is no thermostat control of the power source. The space heater thermostat shall be the only control thermostat.

A-7.32.15 Where heat trace circuits are installed at ground penetrations, the heat trace shall extend 12 inches below grade.

A-7.32.16 Refer to Attachment A-6 for insulation requirements for heat trace and freeze protection system.

A-7.33 CATHODIC PROTECTION

A-7.33.1 The system shall be reviewed and approved by the Buyer prior to installation, however, where dissimilar metals are in contact or close proximity and corrosion may occur through electrolytic action or differences in electrical potential, protection shall be afforded by electroplating, suitable gaskets, cathodic protection, or other means. Underground piping shall be electrically isolated from aboveground piping and other steel components to allow the underground piping to be cathodically protected. At a minimum isolation shall be achieved by installation of isolation flanges with insulating gaskets, bolt tubes, and washers.

A-7.33.2 The cathodic protection system shall control electrochemical corrosion on the external surfaces of designated metal piping buried in the earth, bottoms of above-ground, pad-mounted steel tanks, and interior surfaces of designed, steel water storage tanks. Additionally, Seller shall evaluate the need for cathodic protection for buried foundations and provide cathodic protection if so determined.

A-7.33.3 The cathodic protection system shall be designed and installed in accordance with the latest issue of NACE International and any applicable local or national Codes and Standards.

A-7.33.4 Chromium plated parts shall not be used in any damp or corrosive atmosphere.

A-7.33.5 All surfaces shall be adequately protected in transit, and any damage shall be renovated immediately on off-loading and on completion of erection. After cleaning and inspection but before the equipment leaves the Seller's works, the machined surfaces of steel and ironwork shall be covered with a preserving fluid or otherwise protected to the Buyer's satisfaction.

A-7.33.6 All external steel screw fixings shall be supplied in the hot dipped spun galvanized condition, stainless steel, or sherardized with passivation treatment.

A-7.33.7 It is the responsibility of the Seller to provide the permanent Facility cathodic protection system as soon as possible to prevent corrosion of installed piping during construction activities. Temporary cathodic may be provided with Buyer approval.

A-7.33.8 After the system is operational, it shall be verified by a final corrosion surveyor/inspector.

A-7.34 EMERGENCY DIESEL GENERATOR (EDG)

A-7.34.1 Codes and Standards:

A-7.34.1.1. NEMA MG 1, “Motors and Generators”

A-7.34.1.2. IEEE 115 – Test Procedures for Synchronous Machines

A-7.34.1.3. IEEE 126 – Recommended Specifications for Speed Governing of Internal Combustion Engine – Generator Units

A-7.34.1.4. NFPA 110 – Standards for Emergency and Standby Power Systems

A-7.34.2 General Requirements:

A-7.34.2.1. Seller shall furnish, deliver, and install complete and ready for operation an EDG and accessories. The system shall include, but not be limited to, the engine, generator, controllers, instrumentation, enclosures, alarms, tanks, panels, skids, other appurtenances and shall also include all wiring, bus work, raceway, and supports to connect the diesel generator system to a 480 V motor control center or switchgear.

A-7.34.2.2. The EDG shall be rated 480 volt, 3-phase, 0.8 pf, 60 Hz. The design rating of the diesel-generator shall be “standby” and shall be minimum 2000 kW, or as required by loading calculation. The Seller shall provide a diesel generator in accordance with the single line diagram and shall be operated in parallel with the grid for testing and sized with design margin. The EDG shall have a disconnect device for isolation/maintenance.

A-7.34.2.3. The EDG unit shall be capable of successfully operating at all loads, up to and including rated load, under the operating requirements, and 125 percent of rated load for 2 hours out of every 24 hours without adverse effect for the full range of power factors.

A-7.34.2.4. The EDG shall be capable of unattended remote, manual, and automatic starting. It shall reach full speed and be ready for loading in 10 seconds or less and pick up full rated load in not more than 30 seconds after it receives the start signal. The diesel-generator set shall be capable of continuous unattended operation at full load for a minimum period of 24 hours. The EDG shall be capable of being manually started as required.

A-7.34.2.5. Lube oil leak detector switches shall be provided on the EDG and fuel oil module.

A-7.34.2.6. Final ratings and operational philosophy shall be determined during detailed design with approval with the Buyer.

A-7.35 CALCULATIONS

A-7.35.1 Seller shall use the latest version of ETAP.

A-7.35.2 Calculations shall be performed for non-standard type tray and conduit supports to ensure they meet applicable codes, standard engineering practices, and provide appropriate safety margins.

A-7.35.3 Cable pull tension calculations shall be performed for conduits exceed 360 degrees of total bends or pulls in excess of 1000 feet.

A-7.36 ON-SITE STORAGE OF EQUIPMENT CARE

A-7.36.1 Seller shall provide to Buyer a procedure defining the preventative maintenance of equipment prior to installation. This procedure shall include process for tracking equipment maintenance logs such as rotating motor shafts, meggering motors, GSUs, providing space heaters. This procedure shall be submitted to Buyer for review and approval prior to any equipment deliveries to site.

A-7.36.2 Generators, motors, and other equipment requiring space heaters should be connected to temporary power. Also, when installed but before commissioned they should be connected to temporary power until final operation. Temporary power should be connected without the use of extension cords such that they are not easily unplugged by someone needing a receptacle to use.

END OF ATTACHMENT A-7

BOT Scope Book
Attachment A-8
Instrumentation and Control Requirements and Design Criteria

Table of Contents

Formatted: Font: Not Bold

Formatted: Header, Left

A-8.1 INTRODUCTION

A-8.1.1 The purpose of this document is to define the Project Design Criteria for instrumentation, including selection, installation, and testing.

A-8.2 Scope of supply

A-8.2.1 The Seller shall design, integrate, supply, factory test, pack and deliver to Project site, erect, install, and perform site calibration, testing, commissioning, operator training and provide drawings, operating and maintenance manuals for the instrumentation and control systems provided for the Facility. Any equipment from vendors/manufacturers which are not listed in the Approved Manufacturers List must be approved by the Buyer.

A-8.2.2 Balance of Plant (BOP) and overall plant control is implemented in the Emerson Ovation DCS. The plant DCS interfaces with the Turbine Control System (TCS) and other PLCs for supervisory control, monitoring, and status. The BOP DCS is not configured to mimic the turbine proprietary control functions or other functions of the turbines or equipment, including control duplication, alarm rationalization, and alarm acknowledgement capabilities. The Facility DCS shall be a redundant microprocessor-based system. The Seller shall identify how each of such control systems interfaces with the BOP Facility DCS, the Control Room operator interface and any local control panels. Any such equipment, not being directly controlled by the Facility DCS, shall have the proposed interfaces to the Facility DCS, the Control Room operator interface and local control panels reviewed and approved by Buyer.

A-8.2.2.1 Systems to be controlled directly by the Facility DCS shall include, but not be limited to, the following:

A-8.2.2.1.a Heat Recovery Steam Generator auxiliaries control

A-8.2.2.1.b Unit load control

A-8.2.2.1.c Steam bypass system

A-8.2.2.1.d Steam temperature control

A-8.2.2.1.e Feed water control

A-8.2.2.1.f Condensate control

A-8.2.2.1.g Cooling water systems

A-8.2.2.1.h Make up water control.

A-8.2.2.1.i Chemical injection control

A-8.2.2.1.j Selective catalytic converter and auxiliaries control

A-8.2.2.1.k Steam turbine auxiliaries not controlled directly by the steam turbine control system.

A-8.2.2.1.l Combustion turbine auxiliaries not controlled directly by the combustion turbine control system.

A-8.2.2.1.m Plant auxiliary power system

A-8.2.2.1.n Balance of plant equipment

A-8.2.2.2 The Combustion Turbine Generators and Steam Turbine Generator controls and monitoring screens (referred to as Turbine Controls, Turbine Control System, or TCS) shall be duplicated in the Facility DCS with limited functionality as agreed upon with Buyer. Two (2) individual dedicated HMIs shall be provided for the Turbine Controls in the Control Room. One (1) dedicated engineering workstation shall be provided for the Turbine Controls in the Control Room. The following systems shall be controlled by the Facility DCS in a supervisory mode through hardwired I/O and monitored with a data link:

A-8.2.2.2.a Steam turbine

A-8.2.2.2.b Combustion turbines

A-8.2.2.2.c Water treatment

A-8.2.2.2.d Air compressors

A-8.2.2.2.e Standby Diesel generator

A-8.2.2.2.f Electrical switchyard

A-8.2.2.2.g Skid mounted systems controlled by a PLC or dedicated controller as approved by Buyer.

A-8.2.2.2.h Generation Management System (GMS)

A-8.2.2.3 The systems listed below shall be interfaced to the Facility DCS through a data link for monitoring and alarming and shall be accessible from the BOP Facility DCS HMI. Each system shall be specified with a data link capable of using the Modbus protocol or other approved by Buyer. The data link shall be discussed during detail design stage.

A-8.2.2.3.a Continuous emissions monitoring System (CEMS) shall be connected to the plant Facility DCS through RS-232 or RS-485. The RS-232 or RS-485 can either be at the data loggers or the plant Facility DCS. CEMS shall require a communication protocol break. The Seller shall implement the agreed upon scheme for providing communication protocol break as required by Buyer.

A-8.2.2.3.b Protective relaying and metering

A-8.2.2.3.c Gas chromatograph and metering station

A-8.2.2.3.d Generator Step-Up and Unit Auxiliary ~~T~~transformers

A-8.2.3 The extent of supply described shall consist of, but not be limited to, the following:

A-8.2.3.1 Complete control hardware and software, instrumentation, monitoring, and alarm equipment packages for all plant equipment being supplied, including all local control, electrical room, and Control Room consoles, plus engineering consoles for all control systems.

A-8.2.3.2 A Facility DCS with remote drops, to provide centralized monitoring and control of all Facility systems from the Control Room including high resolution HMI screens, keyboards,

pointing device, printers, data storage devices, redundant data highway, uninterruptible power supply, interconnecting cables, software with full licenses and all associated hardware.

A-8.2.3.3 Equipment hardware and software interfaces between Facility DCS equipment and all control and instrumentation packages of individual Facility systems, such that all plant areas are integrated into one control scheme.

A-8.2.3.4 Redundant network communications links between the Facility DCS and all plant equipment control computer systems.

A-8.2.3.5 All instrumentation as described in the control system design requirements of this Attachment including pressure, differential pressure, temperature, level, flow using gauges, transmitters, switches, all associated instrument taps, tubing, pipework, valves, manifolds, thermowells, local panels and racks.

A-8.2.3.6 Instrumentation suitable for performance metering and monitoring, for the display and logging of actual and integrated plant parameters, and for the processing of data to produce calculated data such as individual unit efficiencies.

A-8.2.3.7 The DCS shall be designed to integrate analog input signals (as required) over time to produce totalized values for water flow, fuel flow, ammonia flow, and MW.

A-8.2.3.8 All hardwired signals and equipment for the plant's protection systems to ensure safe startup, operations, and shutdown in both normal and emergency situations.

A-8.2.3.9 The redundant master clock system shall be provided, for the purposes of synchronizing data acquisition, data logging, alarm and trip events, Facility DCS, TCS, CEMS, protective relays, etc., for all systems employed in such a manner on the Project site. The master clock system would be driven by a signal received from a global positioning satellite (GPS). The equipment shall be supplied with sufficient outputs of the correct type to meet the operating requirements of the Facility.

A-8.2.3.10 Factory acceptance testing and inspection of all systems.

A-8.2.3.11 Facility erection, installation, and commissioning.

A-8.3 NERC CIP – Physical Security and Cybersecurity

A-8.3.1 The Facility physical security shall include cameras, card readers, intercom, fencing, gates, etc.

A-8.3.1.1 The Buyer shall supply specifications of hardware and software during the Project design phase, as necessary for the Seller's detailed design.

A-8.3.1.2 The Buyer shall be responsible for the supply and installation of all cameras, intercom, cabling, and video security system servers and monitors required.

A-8.3.1.3 The Seller shall supply and install camera poles and foundations necessary to accommodate the security camera design.

A-8.3.1.4 The Buyer shall be responsible for the supply and installation of the badge readers, cabling, and security system servers and software required.

A-8.3.1.5 The Seller shall ensure that all buildings are equipped with the necessary power supply, conduit, fiber, and power wiring to facilitate the installation.

A-8.3.1.6 Attachment A-9 identifies security requirements (cameras, card readers, etc.) for building exterior and interior doors, respectively.

A-8.3.1.7 In addition to the cameras for doors and gates as described in the cross-referenced Attachments above, exterior cameras shall be strategically placed around the Facility to provide visual coverage of the entire perimeter and primary drive ways inside the Facility. Stationary cameras should be used to cover the perimeter and controllable pan tilt zoom cameras may be used on the interior of the Facility.

A-8.3.1.8 All security devices, badge readers, electronic lock, door sounders and cameras, shall be powered by the UPS power system.

A-8.3.2 This Attachment covers the security requirements associated with physical and cyber security for the Project. The equipment shall be designed to comply with all physical and cyber related security policies, standards, requirements, and procedures as outlined herein.

The design will comply with the latest North American Electric Reliability Corporation (NERC) Critical Infrastructure Protection (CIP) standards.

A-8.3.2.1 External vendor access to control systems, for example, packaged systems supplied with a PLC control system (compressors, water treatment, etc.), shall be prohibited, unless approved by Buyer.

A-8.4 Instrumentation & Control System Requirements

A-8.4.1 The following sections describe the technical requirements for the design, supply and installation of the instrumentation and control (I&C) system and equipment necessary to allow the safe, reliable, and efficient operating conditions at the plant site.

A-8.4.2 Basis of Design

A-8.4.2.1 Instrument and control devices shall be provided to monitor and control process variables and to protect supplied systems and equipment. This shall include, but not be limited to, primary elements, transmitters, temperature sensors, flow meters, control valves, control drive units, temperature/pressure/vibration switches, and other instrumentation or controls required to make a complete system.

A-8.4.2.2 Instruments, controls, and associated items will be fit for purpose i.e., suitable for the application given the functional requirements, process conditions, environmental conditions, and hazards. Instruments will be protected from extremes of temperature and other adverse conditions.

A-8.4.2.3 Instrument, control, and sampling tubing systems will be designed, fabricated, and tested in accordance with ASME B31.1.

A-8.4.2.4 Local self-acting controllers or pneumatic controllers may be used for simple applications where no regular operator intervention is required. Field and local panel-mounted controllers for applications except displacement-type level instruments and blind pressure controllers will be of the indicating type.

A-8.4.2.5 Instrument wetted parts will be compatible with the fluid to which they are exposed.

A-8.4.2.6 Emergency stop devices shall be provided where deemed necessary. When emergency stops are specified, they shall be provided in accordance with NFPA 79. Emergency stop switches shall have means to prevent accidental operation, such as clear plastic/Lexan covers or pushbutton guards. Main Control Room emergency stop pushbuttons shall include, but not be limited to, the following:

A-8.4.2.6.a CT(s) Emergency Stop

A-8.4.2.6.b ST Emergency Stop

A-8.4.2.6.c Fuel Gas Emergency Stop (one pushbutton to shut main fuel trip valve(s))

A-8.4.2.7 Process transmitter inputs shall be provided with sufficient redundancy such that failure of any single instrument will not reduce Project load or shut down the Project. A single transmitter input is provided for process monitoring and non-critical controls. Dual transmitter inputs with average or single input selection are provided for controls which are required to maintain Project output. Three transmitter inputs with median, average, or single input selection are provided for controls which are required to prevent Project shutdown.

A-8.4.2.8 Redundancy of control instruments should be provided as follows:

A-8.4.2.8.a For situations where codes require direct initiation of a plant shutdown upon input failure, three independent measurement inputs will be provided for process control and alarm. These situations are to be identified during initial P&ID development.

A-8.4.2.8.b For situations where plant generation is directly reduced upon input failure, two independent measurement inputs will be provided for process control and alarm. These situations are to be identified during initial P&ID development.

A-8.4.2.8.c Non-critical parameters may utilize single process measurements.

A-8.4.2.8.d Additional required trip inputs will be documented during initial P&ID review.

A-8.4.2.8.e First out trips shall be captured in DCS historian or TCS historian (If available).

A-8.4.3 The control system shall be based upon a Facility DCS that has redundant controllers and redundant network communications as described herein. All functions shall be performed via the Facility DCS display screens with the minimum of conventional hard panel controls and displays. Therefore, other than emergency stop buttons, there will be no conventional hard panel controls, alarm panels, or paper chart recorders for operation of the plant. All plant operation and plant history (alarm records, alarm reports, sequence of events etc.) shall be through the Facility DCS with, if necessary, hard copy reports from the Facility DCS printers.

A-8.4.4 A consistent control, instrumentation and data acquisition philosophy shall be applied. The objective shall be to standardize all equipment, wherever possible, throughout the plant in order to simplify operation, maintenance and reduce spare parts.

A-8.4.5 The Facility shall include semi-automatic start-up sequencing with manual override programmed in the Facility DCS. Once the CTG has started, the Operating Facility DCS

shall manage the start-up of the HRSG, including venting and draining requirements, drum-level control, and steam system initial set points and ramping of these set points to facilitate starting the Steam Turbine Generator (STG). This shall include managing the steam turbine bypass systems, managing steam temperature, and establishing condenser vacuum. Once all STG permissives are met, the STG shall be started.

A-8.4.6 The operating staff of the Facility will be kept to a minimum. Therefore, a high level of automation and reliability is required.

A-8.4.7 The main objectives of the control and instrumentation scheme shall be as follows:

A-8.4.7.1 To provide safe, efficient, and reliable operation of the Facility in accordance with all applicable codes and standards.

A-8.4.7.2 To give a high level of automatic control incorporating synchronizing, ramp loading, unloading, start-up and shutdown to minimize operator manning levels.

A-8.4.7.3 To reduce start-up and shutdown sequence times to an optimum using thermal stress management.

A-8.4.7.4 To provide facilities for comprehensive monitoring, storage and presentation of information concerning plant conditions and performance with dedicated systems for sequence of events, energy management and plant data history.

A-8.4.7.5 To standardize instrumentation and control equipment where practicable to reduce spare parts requirements.

A-8.4.7.6 To eliminate unnecessary interfaces.

A-8.4.7.7 To minimize installation, testing and commissioning time.

A-8.4.7.8 To minimize maintenance downtime.

A-8.4.7.9 To minimize staff training requirements.

A-8.4.8 The control system will provide safe shutdown of the Facility systems and equipment in the event of a Facility DCS failure. Fail-close, fail-open, and fail-in-place lock-up features, for all devices as required, upon loss of air or signal will be provided as appropriate for the application.

A-8.4.9 The Facility DCS and local controls shall be designed such that operation of plant equipment shall not be possible from local and remote control units simultaneously. The DCS shall display the local/remote control status of the equipment.

A-8.4.10 The controls associated with each of the main plant equipment or components shall be physically and electrically segregated to minimize common mode failure and possible fault transfer from one area to another.

A-8.4.11 The manufacturers' standard package of control and instrumentation shall be supplied for all Equipment where the package meets the requirements of this specification. Protection systems for the STG and CTG shall be redundant and use two-out-of-three majority voting for I/O and shall be independent of the control system for that plant equipment. The control and instrumentation package shall allow automatic control facilities for the plant and auxiliaries, including safety interlocks, emergency tripping, process control, alarm

equipment and local instrumentation. The control and instrumentation package shall be designed and manufactured to enable the equipment to be interfaced with the Facility DCS to allow centralized control and monitoring.

A-8.4.12 Any control system failure shall not drive the plant into an unsafe state or require immediate operator action to avoid plant damage or hazards to personnel.

A-8.4.13 The failsafe condition shall be set for all discrete I/O.

A-8.4.14 Fully open/closed limit switches shall be provided when required for control sequence purposes.

A-8.4.15 When local manual controls are provided as part of an OEM standard (e.g., actuators, drives, self-contained skids) the status of the control selection (local or remote) shall be transmitted via the Facility DCS to the Control Room in order to inform the operator and to inhibit the automatic control and sequence programs, where appropriate.

A-8.4.16 Profibus, Foundation Fieldbus, and wireless communications/protocols shall not be installed on instruments and valves required for control.

A-8.4.17 Local instrumentation and indication shall also be provided where necessary for test and commissioning purposes and where intermittent, local supervision is required. Interlock and safety protection for all drives shall be implemented at the drive level for individual plant equipment.

A-8.4.18 Unit protection shall be independently implemented in separate hardware to the control system(s) to avoid common mode failure and with appropriate redundancy to ensure security of operation. The Unit Equipment shall have separate protection systems, designed and installed to the manufacturer's standard. The main inter-tripping functions between the steam turbine-generator, HRSG and combustion turbine-generator will be implemented via the Unit protection (e.g., lock out relays).

A-8.4.19 Permissive interlocks shall be active at all levels to prevent incorrect operation of the plant and to ensure safe, reliable operation. Interlocks shall be capable of being tested with the plant in operation, where possible excluding TCS. The protection and interlocks systems shall incorporate comprehensive diagnostics to plant input level and shall be visible during the plant start-up and shut-down sequences via the Facility DCS displays for troubleshooting purposes. First-out screens shall be developed for all trips for each CTG, HRSG, and the STG.

A-8.4.20 All control systems shall operate satisfactorily for the environment which it is installed. All control devices and components shall be heavy-duty type suitable for operation at nominal 120 VAC or 125 VDC (see Attachment A-7 for detailed DC voltage requirements). Insulation of coils shall permit continuous operation at a temperature of 130°C.

A-8.4.21 Contacts for external control circuits shall be heavy-duty type. The contacts shall have an AC interrupting capacity of ten times their normal rating and shall not exhibit excessive arcing or contact bounce. Relays with exposed contacts shall not be used.

A-8.4.22 Mercury encapsulated switches shall not be used.

A-8.4.23 All control systems power and grounding systems shall be per the manufacturer's installation instructions and shall comply with all applicable standards listed in this

specification. The Project site has unique grounding issues as described in Attachment A-06.

A-8.5 Facility distributed control system (DCS)

A-8.5.1 A fully integrated Facility DCS shall be an Emerson Ovation system with an Embedded Simulation system (Digital Twin). The Emerson Ovation DCS shall be supplied to monitor, control, display, alarm and record the process and electrical parameters associated with all plant control systems and areas. To ensure that a common and integrated approach across the entire Facility is achieved, the Facility DCS system design shall be coordinated through a single point of contact within the Seller's organization.

A-8.5.2 Facility DCS Hardware

A-8.5.2.1 The Facility DCS shall be provided with spare capacity, (in percentage of total capacity) after factory acceptance test (FAT) and prior to shipment to Project site as follows:

A-8.5.2.1.a Control Processors: 50% of total processing capacity per module

A-8.5.2.1.b Power Supplies: 25% of full capacity for the rack

A-8.5.2.1.c Cabinet Spare Rack Slots: 20%

A-8.5.2.1.d I/O: 20% by wired I/O type at each I/O and remote I/O location.

A-8.5.2.1.e System Communications: 70% (maximum design throughput 30%)

A-8.5.2.2 All workstations, HMIs, engineering stations, historians, etc. shall be rack mounted server class machines with KVM extenders or thinclients, to allow the keyboards, monitors, and mice to be located elsewhere in the room. The supplied DCS system shall also be provided with control room speakers to provide the ability for audible alarms.

A-8.5.2.3 Communication Network

A-8.5.2.3.a Communications between the Facility DCS drops, located in different plant areas, and the operator and engineer workstations located in the Control Room shall be performed over a redundant high-speed fiber optic data highway with redundant communication hardware (see Attachment A-7). The communications system shall be designed to perform at the speed necessary to ensure that all variables are updated, and control commands are issued without loss of system performance under all circumstances, (e.g., major plant transients and alarm flooding, etc.). The communications system shall include all control equipment, redundant controllers, redundant data highways, error detection correction facilities and cabling. Controllers (primary and back-up) shall connect to each redundant data highway.

A-8.5.2.3.b The Facility DCS shall include all equipment and software for a redundant data communications link between the Facility DCS and all other plant control system interfaces. All information on the Facility DCS shall be addressable, using the tag identifier, from any drop and shall include the large-scale block transfer of analog and digital parameters extracted or derived by calculation from the parameters in the Facility DCS database. The equipment shall include the Facility DCS communications port, both local and remote routers and cabling at the Facility. All necessary software shall be provided, for example communications protocol, data compression, error detection and data display application software for use on the interface control systems.

A-8.5.2.3.c The communication hardware shall have automatic loop transfer capability to provide protection against a single loop failure. Loss of either data-highway loop shall be alarmed. No single equipment failure shall interrupt communications between subsystems. Comprehensive system diagnostics shall be incorporated to assist in maintenance and troubleshooting. These shall include, but not be limited to, continuous monitoring of the redundant data highway. The occurrence of a fault condition shall be indicated to the operator together with details of the cause and location of the fault down to card level. The Facility DCS communication cards and cables shall be replaceable without causing a Unit shutdown.

A-8.5.2.3.d The redundant data highways must be physically separated from each other (see Attachment A-7).

A-8.5.2.3.e Communication networking to the switchyard shall be fiber-optic cable.

A-8.5.2.3.f All Controllers, both Primary and Backup, all HMI workstations, all servers, and any other special PC or processor shall have two (2) network connections with unique IP addressability.

A-8.5.2.4 Processors and Cabinets

A-8.5.2.4.a The Facility DCS shall be divided into subsystems. The number of subsystems shall be agreed to by the Buyer and the Seller. The logic hardware for each subsystem shall be independent from the other subsystems. Critical control and safety-related communications between subsystems shall be by hardwired I/O. Redundant processors shall be provided for each subsystem and its control I/O.

A-8.5.2.4.b The system shall be designed to have a functionally and geographically distributed architecture utilizing several independent Facility DCS drops. The equipment located in the Facility DCS cabinets shall include all necessary control processors, I/O cards, power supplies, data highway interfaces, marshalling and termination facilities etc. The control processors shall be capable of autonomous operation and perform all necessary data acquisition, calculation and open/closed loop control functions.

A-8.5.2.4.c All necessary hardware for marshalling and terminating incoming/outgoing plant cabling shall be provided, including gland plates, glands, terminal blocks, barriers, isolation devices, labeling and wiring. All equipment shall be designed to operate in hazardous areas where necessary.

A-8.5.2.4.d Cabinets in dedicated electrical rooms shall be capable of both top and bottom cable entry. Cable entry into system cabinets located outside dedicated electrical rooms shall be through the bottom. Cable supports shall be provided in each cabinet. Cables shall not block access to any cabinet hardware for equipment inspection, maintenance, or removal and replacement.

A-8.5.2.4.e The maximum scan time for digital signals shall be 100 milliseconds and 250 milliseconds for analog signals.

A-8.5.2.4.f Comprehensive system diagnostics shall be incorporated to assist in maintenance and troubleshooting. These shall include, but not be limited to, continuous monitoring of memory and control processors. The occurrence of a fault condition shall be indicated to the operator together with details of the cause and location of the fault down to card level.

A-8.5.2.4.g Facility DCS processors (redundant) shall be replaceable without causing a Unit shutdown, and it shall be possible to modify and download configuration changes on line, ensuring that necessary QA procedures are in place.

A-8.5.2.4.h A high temperature alarm for each Facility DCS cabinet including controller cabinets and I/O cabinets shall be provided and displayed on the console HMIs.

A-8.5.2.5 Facility DCS Inputs and Outputs (I/O)

A-8.5.2.5.a Comprehensive system diagnostics shall be incorporated to assist in maintenance and troubleshooting. These shall include, but not be limited to, continuous monitoring of the input and output modules. The occurrence of a fault condition shall be indicated to the operator together with details of the cause and location of the fault down to card level. Facility DCS cards shall be replaceable without causing a Unit shutdown.

A-8.5.2.5.b The Facility DCS shall have a sequence of events (SOE) input module monitoring capability to allow analysis of the causes of trips or plant disturbances. The SOE shall scan all operated designated digital inputs continuously with a resolution of one millisecond. The Facility DCS shall provide scanning of no less than 200 digital (contact) inputs for the sequential of events recording (SOE) system. These inputs shall be scanned to discriminate between contact operations which occur a minimum of one millisecond apart and print them in their proper sequence when they are opening and closing.

A-8.5.2.5.c Where redundancy is required for primary/standby drives or systems, the I/O shall be segregated such that no control card or cable failure shall affect both drives. All redundant inputs shall be on separate cards. For example, HRSG drum level transmitters and steam temperature trip instrumentation shall be triplicated with inputs brought into three (3) different I/O modules for integrity. Median select for analog signals and two-out-of-three logic for digital signals shall be used in the BOP Facility DCS for these instruments.

A-8.5.2.5.d Inputs, outputs, and other connections shall meet the surge withstand requirements of ANSI C37.90a. The Subcontractor shall provide devices that have input to output isolation and state any shielding, separation of circuits, surge suppression or other measures which may be required in Facility Equipment and wiring to meet these provisions.

A-8.5.2.5.e For the Facility DCS I/O, compression type terminations shall be acceptable. Spring type termination is not acceptable. Excluding thermocouples, all I/O cables at the field end shall be terminated using crimped-on, ring-tongue lugs except where (per manufacturer standard) it is not feasible to use ring-tongue lugs. No more than one wire shall be connected to one terminal, except where jumper wires are necessary.

A-8.5.2.6 Control of Starters, Motor Operated Valves, and Solenoid Valves

A-8.5.2.6.a Switchgear contactors with multifunctional protective relays shall have datalinks to the Facility DCS for data acquisition of operating parameters and status. Devices shall be networked together as appropriate by device type and location to Facility DCS interfaces. Data included in the links shall be at a minimum:

A-8.5.2.6.b Open, closed, and trip power status, relay status, tripped status, phase voltage, phase current, watts, vars, trip coil status, and heartbeat signal to confirm communication.

A-8.5.2.6.c Switchgear Motors and Breakers (if necessary) shall have the following hard wired I/O: DI: Stopped/Opened, Running/Closed, Trip Power Available, Close Power Available, DO: Stop/Trip, Start/Close

A-8.5.2.6.d Motor Control Center (MCC) Starters and Contactors shall have the following hard wired I/O: DI: Running, Stopped, Power available, DO: Start

A-8.5.2.6.e Motor Operated Valves shall have the following hard wired I/O: DI: Not Full Open, Not Full Closed, Torque Switch Open, Torque Switch Closed, Power available/no overload, DO: Open, Close

A-8.5.2.6.f Solenoid Operated Valves shall have the following hard wired I/O: DI: Full Open, Full Closed, Power available, DO: Open (energize to open only) or Close (energize to close only)

A-8.5.2.7 Facility DCS Power

A-8.5.2.7.a Two sources of power shall be supplied to the Facility DCS, its servers (HMIs), monitors, etc. terminated in its cabinets or consoles. The primary source shall be 120 VAC from a UPS. The secondary source shall be from a 120 VAC source independent from the primary source. Automatic transfer power switches shall be installed in the cabinets for equipment without dual power feeds. The main control workstations and engineering workstations shall have automatic transfer power switches with these two sources of power feeding them.

A-8.5.2.7.b Failure of a Facility DCS power supply shall not affect system operation. Failure of any power supply shall be alarmed on the Control Room DCS HMI. Facility maintenance personnel shall be capable of replacing power supplies with the system on-line. DCS power supplies shall be redundant. Comprehensive system diagnostics shall be incorporated to assist in maintenance and troubleshooting.

A-8.5.2.8 Workstation and Human Machine Interface (HMI)

A-8.5.2.8.a The Control Room shall have the Facility DCS operator HMIs, located on a control console/desk. The console/desk shall be as approved by the Buyer. The three (3) operator HMIs shall have quad, 24 inch (minimum) state-of-the-art, high-resolution LCD or LED displays, with keyboard and mouse, and shall allow monitoring, control and adjustment of Facility operation conditions. The large screen 75-inch (minimum) LCD or LED monitor shall be provided and mounted from the ceiling in the Control Room. The rack mounted servers associated with each HMI will be located in the adjacent DCS Network Room to reduce heat load and noise in the Control Room.

A-8.5.2.8.b The Control Room shall contain the Facility DCS Engineering workstations on the engineering console/desk. The two (2) engineering workstations shall include: dual high resolution 24-inch (minimum) LCD or LED screens, keyboards and mice, and a program loading mechanism. These workstations shall provide the interface between the engineer and the plant processes and equipment for control system tuning and control strategy modifications.

A-8.5.2.8.c The Facility DCS shall include an Enterprise Data Server, Database Server, and Asset Management Suite (AMS) workstations on the engineering console/desk. Each of these servers shall be provided with one high resolution 24-inch (minimum) LCD or LED screen

except the AMS server which shall be provided with two (2) high resolution 24-inch (minimum) LCD or LED screens. All these rack mounted servers shall be provided with keyboards and mice.

A-8.5.2.8.d The AMS system software license (with ValveLink SNAP-ON) shall be licensed for up to 400 AMS Devices and 100 ValveLink Devices.

A-8.5.2.8.e The Seller shall solicit and use the Buyer's input on the design, configuration and materials of the control panels, shape and form of consoles/desks and other equipment in the Control Room.

A-8.5.2.8.f The response times for the operator workstation under all operating conditions (i.e., transients and alarm flooding) shall be as follows, irrespective of the Facility DCS size and loading:

A-8.5.2.8.f.1 The time between selection and display of a new HMI screen, fully updated, from the database shall not exceed two (2) seconds. The time between execution of a control function on an operator workstation and the command reaching the output terminations of the field processor shall not exceed one (1) second. The time between the occurrence or change of signal at the field processor and the change of state/value/alarm on the HMI shall not exceed one (1) second.

A-8.5.2.8.g A control panel shall be provided and integrated into the console/desk for fuel gas, CTG, and STG trip push buttons, and other hard wired operator interface instruments as required by code and this specification. The Buyer will specify the location of the remote drum level indicators.

A-8.5.2.9 Printers

A-8.5.2.9.a The Facility DCS Subcontractor shall provide two (2) network multi-tray color laser-jet printers capable of 8 ½" x 11" paper in one tray and 11" x 17" paper in one tray.

A-8.5.2.10 Data Historian, Historical Storage Retrieval (HSR)

A-8.5.2.10.a The purpose of the HSR system shall be to have available detailed information at long intervals, after events have occurred. The HSR shall have the capability to provide two (2) years of on-line access with user-friendly backup. All alarms and returns-to-normal shall be stored, as shall all logs, and all trended variables that are identified for archiving. The HSR shall be furnished with a server class machine, redundant power supplies, hot-swap disk capability, RAID disk arrays, at least 2 TB of storage, and a DVD writer for backups and archival purposes. The HSR system shall be furnished with two – 24" (minimum) LCD or LED monitors, keyboard, mouse, and shall be capable of storing at least 20,000 points.

A-8.5.2.10.b All I/O values, feedback signals, calculated and composed point values, and control loop process variables, setpoints, and outputs shall be archived at a minimum.

A-8.5.2.10.c The historian shall be completed and configured at the plant site before the unit startup.

A-8.5.2.10.d The system shall inform the operator or Facility engineer when the storage media is a stated percentage full and needs to be changed, and if an invalid device has been mounted. The HSR functions shall run in parallel, independent of all other software functions.

A-8.5.2.11 Control System Interfaces

A-8.5.2.11.a The Facility DCS will provide the required hardware and software to bring all plant control system packages into one operator interface scheme. The control system interfaces shall include, but are not limited to, the interfaces as listed in this Attachment A-8.2.2.The operator shall have supervisory control and the ability to monitor and control these interfaced systems from the Facility DCS consoles in the Control Room.

A-8.5.2.11.b The Facility DCS shall be connected to every other plant control system that has a redundant communication network. Supervisory control from the Facility DCS will be performed on all plant control systems. In addition, all supervisory control interfaces with plant control systems shall be hardwired to the BOP Facility DCS, as required.

A-8.5.2.11.c The Facility DCS shall also receive inputs from the TCS for bearing temperatures, bearing shaft vibration, differential expansion, eccentricity, thrust position, temperatures, pressures, flows, switches, etc. through the data link. The inputs shall be monitored, trended, alarmed, logged, and displayed on the BOP HMI. Balance of Plant (BOP) and overall plant control is implemented in the DCS. The plant DCS datalinks interface with the TCS controllers and other PLCs for monitoring and status only. The BOP DCS is not configured to mimic the turbine proprietary control functions or other functions of the turbines or equipment, including graphics and control duplication, alarm rationalization, or alarm acknowledgement capabilities.

A-8.5.2.11.d The Seller shall provide sufficient automatic and manual control capability for CTG and STG speed, generator voltage, megawatts, VARs, and excitation such that operators can control the Facility from the Facility DCS control console.

A-8.5.2.11.e The Seller shall supply OSIsoft Plant Information (PI) system software.

A-8.5.2.11.f Automatic Generation Control (AGC)

A-8.5.2.11.f.1 The AGC load demand signal shall be received by plant Facility DCS through a Remote Terminal Unit (RTU). RTU shall be SEL model. The plant Facility DCS shall generate CTG's load demand signals for each CTG.

A-8.5.2.11.f.2 RTU shall be the interface point between the transmission grid and the Facility. The Facility DCS connection to RTU shall be RS-232 or RS-485 to comply with Buyer's CIP requirements. Communication protocol shall be dictated by the Buyer.

A-8.5.2.11.f.3 In addition, telecom circuits shall also interface with the RTU.

A-8.5.2.11.f.4 The RTU interface details shall be provided during the detail design stage.

A-8.5.2.12 Control System Fault Tolerance

A-8.5.2.12.a No single component failure shall cause or prevent a CTG or STG trip, regardless of function or system (i.e., power, communication, processing, input/output devices, terminations, etc.). All instruments used for control shall be redundant and all signals and instruments used for tripping shall be triply redundant. Any single component should be replaceable for maintenance purposes without causing or preventing a CTG or STG trip, regardless of function or system. Output signals used for modulating control valves and solenoid operated valves, are impractical to make redundant and are excluded from the requirements of this Attachment.

A-8.5.2.12.b The Facility DCS shall include redundant control processors, redundant data highway and redundant power supplies with automatic changeover to the standby unit upon detection of a fault or failure of the operating Unit.

A-8.5.2.13 Embedded Simulator (Digital Twin)

A-8.5.2.13.a The Facility DCS shall include a high-fidelity simulation system using embedded Ovation-based models. The Emerson Ovation Digital Twin Embedded Simulator shall be a combination of physical models, empirical models, and simplified models.

A-8.5.2.13.b The Embedded Simulator shall be supplied complete with the appropriate server, management workstation, network switches, color printer, three (3) dual 24" screen thin client workstations, and two (2) quad 24" screen thin client workstations, at a minimum.

A-8.5.2.13.b.1 In addition to this hardware, the simulator shall include virtual machines to function as the database server, domain controller, engineering station, virtual controller host, operator workstation, model server, instructor station, and anti-virus workstation. All applicable software licenses shall be provided to the Buyer.

A-8.5.2.13.c Additional instrumentation for the sole purpose of the digital twin is not required.

A-8.5.3 Facility DCS Software

A-8.5.3.1 The Facility DCS shall include the following major software components, in the latest versions supplied by the Facility DCS Subcontractor:

A-8.5.3.1.a High level regulatory control-oriented languages for control and monitoring function development, with full documenting and printing capabilities.

A-8.5.3.1.b High level Boolean diagram-oriented language for development of discrete control logic functions with full documenting and printing capabilities.

A-8.5.3.1.c High level graphic generation language for HMI graphic display development, with full documenting and printing capabilities.

A-8.5.3.1.d High level log generation language for development of log report formats.

A-8.5.3.1.e All software to provide the functions described and control, communications, and scheduling within the Facility DCS.

A-8.5.3.1.f System database for identification of all process and calculated variables and for definition of the system attributes associated with each variable.

A-8.5.3.1.g Windows based operator/engineering consoles.

A-8.5.3.1.h Microsoft Excel on the engineering consoles.

A-8.5.3.1.i Performance and optimization software based on the plant thermodynamic model for use in the unit start-up.

A-8.5.3.1.j Anti-virus software.

A-8.5.3.2 Configuration

A-8.5.3.2.a The Facility DCS configuration shall be designed to control by feed-forward action, with system calibration and final correction provided by feedback action. The control equipment furnished shall include all feed-forward devices and other equipment to provide complete stability under all conditions of dynamic steam load changes. Feed-forward demands shall be developed for CTG demand, feedwater flow, fuel flow, steam pressure.

A-8.5.3.2.b The following operational sequences for the plant shall be fully automated through synchronization. Agreed "Hold" points for operator intervention shall be clearly defined:

A-8.5.3.2.b.1 CTG start-ups through synchronization

A-8.5.3.2.b.2 STG start-ups through synchronization

A-8.5.3.2.c The Facility DCS shall be capable of:

A-8.5.3.2.c.1 Providing automatic and manual control of individual drives, such as a pump, motor operated valve, solenoid valve, etc., and systems with bump less transfer (manual-auto-manual).

A-8.5.3.2.c.2 Automatic start-up including permissive checks at the individual drive level.

A-8.5.3.2.c.3 Sequencing a group of drives to an optimized program of plant operation.

A-8.5.3.2.c.4 Sequencing functional groups to provide full automatic plant operation.

A-8.5.3.2.c.5 Coordinated load control of all generation including frequency response and MVAR control. The load range shall be maximized down to the Lowest Sustainable Limit (LSL) while maintaining emissions within the environmental requirements.

A-8.5.3.2.c.6 Automatic speed and load control.

A-8.5.3.2.c.7 Automatic steam temperature control.

A-8.5.3.2.c.8 Automatic sequencing of setpoints for the steam bypass system pressure control.

A-8.5.3.2.d The operator interface software shall enable the operator to carry out the necessary actions in a safe and efficient manner. At minimum, the following are included aspects:

A-8.5.3.2.d.1 Software structured in such a way to provide a hierarchy of control from automatic sequential plant start-up through to manual control of an individual piece of equipment.

A-8.5.3.2.d.2 All software and hardwired permissives and overrides shall be indicated and visible to the operator during manual intervention by the operator (sequence initiation and individual device control under normal and failure conditions).

A-8.5.3.2.d.3 Where process measurements have been duplicated into the Facility DCS for improved reliability, the signals shall be averaged (for two signals) or median selected (for three signals) for control purposes and quality monitoring shall be employed to automatically switch from the median to the average, or to the remaining good signal in the event of an interruption. In addition, the maximum of two or the minimum of two signals may be selected in place of the average, where appropriate.

A-8.5.3.2.d.4 The operator shall have the on-screen ability to select any of the redundant signals, or the average or median (as appropriate), as the measured variable for control.

A-8.5.3.2.e Mechanical equipment on standby status shall automatically start upon a trip of the operating equipment.

A-8.5.3.3 Graphics

A-8.5.3.3.a The Emerson Ovation graphics displays for use by the operators on the HMIs shall be developed in accordance with the Vendor's High Performance or Advanced Operator Graphics format.

A-8.5.3.3.b Graphics shall be a combination of animated P&ID symbols, text, pop up face plates, bar graphs and trend graphs.

A-8.5.3.3.b.1 Face plates include manual/auto stations, set point stations, start/stop controls, and permissive and interlock displays.

A-8.5.3.3.b.2 Animated P&ID graphics shall include valves that change color and fill as they open or close, tanks with changing levels, process lines that change color when active or energized, and single line diagrams for auxiliary power monitoring and control that change color when energized.

A-8.5.3.3.c Graphic sketches shall be supplied for the Buyer's review and comment before they are configured. As a result of the Buyers comments, all system I/O and calculated values shall be subject to be displayed on graphics without additional cost to the Buyer. Graphic displays shall be subject to approval by the Buyer. Approximately two hundred (200) graphic displays will be required (Annunciation displays are not included in this display count). All graphics, alarms, and trending points shall be labeled according to its' specific process application.

A-8.5.3.3.d In addition, the Seller shall configure up to 10 Buyer-defined graphics.

A-8.5.3.3.e Graphics colors shall be used consistently throughout all graphics. The following minimum standards shall apply:

A-8.5.3.3.e.1 Green shall depict valves closed and electrical drives (circuit breakers, contactors, switches, etc.) open, off, or de-energized.

A-8.5.3.3.e.2 Red shall depict valves open and electrical drives closed, on, or energized.

A-8.5.3.3.e.3 Yellow or Amber shall be used exclusively for an alarm state. The alarm color shall not be used for any other function or graphic.

A-8.5.3.3.e.4 White or cyan shall be used for changing process values.

A-8.5.3.3.e.5 The remaining color shall be used for text that does not change.

A-8.5.3.3.f All drives and remotely controlled valves shall have their positions displayed and confirmed on the operator interfaces.

A-8.5.3.3.g Facility DCS controlled regulating valves shall provide actual position indication in "percent open" to the operator in the CR.

A-8.5.3.3.h The operator shall have the ability to tag out equipment (fans, pumps, valves, dampers, etc.) from the HMIs for work performed by maintenance personnel. When a piece of equipment is tagged out by the operator, the operation of that device by the control system shall be inhibited. The graphics displays shall indicate when a device is tagged out.

A-8.5.3.3.i The operator shall have the ability to present real-time and recall data held in the data logger memory or from archives by specifying the time period of interest. The information requested may be presented on the operator workstations either in tabular form or as selected variables on a trend display. Multiple trends of real-time or historical data from the data logger or archives shall be possible to compare on the same display.

A-8.5.3.3.j All graphics shall have their name displayed on the graphics.

A-8.5.3.3.k A logical hierarchy shall be developed by the Seller to aid in navigating from graphic to graphic.

A-8.5.3.4 Alarm Management

A-8.5.3.4.a To facilitate efficient operator interface for the entire combined cycle plant, there shall be a comprehensive alarm management policy to avoid alarm flooding and to ensure that non-critical alarms are grouped to cover an area of plant for display on the Facility DCS monitors and shall be restricted to conditions that only require advisory for information to the operators. All critical alarms for each area of plant that require immediate operator action shall be individually displayed on the Facility DCS. Alarms shall also be provided to meet the requirements of all applicable Fire Protection Codes.

A-8.5.3.4.b Each of the major control systems (TCS and DCS) shall utilize its vendor's standard alarm management system.

A-8.5.3.4.c A hierarchical alarm system shall be implemented with several priorities of alarms. All alarms shall be displayed. Clicking on an alarm on the alarm screen will change the display to the detail of the equipment that is the source of the problem. The system shall have five alarm priorities defined as follows:

Priority Level	Priority Definition	Alarm Definition
Level 1	Critical alarm (Major equipment/unit trip and safety related) and environmental alarms. Alarm will be recorded in the Historian.	– Immediate operator action required to prevent plant shutdown or human health/safety problem. – Eminent boiler/HRSG trip condition. – Eminent combustion turbine trip condition. – Eminent steam turbine trip condition. – Primary and back-up device tripped (loss of capacity).

Priority Level	Priority Definition	Alarm Definition
Level 2	Critical process/equipment alarms (alarms on process/equipment relevant to a managed shutdown). Alarm will be recorded in the Historian.	– Immediate operator action required to prevent activation of safety or process critical interlock. Operator action will prevent unit shutdown or escalation of process upset. – Major control loop rejected to manual. – Condition resulting in unit runback. – Condition resulting in unit rundown.
Level 3	Essential and non-essential process/equipment alarms (alarms on equipment necessary for operation, but not necessary for a managed shutdown). Alarms will be recorded in the Historian.	– Operator action required in excess of 7 minutes. (Fast operator action not required, but the operator is required to perform some action as part of his normal task) – Maintenance issues – Minor control loops reject to manual. – Device faults, bad quality. – Deviation alarms. – DCS system alarms.
Level 4	Normal operations (no alarm).	– Return to normal alarm. – No audible alarm.
Level 5	Equipment in lockout or red tag. These points will be recorded in the Historian.	– No audible alarm.

A-8.5.3.4.d Control logic blocks utilizing alarms for control action shall be kept separate and independent from alarms intended to alert the operator of abnormal process conditions. The following shall apply to operator process alarms generated from analog input signals only, and are distinguished from alarms used for control action:

A-8.5.3.4.d.1 The built-in DCS alarm features (high, high-high, low, low-low, etc.) of analog input point database records shall be used for all priority levels for warning operations of "off-normal" operational parameters.

A-8.5.3.4.d.2 Use of High, Low and High/Low monitor algorithms/function blocks on originated analog points shall be limited to the development of logic schemes or strategies for permits, start/stops, trips, runbacks, etc. Use of these algorithms solely to generate an alarm from an analog point shall be avoided or greatly limited, since the DCS analog database typically has embedded alarm set points for each analog record.

A-8.5.3.4.d.3 The use of the High, Low, and High/Low monitor algorithms/function blocks (identified in the previous section) shall be used to generate the alarm associated with the specific trip, runback, permissive (not met), etc.

A-8.5.3.4.e Each alarm message shall be logged along with tag number, date and time, alarmed value, unit, set point, area, and status (acknowledged, non-acknowledged, or returned to normal). Alarm formats will be Facility DCS Subcontractor's standard.

A-8.5.3.4.f Equipment not in service or tagged out shall have their alarms deactivated.

A-8.5.3.4.g System failures shall be alarmed and logged in the alarm capture computer.

A-8.5.3.5 Reporting

A-8.5.3.5.a All plant operation and plant history (sequence of events etc.) shall be through the Facility DCS with, if necessary, hard copy reports when requested from the Facility DCS printers. All operator functions shall be entered into the Facility DCS so these logs, alarm records, and daily reports shall be made available through the Facility DCS displays.

A-8.5.3.5.b The status of each SOE point shall be time tagged at the source and stored in a database together with other relevant information for a specific time period. Data will be continuously deleted from the database after the specified time period has elapsed. On the occurrence of a nominated event (e.g., turbine trip) or manual initiation via the Facility DCS, all data for the time period before the event shall be retained and continue to be recorded for a period after the event.

A-8.5.3.5.c The Facility DCS Subcontractor shall develop the SOE program to permit storage of the sequence of events log in the HSR system. The HSR shall be sized large enough to store all SOE logs.

A-8.5.3.5.d Facility DCS Shall indicate run times for each CTG, STG, and all motors 480 Volt and higher.

A-8.5.3.5.e The historian shall be capable of building reports which can be either printed or saved electronically. These reports can be set up to run at certain times and days.

A-8.5.3.6 Plant Performance Monitoring System

A-8.5.3.6.a Seller shall provide an interface with the Seller supplied HSR for a secondary Performance Monitoring System for the Facility as designated and provided by the Buyer.

A-8.5.3.6.b The Plant Facility DCS shall be provided with OSIsoft PI System software installed on one of its servers. This server shall be connected to the Plant LAN via a network connection through a data diode provided by the Buyer.

A-8.5.4 Testing: Factory Acceptance, Start-up, and Commissioning

A-8.5.4.1 In addition to the manufacturer's production tests, the Seller shall carry out routine tests on completed Equipment. The Buyer reserves the right to witness such tests. Routine tests on each piece of Equipment shall be fully documented and include at least the following: visual inspection, performance testing, control loop testing, fail over testing (communication and power), and voltage withstand and insulation testing. Where Equipment is intended to operate together, the complete assembly shall be tested to demonstrate that the interconnected pieces are compatible.

A-8.5.4.2 A factory acceptance test shall be performed by the Seller. The Seller shall include all Equipment necessary for full testing to cover both at factory and at Project site. All Facility DCS functions, inputs and outputs and ranges of the same, all information exchanges and paths, all operator interfaces, and all spare hardware shall be tested. These tests shall cover individual module tests, systems tests, and complete Facility DCS system tests using simulated signals and all the different types of interfaces that will exist in the plant. The HSR shall be fully configured and functional prior to startup and commissioning.

A-8.5.4.3 From the various factory equipment/components tests, evidence shall be provided to prove that the Equipment meets the requirements of this specification and is sufficiently reliable

to justify delivery to Project site. The factory acceptance tests are intended to prove that the modules and sub-systems are compatible and that the complete system hardware and software conforms to this specification. This can be achieved by simulating the interfaces between the modules and sub-systems, which are not available to the manufacturer at the time of test.

A-8.5.4.4 The Facility DCS Subcontractor shall provide full test documentation. All spares required for commissioning are to be included. All software shall be checked against all hardware systems.

A-8.5.4.5 The Facility DCS equipment shall conform to, and tests be conducted in accordance with, the latest applicable Standards of the American National Standard Institute, Inc. (ANSI), the Institute of Electrical and Electronics Engineers, Inc. (IEEE), and the National Electrical Manufacturers Association (NEMA).

A-8.5.4.6 A Facility acceptance test shall be performed. The Facility acceptance tests shall be fully documented and include, but not be limited to, the following:

A-8.5.4.6.a Testing of all workstation or PLC facilities without connection to workstations in the new Control Room.

A-8.5.4.6.b Testing of data communications to workstations shall be established for each workstation or PLC.

A-8.5.4.6.c Commissioning tests including, in-situ instrument calibration check to Facility DCS/PLC, control loops, Facility DCS/PLC device drivers, protection and interlock logic, sequences, station master load control, alarms, failover testing (communication and power), power and grounding checks, etc.

A-8.5.4.6.d Facility Tests - Control and Instrumentation: The Seller shall carry out all necessary calibrations of instruments, control valves and control loops. All the testing and proving of instrumentation shall be carried out per the pre-commissioning and commissioning activities specified. Calibration documentation shall be provided in all cases and be part of the “turnover package” submitted to the Buyer.

A-8.5.4.6.e A Facility DCS workstation designated by the Seller solely for Buyers use during the commissioning. The workstation shall be available two weeks after Facility DCS power up at the Facility. It shall be kept current with all the latest graphic and logic changes in the Facility DCS.

A-8.5.4.6.f Data communication and interfaces between Facility DCS and proprietary control equipment as listed in the Control System Interfaces section shall be demonstrated.

A-8.5.4.6.g Full working communication between the BOP Facility DCS, CEMS, Gas Yards, RTU, and the AGC interfaces, established by the Seller and the Buyer.

A-8.6 Combustion Turbine Generator (CTG) controls

Instruments and controls that are supplied as part of the CTG package will be provided in accordance with Subcontractor’s standards except that Factory Acceptance Testing of the complete control package shall be performed using Vendor's standard testing procedures. The tests shall be performed prior to shipment.

A-8.6.1 General TCS Requirements

A-8.6.1.1 The Seller shall supply all the control, protection, and instrumentation equipment for the safe, reliable, and efficient operation of the combustion turbine-generator and its auxiliaries. The CTG and HRSG shall operate as an integral unit. NFPA 85 HRSG purge and CTG to HRSG interlock requirements must be satisfied by the TCS.

A-8.6.1.2 The control systems supplied for the control of the combustion turbine generator shall be directly interfaced with the BOP Facility DCS to provide coordinated operation with all elements of the combined cycle plant (e.g., limiting the ramp rates to within the HRSG stress limitations, etc.).

A-8.6.1.3 The TCS shall provide for the automatic and semi-automatic starting, synchronizing, loading, and shutting down of a single turbine generator. Comprehensive supervisory equipment for monitoring operational status, alarms and automatic protection shall be provided for the safe remote operation of the machine. All the above operational procedures shall be included in the interface to the Facility DCS.

A-8.6.2 CTG Controls

A-8.6.2.1 Consisting of the manufacturer's normal complement of equipment, the control and instrumentation package for each Unit shall include, but not be limited to, the following:

A-8.6.2.1.a Governor controls, droop selection, MW load control, and exhaust temperature limiting. Droop control shall be active in M mode or AGC mode so that the CTG responds to system frequency changes during these modes. See Attachment A-17.

A-8.6.2.1.b Emergency tripping and protection system (fail-safe) including over-speed trip equipment and on-line trip testing facilities. 2 out of 3 (2oo3) voting shall be implemented to the extent practical, with respect to physical space limitations within the OEM standard design. The Buyer shall review and approve all trip systems that do not have 2oo3 voting.

A-8.6.2.1.c Sequence controls and interlocks (e.g., pre-start checks, start-up auto-synchronizing, load run-up, shut-down, etc.).

A-8.6.2.1.d Comprehensive machine condition monitoring and supervisory equipment.

A-8.6.2.1.e Control and instrumentation for auxiliary systems.

A-8.6.2.1.f Local and remote alarms on the operator workstation.

A-8.6.2.1.g Generator control and instrumentation, including electrical protection.

A-8.6.2.1.h Fire and gas detection systems.

A-8.6.2.2 The preferred supervisory instrumentation for the CTG shall be Bently Nevada with provisions for an additional serial card to interface Alta Solutions, including but not limited to the following parameter monitoring: shaft vibration in x and y directions (at 45º and 135º angles of the horizontal plane), phase reference, bearing pad temperatures, thrust bearing to shaft position, thrust bearing temperature.

A-8.6.2.3 The CTG vibration monitoring equipment shall be interfaced with the Facility DCS via TCS, such that all signals and alarms/trips can be monitored in the Control Room.

A-8.6.2.4 The CTG supervisory system shall be fully compatible with the Bently System 1, or equivalent, condition monitoring analysis system installed in the Control Room.

A-8.6.2.5 TCS shall be provided with a network printer in the Control Room and in each local control package.

A-8.6.2.6 Emergency stop push buttons shall be mounted on the trip panel installed in the Control Room.

A-8.6.2.7 Refer to Attachment A-17 for additional instrumentation and controls requirements for the CTGs.

A-8.7 Heat Recovery Steam Generator (HRSG) Controls

A-8.7.1 General HRSG Control Requirements

A-8.7.1.1 The Seller shall supply all control, protection, and instrumentation for the safe, reliable, and efficient operation of the HRSG. All HRSG control functions will be integrated wired directly into the BOP Facility DCS. The combustion turbine and HRSG shall operate as an integral unit. The HRSG shall be capable of following the inherent rapid start up and shut down of the combustion turbine without undue thermal stress.

A-8.7.1.2 All control and instrumentation mounted locally must be suitable for the environmental conditions. Protective instrument enclosures shall be provided to protect against all local weather conditions.

A-8.7.2 HRSG Controls

A-8.7.2.1 The control and instrumentation package shall include, but not be limited to, the following:

A-8.7.2.1.a Drum level control for all three HRSG drums. The drum level control shall be three elements control consisting of level, feedwater (condensate) inlet and steam flow (BFP suction flow) outlet.

A-8.7.2.1.b Steam temperature control for both SH and RH steam temperature. The Steam temperature control shall be cascaded control with final steam temperature controller output cascaded to spray outlet temperature (Secondary SH inlet temperature). Saturation limits shall be applied to prevent spraying into saturation.

A-8.7.2.1.c Economizer inlet temperature (economizer recirc) control.

A-8.7.2.1.d Automatic continuous blowdown monitoring and control.

A-8.7.2.1.e Emergency tripping and protection systems.

A-8.7.2.1.f Sequence control and safety interlocks.

A-8.7.2.1.g Controls and instrumentation for auxiliary systems.

A-8.7.2.1.h Local and remote alarms.

A-8.7.2.2 The control and monitoring systems for the HRSG shall be a drop integral within the BOP Facility DCS. Centralized control and monitoring of the HRSG shall be provided at the Control Room via the Facility DCS.

A-8.7.2.3 Refer to Attachment A-18 for additional instrumentation and controls requirements for HRSG.

A-8.8 Steam Turbine Generator (STG) Controls

A-8.8.1 General STG Control Requirements

A-8.8.1.1 The control and instrumentation systems offered shall provide for the safe, reliable, and efficient operation of the plant as defined by the specification. The systems shall enable the steam turbine to meet the optimum output achievable under steady state and changing load conditions while maintaining safe plant conditions and high levels of efficiency.

A-8.8.1.2 The systems offered shall provide the automatic, semi-automatic and manual controls for starting, loading and shutting-down of the steam turbine-section of the power train.

A-8.8.1.3 The control and instrumentation systems shall be interfaced with the Facility DCS to provide coordinated operation of the steam and combustion turbines. Control and monitoring of the steam turbine shall be provided at the Control Room via the Facility DCS and the TCS HMI in the control room.

A-8.8.2 STG Controls

A-8.8.2.1 The control system shall include the following features:

A-8.8.2.1.a The auto run-up and loading system shall be designed to ensure consistent turbine run-up control from startup speed control to full load at maximum rates compatible with the thermal state of the turbine, the steam conditions applied, and the allowable expenditure of turbine life expectancy. The design of the auto run-up system shall take full account of:

A-8.8.2.1.a.1 All necessary pre-start checks to ensure minimum conditions for auto run-up initiation are satisfied.

A-8.8.2.1.a.2 Selection of run-up rate (cold, warm, and hot).

A-8.8.2.1.a.3 Turning after steam turbine shutdown.

A-8.8.2.2 Governor System

A-8.8.2.2.a The turbine governor shall include the following features:

A-8.8.2.2.a.1 Electro-hydraulic control system

A-8.8.2.2.a.2 Triplex, high-integrity speed monitoring channels for separate turbine control and over-speed protection.

A-8.8.2.2.a.3 Comprehensive self-diagnostic fault detection features.

A-8.8.2.2.a.4 On-load testing of all turbine steam admission valves shall be provided.

A-8.8.2.3 A Bently Nevada turbine supervisory instrumentation (TSI) system.

A-8.8.2.3.a A turbine protection system shall be provided. This protection system shall trip the turbine-generator under hazardous operating conditions. Trip circuit supervision and fault detection

shall be included to provide a high integrity fail-safe system. Emergency stop pushbuttons shall be installed on the trip panel in the Control Room.

A-8.8.2.4 Miscellaneous Turbine Auxiliary Systems

A-8.8.2.4.a The control of the principal turbine drains after the stop valves shall be included.

A-8.8.2.4.b Separate control groups shall provide monitoring, regulating and sequence controlling of all plant functions associated with the turbine oil systems, vacuum and gland sealing systems, condensate, cooling, and all auxiliary systems.

A-8.8.2.4.c The group control sequence shall co-ordinate the operation of pumps and all associated plant functions where required during run-up, shutdown, normal and emergency operations.

A-8.8.2.4.d The TCS shall be capable of printing on a networked printer in the Control Room.

A-8.8.2.4.e Refer to Attachment A-19 for additional instrumentation and controls requirements for the STG.

A-8.9 Balance Of Plant (BOP) Controls

A-8.9.1 General BOP Control Requirements

A-8.9.1.1 Unless otherwise specified, the manufacturers' standard packages of control and instrumentation shall be supplied for all auxiliary plant equipment and BOP systems. Protection systems for major plant equipment, (e.g., Feedwater pumps, etc.), shall use two-out-of-three majority voting and shall be independent of the control system for that Facility. Equipment shall be supplied to interface all BOP systems and all auxiliary Facility equipment items with the Facility DCS to enable remote monitoring and data logging at the Control Room suitable for one-man operation. This shall also be supplemented with local controls, gauges, and other devices to allow local maintenance and testing activities where required. The control and instrumentation systems for the common BOP systems shall be designed, manufactured, and installed to the same standards provided for the main plant process systems.

A-8.9.1.2 Complete control, instrumentation and protection packages shall be provided as applicable for all systems provided under the Agreement. This shall include but not be limited to the following:

A-8.9.1.2.a Steam systems (Steam supply, steam bypass system etc.)

A-8.9.1.2.b Water systems (service and demineralized)

A-8.9.1.2.c Water treatment system

A-8.9.1.2.d Generator cooling systems for combustion turbine generators and steam turbine generators

A-8.9.1.2.e Combustion Turbine inlet chiller system

A-8.9.1.2.f Condensate system

A-8.9.1.2.g Compressed air systems

A-8.9.1.2.h Fire protection system

A-8.9.1.2.i Gas detection system

A-8.9.1.2.j Hydrogen seal system (if supplied)

A-8.9.1.2.k Fuel gas system

A-8.9.1.2.l Condenser systems

A-8.9.1.2.m Independent coolers to cool plant auxiliaries

A-8.9.1.2.n Feedwater system

A-8.9.1.2.o Chemical feed systems

A-8.9.1.2.p New wastewater systems

A-8.9.1.3 The steam bypass system shall be fully instrumented showing temperature, pressures and flows at each pressure level (i.e., HP, RH, LP). The spray water control for the de-superheating shall be based on enthalpy control. All temperatures, flows and pressures for the respective steam and water lines involved with this bypass control scheme shall be completely instrumented, monitored, displayed to the operator, and used by the Facility DCS control loop. Protection shall be included in the system to ensure critical conditions are avoided in the various stages of the bypass system. The steam bypass system shall be fully automated to support the transfer of a HRSG from the bypass system to the steam turbine with minimal operator intervention. The steam bypass system shall be capable of automatically returning to steam bypass mode on a steam turbine trip without steam safety relief valve operation or CTG trip or runback. The steam bypass system shall be capable of bypassing excess steam automatically during fast CTG ramping.

A-8.9.1.3.a The Seller shall design and tune the logic to avoid a quick closure of the bypass valve on high temperature while still protecting downstream equipment from temperature excursions in the event of temporary loss of spray water pressure or control.

A-8.9.1.4 The condenser controls shall be fully instrumented and automated, using the Facility DCS to ensure the operator is fully aware of all conditions. Any manufacturer's standard package shall interface fully with the Facility DCS.

A-8.9.1.5 The demineralized water storage tanks shall have level monitoring and inlet flow totalizers reporting in the Facility DCS.

A-8.9.1.6 Instrument and Service Compressed Air Systems shall each have their own respective PLC based control and monitoring system but shall interface with the Facility DCS for the supervisory control and status/alarm conditions are available to the operator in the Control Room.

A-8.9.1.7 The fuel gas systems shall be designed by the Seller for implementation in the plant Facility DCS system.

A-8.9.1.8 The feedwater system, open loop cooling water system, chemical treatment system and wastewater system shall be fully automated and instrumented. All controls and instrument signals shall interface with the Facility DCS such that the operator shall be able to assess their condition especially under alarm conditions.

A-8.9.1.9 Local systems such as sump pumps, oil water separators, and eye wash stations shall be locally controlled with status alarms wired back to the Facility DCS.

A-8.10 Requirements For Instrumentation

A-8.10.1 Instrumentation General

A-8.10.1.1 This section describes the general requirements for the supply and installation of the instrumentation for the Facility. All instrumentation, related devices, and equipment necessary to allow the safe, reliable, and efficient operation of the Facility shall be supplied.

A-8.10.1.2 The objective shall be to standardize all equipment, wherever possible, throughout the Facility in order to simplify operation, maintenance and reduce spare parts. In general, all Equipment shall be of modern state-of-the-art design, incorporating proven technology. All Equipment shall be subject to the approval of Buyer.

A-8.10.2 BOP Control and Instrumentation Signal Levels

A-8.10.2.1 The following signal levels shall be used for instrumentation and control valve actuating (other signals to the Engineer's approval):

a.	Analog	4 to 20 mA at 24 VDC
b.	Digital outputs	120VAC and 125 VDC, with interposing relays as required by the circuits
c.	Digital inputs	48 VDC, 125 VDC and 120 VAC wetting voltages
d.	Solenoids	120 VAC/ 125 VDC

A-8.10.3 Field Mounted Instruments

A-8.10.3.1 Unless otherwise specified or approved by Buyer, all parameters (e.g., pressure, flow, level, temperature) for indication on local control panels or control panels remote from the point of measurement or for use in the BOP Facility DCS, Control Room, or other Facility auxiliary control/monitoring system shall utilize state-of-the-art electronic 2-wire transmitters.

A-8.10.3.2 All field mounted electrical equipment shall be weatherproof to NEMA Type 4 or equivalent and suitable for the local ambient weather conditions.

A-8.10.3.3 All smart transmitters with HART Protocol shall be provided with both the Facility DCS and field programmable tools. Each transmitter which is used to transmit a signal to the control system shall be loop powered directly from the Facility DCS I/O cards, compatible with the Facility DCS scheme.

A-8.10.3.4 All transmitters shall be of the indicating type or equipped with separately mounted local indicators, except transmitters in the CTG enclosure. All transmitters shall be provided with test connections and instrument isolating valve manifolds (2-way for single input, 5-way for differential inputs). For high-pressure systems (above 200 psi), manifold blowdown pipework or plugs must be provided.

A-8.10.3.5 Unless required by code, transmitters shall be used to the greatest extent possible in place of process type switches.

A-8.10.3.6 Switches for pressure, temperature, and level monitoring shall be of the heavy-duty type with double pole changeover contacts, double pole-double throw (DPDT). Contacts shall be rated to suit their required duty. Mercury switches shall not be used. All pressure types shall be provided with isolation valves and two-valve manifolds, and float-type level switches shall be provided with isolation valves.

A-8.10.3.7 Instruments shall be grounded at the source end only, not at both ends. The cable shield shall be isolated at the instrument end.

A-8.10.4 Flow Instruments

A-8.10.4.1 Paddle type orifice plates shall generally be used as the primary elements in flow measurement. Orifice plates shall be of the square edge concentric type for clean fluids. Differential pressure instruments shall be close coupled to the orifice taps where practical. Orifice plate sizing, orifice plate construction, and the design of associated meter piping shall conform to the requirements of ASME.

A-8.10.4.2 The orifice plate information shall be stamped on the upstream side of the paddle handle, and the tag number shall be stamped on the downstream side.

A-8.10.4.3 Orifice plates shall be made of a material suitable for the service application.

A-8.10.4.4 The orifice beta ratio (d/D) shall be between 0.4 and 0.75 for flow control measurements.

A-8.10.4.5 Orifice meter accuracy shall conform to ASME MFC-3M specifications.

A-8.10.4.6 Rotameters shall be used for local indication on low flows. Process rotameters shall have metal tubes. Glass tube rotameters shall only be used for purging or auxiliary service with non-hazardous fluids.

A-8.10.4.7 Positive displacement type meters shall be used for measuring oil flow.

A-8.10.4.8 Flow meters employing alternative measurement principles may be utilized for appropriate applications subject to the approval of the Buyer. For special applications, turbine meters, positive displacement meters, magnetic flow meters, venturi flow tubes, pitot tubes, Annubar tubes, Coriolis mass flowmeters, vortex meters, sonic and ultra-sonic flowmeters, etc., shall be used. Straight meter runs for all special application flow meters shall conform to industry accepted design standards and/or the meter manufacturer's requirements. Calibrated flow elements shall have accuracy within +/- 1.0 percent or better of calibrated full-scale range.

A-8.10.4.9 Where density, temperature or pressure corrections for metered performance monitoring signals are required, such measurements shall be made close to the flow meter location.

A-8.10.4.10 Flowmeters for the fuel gas flow measurements for the CTGs shall meet the requirements of the EPA. A manufacturer’s calibration certificate shall be provided that shows that the flow meter meets the accuracy requirements of the EPA.

A-8.10.4.11 Flowmeters for the feedwater flow measurements for the HRSG shall be a flow nozzle meter and the design of associated meter piping shall conform to the requirements of ASME.

A-8.10.5 Level Instruments

A-8.10.5.1 Level measuring devices may be of direct measurement, differential pressure, or electrical/electronic type as appropriate to the application. For local indication of level, direct measuring devices shall be used. Unless otherwise approved by the Buyer, each measuring instrument shall be removable without the vessel or other instruments being taken out of service.

A-8.10.5.2 Level gauges shall be of the reflex type made from stainless steel bar, fitted with toughened borosilicate glass, and marked with their safe working pressure and temperature, except on low temperature and pressure application when transparent types may be used.

A-8.10.5.3 Generally, magnetic float type level gauges with magneto-restrictive level transmitters shall be used for clean liquid level measurements. The gauges shall be mounted in external cages with flanged connections, rating same as vessel.

A-8.10.5.4 Differential pressure type transmitters shall be used for clean liquid level measuring service where it is not practical to use magnetic float type level transmitters. Level transmitters shall have accuracy within +/- 0.1% (+/-0.5% for TCS) or better of calibrated full-scale range. Filled capillary system level instruments shall be used where fluids are viscous or contain solids that may plug external devices. Other types of sensing elements (paddle, capacitance, sonic, etc.) when float/displacer type switches are not suitable for the application.

A-8.10.5.5 Direct measurement of level by means of internally mounted floats etc., shall only be used when the switch-point is either well defined in advance or is adjustable in service, and the vessel can be emptied and/or depressurized for the removal of the switch without effect to the normal operation of the plant, or where choking of extended connections is likely to occur.

A-8.10.5.6 Float switches shall be glandless with magnetic coupling.

A-8.10.6 Pressure and Differential Pressure Instruments

A-8.10.6.1 In general, process transmitters shall be 4-20 mA DC, two wire, solid state SMART type with HART protocol. All process transmitters shall have an accuracy within ±0.1% of calibrated range or better, which shall include the combined effects of linearity, hysteresis, and repeatability. Pressure and differential pressure transmitters shall have adjustable zero and span and shall have zero elevation/suppression capability. All transmitters with local indication shall be furnished with a display scale of 0-100% of range. Transmitters for fluid applications that may be corrosive, highly viscous, or contain entrained solids shall be furnished with diaphragm seals and stainless-steel capillary tubing (if required). All differential transmitters shall be equipped with 5 valve manifolds. All pressure transmitters shall be equipped with two valve manifolds.

A-8.10.6.2 Transmitters shall be used whenever possible in place of process type switches (pressure, level, flow, etc.) for all system applications.

A-8.10.6.3 Locally mounted pressure gauges shall be provided upstream and downstream of each piece of equipment that can affect process pressure, i.e., pumps, filters, heat exchangers, etc., except for CTG and STG packages. Pressure indicators on pump headers shall be provided with snubbers and shall be glycerol filled.

A-8.10.6.4 Pressure gauges shall have a weatherproof case, a solid front with blowout back, an accuracy within ±0.5% (±2.0% for TCS) of calibrated full-scale range (both upscale and downscale), and be furnished with helical type elements with Type 316 stainless steel wetted parts unless a more corrosion resistant material is required. Pressure gauges shall have 4½" dials with black graduations and pointer on a white face, ½" NPT lower bottom connection, and furnished with windows of shatterproof glass or plastic material. Pressure gauge ranges shall be selected such that the maximum operating system pressure does not exceed 75% of the full-scale range. Pressure gauges for fluid applications that may be corrosive, highly viscous, or contain entrained solids shall be furnished with diaphragm seals.

A-8.10.6.5 Differential pressure indicators shall have bellows, piston, bourdon tube or diaphragm type sensing elements with wetted movement parts of 316 stainless steel, unless a more corrosion resistant material is required. Differential pressure indicators shall be furnished with 4½" minimum diameter indicator dials, ½" NPT process connections, and windows of shatterproof glass or plastic material. Accuracy shall be within ±1.0% (±2.0% for TCS) full-scale indication (both up and down) or better with no leak-through.

A-8.10.6.6 Differential pressure instruments shall be capable of taking full line pressure on one side only, without damage or loss of calibration.

A-8.10.6.7 Pressure and differential pressure switches, if used, shall be either of the bellows, piston, or bourdon tube type. The setpoint adjustment shall be internal with some means of tamper-proofing provided. Pressure switches shall have repeatability within ±1.0 percent of operating range or better. Switches used for control shall not be used for other functions such as alarming or tripping.

A-8.10.6.8 Pressure instruments exposed to possible vacuum shall be protected for full vacuum.

A-8.10.6.9 Diaphragm seals shall be used for slurries, corrosive fluids, and for very viscous liquids.

A-8.10.6.10 Pulsation dampeners shall be used for pressure instruments that are directly connected to positive displacement pump and reciprocating compressor suction or discharge lines. Liquid-filled gauges shall be used where extreme vibration of the gauge is expected.

A-8.10.6.11 Siphons shall be used for pressure instruments on steam service unless a liquid filled sensing line is used.

A-8.10.6.12 Pressure gauges shall be 4½ inch minimum local mounted, 3½ inch panel mounted, and 1½ inch to 2½ inch mounted on air operated dampers and control valves.

A-8.10.7 Temperature Instruments

A-8.10.7.1 The method of temperature measurement to be employed shall be selected for each particular application, bearing in mind requirements for accuracy and reliability.

A-8.10.7.2 The primary elements for temperature service shall consist of thermocouples or resistance temperature detectors (RTD), depending upon the service applications. The temperature

sensors shall have accuracy according to ASTM E230/E230M Special for thermocouples and ASTM E1137 Grade A for RTDs.

A-8.10.7.3 Thermocouple extension wire will have the same characteristics as the thermocouple. Connections shall be made to avoid cold junctions.

A-8.10.7.4 Thermocouple temperature detectors shall conform to ANSI MC96.1 and shall be Dual Element type chromel-constantan (ISA Type E) or chromel-alumel type (ISA Type K) for high temperature applications. Thermocouple calibrations shall conform to the latest issue of ANSI-MC96.1 Temperature Measurement Thermocouples, with cold junction reference at 32°F. Thermocouples shall be ungrounded.

A-8.10.7.5 Resistance temperature detectors (RTD) shall be used for temperatures less than 200°F. Process control applications shall use 100 Ω at 0°C, three-wire platinum type RTDs. All RTD elements shall be duplex.

A-8.10.7.6 Thermocouples and RTDs elements shall be spring-loaded to provide good thermal contact with its associated thermowell. All connection heads shall be rated NEMA 4 as a minimum with appropriate hazardous area rating as required, made of cast iron, steel, or aluminum with screwed covers and retaining chain, and supported from the well by a nipple-union-nipple extension. Connection heads shall be furnished with insulated brass terminal blocks for extension wiring. Connection head conduit connections shall be ½" NPT.

A-8.10.7.7 Local temperature indicators shall be provided upstream and downstream of each piece of equipment that can affect process temperature (e.g., large pumps [Boiler Feed Pumps, Condensate Pumps, Closed Cooling Water Pumps], heat exchangers, coolers, etc.), apart from CTG and STG packages. Local temperature indicators shall be bimetal type with adjustable angle head, 5-inch dials with plastic windows, hermetically sealed stainless-steel construction with 0.25" O.D. stems.

A-8.10.7.8 All fluid system temperature sensors shall be equipped with thermowells. Thermowell material shall be the same general type of material as the pipe or vessel. The minimum material for thermowell shall be 316 stainless steel.

A-8.10.7.9 Thermowells shall be installed in all locations requiring temperature test points. Thermowells shall also be installed at all locations necessary to support the requirements for ASME performance testing where required.

A-8.10.7.10 Thermowells shall be suitable for the design pressure, flow, and temperature of service. Each thermowell shall be provided with brass plug and chain. Thermowells installed in high velocity streams shall be subjected to frequency ratio calculation to prevent the wells from breaking.

A-8.10.7.11 Sensing elements for air, inert gas, and radiant temperature measurements shall be complete with a suitable protective sheath. For steam, water, and hazardous applications, thermowells shall be utilized.

A-8.10.7.12 No temperature measuring system shall use mercury as its sensing medium.

A-8.10.7.13 Thermocouples and RTDs shall be wired directly to the Facility DCS and shall not use temperature transmitters.

A-8.10.8 Analyzers

A-8.10.8.1 Measuring instruments monitoring chemical or physical properties of process fluids and substances may be installed either directly in the process line, vessel, or at a distance and connected by means of sampling systems.

A-8.10.8.2 Analytical instruments shall be selected to operate continuously, infrequently or on a continuously interrupted cycle as most suited to the measurement and the intended application.

A-8.10.8.3 If sampling systems are employed then they must be designed such that the sample cannot be contaminated and time lags between the sampling point and the analyzer are insignificant (e.g., on start up where the lines may have been stagnant and steam/water quality is a required release condition for the steam turbine).

A-8.10.8.4 Sensors shall be of rugged construction and shall not require frequent maintenance or recalibration. Where sensors require the use of calibration solutions or gases, then a minimum of one year's supply at normal usage shall be supplied. Where sensors require replacement or removal for recalibration or rejuvenation at regular intervals, then an adequate number of spare sensors shall be supplied for one year's normal usage.

A-8.10.9 All instrument tagging shall agree with the approved project tagging procedure and shall be read in English units. Instrument tags shall be stainless steel and either screwed into instrument or attached to instrument by stainless steel wire.

A-8.11 Instrument Installation Requirements

A-8.11.1 Installation Responsibility

The Seller shall be responsible for the installation of all instruments furnished by the Seller as well as the Seller's sub-vendors.

A-8.11.2 General

A-8.11.2.1 In general, valves shall be located as follows:

a. Frequently operated manual valves, control valves, non-return valves, high energy safety valves, and interior header fire protection isolation valves shall be located at an accessible location at floor level or at fixed platform level.
b. Other valves, including but not limited to, air operated valves, regulators, motor operated valves, and instrument root valves may be located where a ladder, manlift, or scaffolding may be required for access.
c. Clearance shall be allowed between the top of the control valve actuator and the underside of the nearest obstruction above it for removal of the control valve actuator and trim in one piece.
d. Threaded control valves shall have flanges or unions in accordance with the Piping Material Specifications immediately adjacent to the control valve for purposes of removing the valve.

A-8.11.2.2 Instrument and control equipment for outdoor usage where the process is subject to freezing (such as steam or water) shall be installed in instrument enclosures to prevent damage from freezing, wind, rain, salines, fumes, and dust. Equipment enclosures shall be appropriately rated for ultraviolent exposure and shall be provided with heaters.

A-8.11.2.3 Instrument enclosures and racks shall be designed to facilitate instrument calibration and maintenance. Local instruments shall be easily read without dismantling equipment.

A-8.11.2.4 If required, analytical detector systems mounted outdoors shall be installed in noncombustible, corrosion resistant, weatherproof enclosures.

A-8.11.2.5 The sensor and analyzer shall, where possible, be mounted near the sample point and shall be properly protected from the environment.

A-8.11.2.6 Analyzers may be installed in analyzer houses near the measuring points in-field. The temperature inside the analyzer houses shall be controlled to ensure adequate ambient condition.

A-8.11.2.7 pH electrodes shall be designed where the electrode remains wet and shall be installed with provision to allow easy removal for periodic cleaning, inspection and replacement or full calibration when the process is in service. Electrodes shall include provisions to disconnect cable at the probe.

A-8.11.2.8 In-line instruments shall be located where they shall be accessible for maintenance and servicing.

A-8.11.2.9 Instruments not mounted inline shall be located where they shall be accessible from platforms or grades. Indicating instruments shall face forward toward the normal operating area and shall be within reading distance and in the line of sight.

A-8.11.2.10 Instruments shall be mounted level and plumb, rigidly supported, and in such a manner as to provide protection from heat, shock and vibration; accessible for maintenance; and free from interference with piping, conduit, and equipment.

A-8.11.2.11 Tubing shall be installed in a neat, workmanlike manner, being properly sloped, and showing no sign of crumpling, bending with too short a radius, flattening, etc. Open tube ends and connections shall be kept plugged to keep out dust, dirt, moisture, oil, etc. Tubing, fittings, and instrument manifold installations shall be in accordance with ASME B31.1, “Power Piping”.

A-8.11.2.12 Instrument enclosures, if used shall be provided with a low temperature alarm to notify the plant operator when a heater fails or a heat trace circuit trips. The alarm can be wired into a heat trace panel alarm circuit.

A-8.11.2.13 Instrument tubing shall not be welded and shall be ½ inch minimum size.

A-8.11.3 Classified Areas

A-8.11.3.1 Hazardous location classes will be as per NFPA No. 70.

A-8.11.3.2 In general, instruments requiring electrical power shall be located outside of hazardous areas. However, if it is deemed that an instrument requiring electrical power shall be in a hazardous area, the design shall incorporate appropriate methods of protection.

A-8.11.3.3 The preferred methods of protection shall include:

a. Locate outside of classified area.
b. Non Incendive

c. Explosion Proof
d. Intrinsically Safe
e. Purged and Pressurized

A-8.11.3.4 Non-incendive design will be permitted for use in Class I, Division 2 areas, but shall be used only in conjunction with equipment certified for use in non-incendive applications.

A-8.11.3.5 If intrinsically safe systems are specified, the electronic instruments shall be certified by the appropriate agency when used with approved current limiting device.

A-8.11.3.6 All instrumentation and control devices shall be suitable for the environment where they will be located.

A-8.11.4 Personnel Protection

A-8.11.4.1 Consideration shall be given to personnel protection during the normal operation of field instruments.

A-8.11.4.2 Process sensing lines above 140°F during normal operation and readily accessible to personnel shall be provided with means to prevent direct contact in readily accessible areas.

A-8.11.5 Process Tap Connections

A-8.11.5.1 Connection to the process system shall be in accordance with each particular application. Connections shall be in accordance with the applicable Codes, piping line specifications, or manufacturer recommendations as shown on the Piping and Instrumentation Diagram and/or manufacturer's equipment drawings. Provide independent taps for all redundant instrument installations.

A-8.11.6 Process Connection Orientation

A-8.11.6.1 Pressure and flow connections shall be located on the side of the pipe for liquid or steam applications. Gas and non-condensing vapor connections shall be located on the top of the pipe.

A-8.11.6.2 Temperature connections shall typically be located on the top of the pipe. Temperature connections can also be located on the side or at 45º between the side and top of the pipe.

A-8.11.6.3 Level connections – varies depending upon type detector.

A-8.11.7 Pressure connections

A-8.11.7.1 Connection size shall be ¾" for piping with a design pressure equal to or less than 600 PSIG and a design temperature equal to or less than 750ºF. Connection size shall be 1" for other applications.

A-8.11.8 Flow Connections

A-8.11.8.1 Transmitters for flow nozzles shall be mounted external to the nozzles. The material and installation shall be in accordance with the pipe class of the process in which the instrument is used.

A-8.11.8.2 Connections on orifice plate flow elements shall be through orifice-tapped flanges. Two sets of orifice flange tap connections shall be provided. The minimum flange rating for the orifice flanges shall be 300 lbs.

A-8.11.8.3 Transmitters for flow orifices shall be mounted separate from the flow taps. The root valve material and installation shall be in accordance with the pipe class.

A-8.11.9 Level connections

A-8.11.9.1 Tank level transmitters using dP pressure transmitters mounted external to tanks shall be the same as pressure transmitters mounted external to pipe. Tank level transmitters may also be flange mounted to nozzles at the tanks.

A-8.11.10 Instrument Sensing Lines

A-8.11.10.1 Instrument Sensing Line Material

A-8.11.10.1.a 316 stainless steel tubing, compression fittings, welded fittings, and valves shall be used for all instrument sensing lines unless otherwise required by process conditions. Welded fittings shall be utilized for all applications rated 900 PSI or greater or 900F or greater. Swagelok compression fittings shall be utilized for all other applications.

A-8.11.10.1.b Tubing wall thickness shall be determined for each installation application in accordance with ASME 931.0 based on average wall thickness.

A-8.11.10.1.c All tubing for this service shall, in general, have a minimum outside diameter of ½-inch (except as noted for high pressure/temperature applications per ASME B31.1). All tubing shall conform to the following requirements:

A-8.11.10.1.d ASTM A213 Dual Rated Grade TP316/316L, carbon content ≤0.0354% average wall, Rockwell Hardness shall not exceed 90Rb for applications of < 1,000°F.

A-8.11.10.1.e ASTM A213 TP316H for applications of > or = 1,000°F, Rockwell hardness shall not exceed 95Rb.

A-8.11.10.1.f Seamless Stainless Steel

A-8.11.10.1.g Cold Drawn Fully Annealed

A-8.11.10.1.h 20 ft. Lengths or Longer

A-8.11.10.1.i All fittings shall be ASTM A213 316/316L for application of < 1,000°F or ASTM A213 316H for applications of > or = 1,000°F.

A-8.11.10.2 The material specification, outside diameter, and wall thickness requirements for tubing shall conform to the Instrument Tubing Maximum Design Pressure Calculation approved for the Project. The minimum bending radius of instrument sensing line tubing shall be three times the tube outside diameter.

A-8.11.11 Instrument Sensing Line Configuration

A-8.11.11.1 Sensing Line Routing

A-8.11.11.1.a Instrument sensing lines shall be routed as directly as practical from the process rout valve to the instrument.

A-8.11.11.1.b Routing of instrument primary piping and tubing, including piping from the process connection through the root valve and the instrument primary piping, shall be in accordance with the following criteria:

A-8.11.11.1.b.1 Special fittings such as reservoirs (condensate pots) and other devices shall be installed at primary flow element connections as required by the design of the instrument, in accordance with the instructions of the instrument manufacturer. Condensate pots are to have double isolation vent valves for venting while filling the condensate pot, not welded plugs.

A-8.11.11.1.b.2 To insure a constant static head, the connection from low pressure steam and low-pressure liquid filled lines shall slope downward continuously from the primary element connection to the instrument (for steam flows this downward slope is from the condensate pots). Horizontal runs shall have a slope of not less than ½ inch per foot and must be adequately supported to maintain the constant slope. Vacuum connections to the condenser and low-pressure extractions shall always slope upward to the instrument.

A-8.11.11.1.b.3 Instrument primary piping for steam, liquid pressure, flow, and/or manometer level measurement systems shall slope downward (avoiding high points) from the primary element connections to the instrument (for steam flows this downward slope is from the condensate pots). Instrument primary piping for flue gas and airflow measurement systems shall slope upward from the primary element connections to the instrument. If these requirements cannot be met, special venting and drain provisions will be required.

A-8.11.11.1.b.4 Sensing lines for gas and air applications shall be routed from the process taps to the instrument avoiding low points that can trap condensate.

A-8.11.11.1.b.5 Primary piping instrument taps shall not be located on the bottom of the pipeline.

A-8.11.11.1.b.6 Redundant transmitters and switches shall be provided with separate process connections.

A-8.11.11.1.b.7 All instruments and gauges shall have independent process connections.

A-8.11.11.2 Sensing Line Support

a. Support of tubing shall be adequate to assure that the tubing is not overstressed and to prevent sagging.
b. The preferred method of routing and supporting tubing is in tube tray.

A-8.11.12 Remotely Mounted Instruments

A-8.11.12.1 Control devices for high temperature applications or equipment in inaccessible areas shall be mounted remotely.

A-8.11.13 Freeze Protection

A-8.11.13.1 For steam or water services subject to freezing at the Project defined conditions, the following shall apply:

A-8.11.13.1.a All outdoor instrument sensing lines shall be electrically heat traced and insulated (see Attachment A-6).

A-8.11.13.1.b Instruments located outdoors or in unheated areas indoors, which are subject to freeze damage, shall be mounted in electrically heated instrument enclosures. Enclosure shall be rated as a minimum for NEMA 4 with windows for viewing enclosed gauges or transmitter LCD readouts. Prefabricated instrument boxes or floor stand cabinets may be used, depending on the number of instruments to be mounted. Instrument enclosures shall be provided with a low temperature alarm to notify the operator of heater malfunction.

A-8.11.13.1.c For heat traced sensing lines, heat trace cable is to be adequately rated for all process temperature conditions.

A-8.11.13.1.d Refer to Attachment A-7 for additional heat tracing design conditions and requirements.

A-8.11.14 Calibration

A-8.11.14.1 Instruments shall be calibrated or shall meet specified tolerances as defined below. Calibration and test equipment shall be traceable to the National Institute of Standards and Testing (NIST).

Instrument Type	Calibration Requirement
Analyzers - Field mounted	Analyzers shall be factory calibrated to manufacturer's standard.
Continuous Emissions Monitoring Systems (CEMS)	CEMS analyzers shall be factory and field calibrated by the CEMS Subcontractor.
Control Valves	Valve stroke and proper action of accessories (positioners, switches, solenoids, etc.) shall be set by manufacturer.
Flow Elements - Orifice plates, Flow nozzles, Venturis and Annubars	Flow elements shall be inspected in the factory by the manufacturer to manufacturer's standards.
Flowmeters - Vortex, Magnetic, Turbine, Ultrasonic	Flowmeters - Vortex, magnetic and turbine shall be calibrated to the specified range in the factory by the manufacturer.
Gauges - Pressure & Temperature	Gauges shall be factory calibrated to manufacturer's standard.
Level Switches - Float & Displacer	For pre-assembled equipment, switches shall be factory set to manufacturers' standard. For field assembled equipment, switches shall be set in the field.
Process Switches - Pressure & Temperature	Switches shall be calibrated to the specified setpoint(s) by the manufacturer.
Position Switches - Valves & Dampers	Switches shall be set by manufacturer.
Transmitters - Digital	Digital/smart transmitters (pressure, differential pressure, and temperature) shall be calibrated and set to the specified range in the factory by the manufacturer.
Transmitters Level - any non-differential pressure type. Radar, ultrasonic, displacer, etc.	Factory calibrated by the manufacturer, if possible.
Thermocouples and RTDs	Factory calibrated to be in accordance with ITS-90, IEC-60751 or other standard required by the purchase specification.

A-8.11.14.2 Instruments provided as part of vendor skids shall be calibrated in the factory before shipment/installation. Calibration for these devices shall be checked after installation and recalibrated, as necessary.

A-8.11.15 Pressure Testing

A-8.11.15.1 Instrument air supply lines shall be pressurized to instrument air system pressure and checked for leaks using a leak detection liquid surfactant.

A-8.11.15.2 Tubing used for instrument sensing lines shall be pressure tested using either hydrostatic, pneumatic, or initial service test methods as defined in ASME 831.1. Sensing lines, where the design conditions are ≥ 900 psig or ≥ 800 °F, shall be tested before putting the line into service.

A-8.11.15.3 Sensing lines for hazardous process fluids (i.e., ammonia, fuel oil, natural gas, hydrogen, etc.) shall be tested before putting the line into service. Generally, these lines cannot tolerate traces of water, thus these lines shall be tested pneumatically using nitrogen.

A-8.11.15.4 Other sensing lines may be tested during initial service.

A-8.12 Continuous emissions monitoring system (CEMS)

A-8.12.1 General Technical Requirements

A-8.12.1.1 Required Measurements: The Seller shall furnish Continuous Emission Monitoring Systems (CEMS) as specified herein to continuously monitor the flue gases at the sampling point in the HRSG stack. The CEMS shall consist of all instrumentation and auxiliary equipment necessary to continuously measure: (a) NOx volumetric concentration; (b) O2 percent; (c) CO volumetric concentration; (d) NH_3 slip and produce all required data logging and reporting as required by the Air Permit.

A-8.12.1.2 The CEMS shall include sampling probe, heated sample line, calibration gas regulators, calibration gases, sample conditioning equipment, air purge equipment, and other appurtenances necessary to achieve the specified systems accuracy.

A-8.12.1.3 The CEMS shall utilize microprocessor-based hardware mounted in CEMS cabinets. The complete systems shall be designed to allow unattended operation of the systems between regularly scheduled maintenance.

A-8.12.1.4 The CEMS shall be installed as an extractive system, if required by the Air Permit.

A-8.12.1.5 For NOx, O2, CO, and NH_3 slip CEMS equipment, conformance with equipment performance specification requirements of current PS 2, 3, and 4A of 40 CFR 60 Appendix B, 40 CFR 75 Appendixes A through G and EPA Performance Specifications set forth in any other proposed or promulgated Applicable Laws as of the date of testing. Calibration, accuracy, and drift shall follow these regulations or the following, whichever are most restrictive:

A-8.12.1.5.a For a O_2 monitor, the Relative accuracy is to be determined in accordance with P75 requirements where the mean difference between the reference method values from the RATA and the corresponding monitor values is within $\pm$ 1.0 percent O_2, determined by relative accuracy test audit (RATA) These requirements shall be included in the Seller's operator manuals and maintenance/instruction books.

A-8.12.1.5.b The NH3 concentration in the CTG Stack shall be tested or calculated according to one of the methods listed below:

A-8.12.1.5.b.1 Install, calibrate, maintain, and operate a CEMS to measure and record the concentrations of NH3.

A-8.12.1.5.b.2 Install and operate a second NO_X CEMS probe located between the duct burners and the SCR, upstream of the stack NO_X CEMS, which may be used in association with the SCR efficiency and NH_3 injection rate to estimate NH_3 slip.

A-8.12.1.5.b.3 Install and operate a dual stream system of NO_X CEMS at the exit of the SCR. One of the exhaust streams would be routed, in an unconverted state, to one NO_X CEMS and the other exhaust stream would be routed through a NH_3 converter to convert NH_3 to NO_X and then to a second NO_X CEMS. The NH_3 slip concentration shall be calculated from the delta between the two NO_X CEMS readings (converted and unconverted).

A-8.12.1.5.c The NH_3 concentration in the CTG Stack will be tested or calculated using 24-hour zero drift and 24-hour calibration drift less than or equal to 2.5% (0.5% for O_2) of the span value, determined separately for pollutants in units of ppm and %, by calibration gas injection in accordance with Seller's operator manuals and maintenance/instruction books.

A-8.12.1.6 Operational and Performance Requirements: The CEMS shall meet all applicable operational and performance specifications promulgated by the United States (U.S.) Environmental Protection Agency (EPA) in Title 40 of the Code of Federal Regulations (CFR) Parts 60 and 75, and its applicable appendices and the Air Permit.

A-8.12.1.7 Seller shall prepare the CEMS QA/QC plan and submit them to the Buyer for review and comment to support submission to the USEPA and appropriate state and local agencies.

A-8.12.1.8 The probe and all other surfaces which come into contact with the flue gas or calibration gas stream shall be glass, heavy wall 316 stainless steel, or another appropriate material.

A-8.12.1.9 All necessary tubing and hardware required for a complete installation shall be provided by the Seller.

A-8.12.1.10 The Seller shall provide controls, instrumentation, and alarms for maintenance, testing and unattended operation of the CEMS.

A-8.12.1.10.a CEMS certification shall be provided by the Seller.

A-8.12.1.10.b Each analyzer shall provide 4-20 mA hardwired outputs to the ESC 8864 Data Loggers.

A-8.12.1.10.c Each ESC 8864 Data Logger shall be provided with individual hardwired inputs and outputs for each monitored parameter, combustion turbine load and percent load, steam turbine load and percent load, fuel flow, ammonia injection flow, flame on, CEMS in calibration, CEMS in maintenance, CEMS general alarms, pounds per hour, startup/shutdown, permitted values, etc.

A-8.12.1.10.d The Data Logger shall provide one independent output for each NO_x, CO, O_2, and NH_3 slip analysis. Each of the outputs shall be an isolated 4-20 mA VDC linear, analog signal capable of driving a 600-Ω (minimum) load. Individual output for each channel shall be provided.

A-8.12.1.10.e The analyzers shall measure in units:

A-8.12.1.10.e.1 NOx – ppm

A-8.12.1.10.e.2 CO – ppm

A-8.12.1.10.e.3 O_2 – %

A-8.12.1.10.e.4 NH_3 – ppm

A-8.12.1.11 The Seller shall furnish any other analyzer as called for in the operating permit for this Facility.

A-8.12.1.12 Analyzers shall be provided in accordance with the following criteria:

A-8.12.1.12.a Individual analyzers shall be provided to measure the volumetric concentration of each specified gas. The analyzers shall be designed for continuous unattended operation.

A-8.12.1.12.b Analyzers shall be scaled per EPA guidelines to measure the range of concentrations specified herein. Auto range selection capability is required.

A-8.12.1.12.c Each analyzer shall be designed for ease of manual calibration and adjustment.

A-8.12.1.12.d Each analyzer shall include a panel meter for display of monitoring data.

A-8.12.1.13 Data Acquisition and Handling System (DAHS)

A-8.12.1.13.a The Buyer will provide the DAHS server to meet corporate build requirements, which will be located in one of the LAN network cabinets in the Administration Building LAN room. The Seller shall provide the Buyer with the software, configuration, licenses, activation codes, etc. for the ESC Stack Vision software.

A-8.12.1.13.b The Data Loggers shall be connected to the Plant LAN to communicate with the DAHS server.

A-8.12.2 CEMS Enclosure

A-8.12.2.1 All non-stack-mounted devices except the gas cylinders and the CEMS DAS system shall be enclosed in a pre-engineered steel enclosure. The enclosure roof and siding shall be constructed out of insulated metal siding with interior panels. The enclosure shall be walk-in type constructed in accordance with applicable national, regional, and local building code requirements. The Seller shall furnish fully redundant heating, ventilation, and air conditioning equipment for personnel comfort and equipment protection. The CEMS enclosure shall have a 6'x 2' table and upper and lower cabinets. Space shall be allocated in the CEMS enclosure for another CEMS rack and analyzers to be installed for CTGs discharge emissions.

A-8.12.2.2 Gas cylinders shall be enclosed in a rigid frame rack with a protective rain hood, be convenient for cylinder change out, and be mounted outside the CEMS enclosure.

A-8.12.2.3 Analyzers shall be mounted on a rack, completely piped, and wired with all field sample tubing and electrical wiring connections terminating at bulkhead tubing fittings and electrical junction boxes.

A-8.12.2.4 The Seller shall configure the shelter so that all penetrations are on the side of the shelter closest to the stack.

A-8.12.2.5 CEMS Power Supply:

A-8.12.2.5.a The shelter main power entrance shall be configured for side feed. Power distribution panels shall be provided to receive two (2) 480-VAC, 3-phase, 60-Hertz, unregulated power supply feeds and one (1) 120-VAC, 1-phase, 60 Hz UPS for the following services by the Seller:

A-8.12.2.5.b 480V auto-transfer switch

A-8.12.2.5.c 480V to 208/120-volt transformer

A-8.12.2.5.d Heating, ventilating and air conditioning equipment.

A-8.12.2.5.e Lighting and power receptacles

A-8.12.2.5.f Power distribution panels, which shall have an interrupting capacity of 65,000 rms symmetrical.

A-8.12.2.5.g The Facility UPS electrical power supply, which shall be used for the CEMS analyzers, controllers, monitors, controls, instrumentation, and other monitoring accessory equipment.

A-8.12.2.5.h All electrical protection equipment and accessories, distribution panels, circuit breakers, etc., which shall be provided by the Seller.

A-8.12.2.6 Heating, Ventilation and Air Conditioning (HVAC):

A-8.12.2.6.a All HVAC equipment shall be suitable for use in industrial or heavy commercial environments and shall have a three-phase 480V rating. Insulation, air-conditioning/heating shall be provided to maintain interior environment at conditions required for the housed equipment constraints. The insulation shall be adequate for the size of the HVAC system.

A-8.12.2.6.b HVAC shall be provided to maintain the shelter's inside temperature between 68ºF and 75ºF, and 50% relative humidity the year round, with or without the inside equipment running (see Attachment A.9 for ambient weather condition requirements).

A-8.12.3 FACTORY ACCEPTANCE TESTING

A-8.12.3.1 The Seller shall perform a complete functional acceptance test (FAT) of the CEMS at the factory before shipment of any equipment to the Project site. The CEMS shall be fully interfaced with the Data Loggers and the data acquisition system to demonstrate full integration of the systems' hardware and software. The FAT shall involve the use of NO_X, CO, and O_2 gases which will be sampled through a complete sampling system (where applicable), set up in the same manner as it will be set up in the field. The FAT shall cover and demonstrate all functions to be performed by the CEMS including but not limited to: (1) automatic calibration drift check, (2) manually initiated calibration drift check, (3) all status indicator functions, (4) all alarm condition functions, (5) all programmable logic controller functions (including but not limited to successful data transfer out of the communication ports), (6) all data acquisition system functions, (7) all hardwired signal to Facility DCS, and (8) Linearity and software calculation review.

A-8.13 Vibration Monitoring System

A-8.13.1 All medium voltage motors and driven equipment shall be either furnished with vibration monitoring equipment or provided with mounting plates for possible future installation of vibration monitoring equipment.

A-8.13.2 Vibration monitoring shall be provided for select rotating equipment deemed critical to the operational process as listed below:

- Steam Turbine/Generator
- Boiler Feed Pump(s)
- Combustion Turbine/Generator
- ACC Fans

A-8.13.3 Each lineup of critical equipment referenced in the previous paragraph, except ACC Fans, shall be supplied with Alta Solutions AS-7000 (preferred) or Bently Nevada 3500 (acceptable) vibration monitoring system. The ACC Fans shall be supplied with vibration sensors/transmitters, which shall be wired to the DCS.

A-8.13.4 Axial displacement shall be monitored if recommended by the equipment Subcontractor. If axial displacement is monitored, two probes shall be provided in accordance with API-670.

A-8.13.5 Each bearing shall be monitored in both the x and y directions (at 45° and 135° angles of the horizontal plane) and a Keyphasor will be included for each lineup.

A-8.13.6 Vibration inputs shall be continuously monitored in the vibration monitoring system and separate alarm and trip points for each lineup shall be available for use in the Facility DCS. An alarm point shall be provided which shall be initiated before the trip point.

A-8.13.7 Vibration monitoring input tagging shall be descriptive to facilitate operator identification of input equipment identity.

A-8.13.8 HRSG Ammonia Dilution (SCR) Fans bearings to be provided with vibration transducers and temperature measurements which shall be connected to Facility DCS.

A-8.13.9 The vibration monitoring package shall be perpetual, royalty free package.

A-8.13.10 The computer or server can be located in the Facility DCS network room, but the monitor shall be on the control room engineering console.

A-8.14 Weather Station

Seller shall furnish and install a weather station to monitor ambient temperature, relative humidity, rain gauge, and wind gauge. These measurements shall be fed to Facility DCS and shall be available to plant operator through HMI displays.

END OF ATTACHMENT A-8