# Passaic Valley Sewerage Commission



"Protecting Public Health and the Environment"

#### REQUEST FOR PROPOSAL FOR GOODS AND SPECIAL SERVICES FOR PASSAIC VALLEY SEWERAGE COMMISSION

#### POWER GENERATION SYSTEM PROCUREMENT CONTRACT

NJEIT Project No. S340689-23

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Passaic Valley Sewerage Commission 600 Wilson Avenue Newark, New Jersey 07105

### MAY 2018

Date: DOMENICK A. LOSCHIAVO, P.E. N.J. Professional Engineer – Lic. No. GE 52430

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#### NOTICE INVITING PROPOSALS

The Passaic Valley Sewerage Commission (PVSC) is soliciting proposals from qualified Proposers to provide a Power Generation System in support of its Federal Emergency Management Agency (FEMA) Resiliency Program as specified herein.

#### <u>CONTRACT NO. B129</u> <u>POWER GENERATION SYSTEM PROCUREMENT</u>

Proposals are to be enclosed in opaque sealed envelopes, addressed to the **Passaic Valley Sewerage Commission, Purchasing Department, Public Meeting Room of the Administration Building, 600 Wilson Avenue, Newark, New Jersey 07105**, with name and address of Proposer, Contract Numbers, Contract Name and Proposal Submission Date plainly marked outside. Proposals will be accepted by mail. Proposals must be sealed and identified as indicated above, enclosed in a mailing envelope with proper postage, and received during the time set for receiving proposals.

Sealed Proposals shall be received by PVSC on **Month Day**, 2018 until 10:00 a.m. in the morning, prevailing time. Proposals shall be opened publicly and read aloud on **Month Day**, 2018 at 10:00 a.m. at PVSC's Public Meeting Room in PVSC's Administration Building.

Proposals may be withdrawn or modified prior to the time for the opening of proposals or the authorized postponement thereof. No proposal may be withdrawn for a period of sixty (60) calendar days after the date of the opening of proposals.

Point of Contact for RFP Inquiries:	Thomas Fuscaldo
	Purchasing Agent
	Email: tfuscaldo@pvsc.com
	Telephone: (973) 817-5702

The person listed above is the only point of contract for any inquiries regarding any aspect of this Request for Proposal (RFP).

In the event that a potential proposer obtains the RFP in any manner other than as specified herein, the PVSC will not have the contact information of the potential Proposer for purposes of issuing addenda, if any. The non-receipt of any addenda (in the event that any addenda are issued) and the failure of the Proposer to acknowledge the receipt of any and all addenda at the time of proposal submission shall be considered a fatal defect in such Proposer's submission and said proposal shall be immediately rejected. Therefore, if a potential proposer obtains the RFP in any manner other than as specified herein, said Proposers shall promptly provide written notice to PVSC accordingly.

A pre-proposal meeting and tour of the Point of Destination will be held on **Month Day, 2018 at 10:00 a.m**. The meeting will take place at PVSC's Operations Engineering & Maintenance (OEM) Building Main Conference Room, second floor, 600 Wilson Avenue, Newark, New Jersey, 07105, with site visit to follow.

The Contract is expected to be funded in part with funds from FEMA, the New Jersey Department of Environmental Protection (NJDEP) and the New Jersey Environmental Infrastructure Trust (NJEIT). Neither the United States nor the State of New Jersey, the NJEIT, nor any of their departments, agencies, or employees is, or will be, a party to the Contract or any lower tier contract or subcontract.

Passaic Valley Sewerage Commission Joseph Kelly Clerk

### **SECTION 1: INTRODUCTION**

#### 1.1 **Procurement Procedure**

PVSC is not subject to the Local Public Contracts Law (N.J.S.A. 40A:11-1 et seq.) However, in keeping with longstanding PVSC policy, this contract will be awarded using the Competitive Contracting provisions of the Local Public Contracts Law ("LPCL") (N.J.S.A. 40A:11-4.1 et seq.) as a guide with the goal of procuring the required services and equipment by means of a competitive and transparent process.

Proposals will be evaluated in accordance with the criteria set forth in this Request for Proposals (RFP). At its sole discretion, PVSC's Board of Commissioners will approve a resolution awarding a contract to the successful Proposer for a sum not to exceed a specified amount.

#### **1.2** Competitive Contracting

As set forth in Section 3.1, this contract award will be guided by the Competitive Contracting provisions of the Local Public Contracts Law (N.J.S.A. 40A:11-4.1 et seq.).

PVSC has structured a procurement process that seeks to obtain the desired equipment and services, while establishing a competitive environment to assure that each person and/or firm is provided an equal opportunity to submit a proposal in response to the RFP. Proposals will be evaluated in accordance with the criteria set forth in Section 7 of this RFP, which will be applied in the same manner to each Proposal received.

#### 1.3 **Purpose of Solicitation**

The Passaic Valley Sewerage Commission (PVSC) is seeking proposals from qualified Firms (Proposers) for services of, but not limited to, engineering, design, manufacturing and field support services for a Power Generation System as described herein. All Proposers submitting proposals are responsible for examining the entire RFP. Failure to do so shall be at the Proposer's risk.

### 1.4 **Project Background**

The PVSC owns and operates a 330 million-gallon-per-day secondary wastewater treatment facility (WWTF) located in Newark, New Jersey, one of the half-dozen largest modern wastewater facilities in the United States. In the early 1980's, PVSC underwent a major expansion at which time most of the facility's process treatment equipment was installed and placed in service.

The 140-acre site is generally located at the intersection of Wilson Avenue and Doremus Avenue in Newark, New Jersey. Doremus Avenue provides the separation between the eastern and western parts of the project site. Connecting the two sides is a 450-ft long bridge that goes over Doremus Avenue. Immediately adjacent to the PVSC site to the east is the Newark Bay.

In the wake of Superstorm Sandy, many of PVSC's facilities suffered extensive damage due to flood waters that submerged much of the plant. This flooding was due in part to loss of electrical power at the treatment plant. As a result, PVSC has chosen to design and install a standby power generation system that can provide sufficient power for all treatment plant needs in case of a similar event. Power provided by the new generation facilities will tie into existing Electrical

Substation No. 1 (which is located within the Plant's property boundary) and distributed throughout the plant by the existing power distribution system.

# 1.5 Attachments

The following attachments are included with this Request for Proposals.

Attachment A – PVSC Mandatory Forms

- PVSC Proposal Transmittal Letter
- Two-Year Chapter 51/Executive Order 117 Vendor Certification and Disclosure of Political Contributions
- New Jersey Business Registration Certificate
- Proposal Security (P-00301)
- Consent of Surety (P-00302)
- Proposer's Affidavit (P-00303)
- Non-Collusion Affidavit (P-00304)
- Statement of Ownership (P-00305)
- Affirmative Action Affidavit (P-00306)
- Acknowledgement of Receipt of Changes to RFP Form (P-00307)
- Disclosure of Investments Activities in Iran (P-00406)
- Attachment B Technical Documents Required with Proposal (P-00350)

Attachment C – Cost Proposal Form

Attachment D – Qualification Form (P-00400)

Attachment E – Contract Agreement (P-00500), Maintenance Bond Form (P-00601), Performance Bond Form (P-00610) and Payment Bond Form (P-00615)

Attachment F – General Conditions (P-00700) and Supplementary Conditions (P-00800)

Annex A – Technical Specifications and Performance Requirements

# **SECTION 2: INSTRUCTION TO PROPOSERS**

# 2.1 Proposal Submission Requirements

To be responsive, Proposals must provide all requested information, and must be in strict conformance with the instructions set forth herein. Proposals and all related information must be bound, and signed and acknowledged by the Respondent.

# 2.1.1 Number of Copies

Respondents must submit one signed original and ten (10) copies of their proposal and one (1) softcopy file in PDF format that is indexed and text searchable on Compact Disc.

# 2.1.2 Proposal Format

To facilitate a timely and comprehensive evaluation of all submitted Proposals, it is essential that all Respondents adhere to the required response format. PVSC requires a standard format for all Proposals submitted to ensure that clear, concise and complete statements are available from each Respondent in response to requirements. The required format is detailed in Section 5.

PVSC is not under any obligation to search for clarification through additional or unformatted information submitted as a supplement to the formatted response. Where a proposal contains

conflicting information, PVSC at its option may either request clarification or may consider the information unresponsive.

# 2.1.3 Proposal Security

Each proposal shall be accompanied by a proposal security in one of the following forms:

- Cashier's check or certified check drawn on a solvent bank, payable to "Passaic Valley Sewerage Commission," for an amount equal to ten percent (10%) of the total maximum amount of the Proposer's Cost Proposal but not exceeding \$20,000; or
- A satisfactory corporate surety proposal bond or a Letter of Credit for an amount equal to ten percent (10%) of the total maximum amount of the Proposer's Cost Proposal, but not exceeding \$20,000, may accompany the proposal.

If Proposer elects to submit a Letter of Credit, it must be issued by the United States of America office of a commercial bank or trust company with assets of at least \$10 Billion and credit rating of at least A- by Standard & Poor's and at least A3 by Moody's.

Said security shall serve as a guarantee that the successful Proposer shall, within sixty (60) calendar days from the date established pursuant to Section 8.01 of the award of the contract, enter into a valid contract with PVSC for said Work in accordance with the Contract Documents, at which time the Proposal Security will be returned to all Proposers.

# 2.2 Addenda or Amendments to RFP

During the period provided for the preparation of responses to the RFP, the PVSC may issue, clarifications, addenda, amendments or answers to written inquiries. Those addenda will be noticed by the PVSC and will constitute a part of the RFP. All responses to the RFP shall be prepared with full consideration of the addenda issued prior to the proposal submission date.

All communications concerning this RFP or the RFP process shall be directed to the PVSC's **Point of Contact**, in writing, via fax or e-mail. Responses to all questions will be forwarded as addenda to all prospective respondents who have provided accurate and current contact information (mailing address, fax number, e-mail address) to PVSC.

Subsequent to issuance of this RFP, the PVSC (through the issuance of addenda to all persons and/or firms that have received a copy of the RFP) may modify, supplement or amend the provisions of this RFP in order to respond to inquiries received from prospective Respondents or as otherwise deemed necessary or appropriate by (and in the sole judgment of) the PVSC.

# 2.3 Sales Tax

Proposers shall be aware PVSC is exempt from payment of sales tax on all goods and services to be provided under the project. Proposers shall follow requirements as described in Article 5 of the Procurement Supplementary Conditions (Attachment F) regarding sales tax.

# 2.4 Collusion

The proposal of any Proposer or Proposers who engage in collusion shall be rejected. Any Proposer who submits more than one proposal in such manner as to make it appear that the proposals submitted are on a competitive basis from different parties shall be considered a collusive Proposer. The PVSC may reject the proposals of any collusive Proposer upon proposal opening. However, nothing in this section shall prevent a Proposer from superseding a proposal by a subsequent proposal delivered prior to proposal opening which expressly revokes the previous proposal.

# **SECTION 3: GENERAL INFORMATION**

### **3.1** Evaluation Committee

Proposals will be reviewed and evaluated by a committee appointed by the PVSC's Executive Director. The proposals will be reviewed to determine if the Respondent has met the qualifications, professional, administrative and subject area requirements described in this RFP. Pursuant to N.J.A.C. 5:34-4.3, "the names of the individuals who serve as committee members shall not be publicly disclosed until the evaluation report is presented to the governing body."

#### 3.2 **Procurement Schedule**

The steps involved in the process and the anticipated completion dates are set forth in the Procurement Schedule below. The PVSC reserves the right to, among other things, amend, modify or alter the Procurement Schedule upon notice to all potential Respondents.

Commissioner Approval of Resolution	November 13, 2017
Issuance of Request for Proposal	April 5, 2018
Pre-Proposal Meeting	April 19, 2018
Deadline for Questions	May 3, 2018
Issuance of Clarification/Addenda	May 17, 2018
Receipt of Proposals	May 31, 2018
Meeting with Proposers	June 21, 2018
Completion of Evaluation of Proposals	July 19, 2018
Anticipated Notice of Intent to Award	September 13, 2018
Executed Contract	October 11, 2018
Notice to Proceed	October 18, 2018

### **3.3** Qualification Evaluation

Proposals will be evaluated initially on the basis of the Qualifications Criteria listed below. Proposals which do not meet the Qualification Criteria will be deemed non-responsive and their Proposals will not be considered. Proposals that meet the Qualification Criteria will be evaluated initially on the basis of the evaluation criteria contained in the written response to the RFP. Proposers may be invited to make an oral presentation to the Evaluation Committee.

• The Proposer is required to be experienced and an expert in the supply of combustion turbine generators for simple cycle power plants. The Proposer shall be a combustion turbine generator Original Equipment Manufacturer (OEM) and shall be the sole entity responsible for providing all equipment specified herein, no exceptions.

- Proposer's equipment that comprises the Power Generation System shall provide 34 Megawatt (MW) (net) electrical power per the equipment type, quantity and configuration as described in the Technical Specification (Annex A).
- Proposer's equipment shall meet the exhaust emissions guarantee requirements set forth in the Technical Specification (Annex A).
- Proposer's equipment shall meet allotted spatial requirements per the orientation described as presented in the Technical Specifications (Annex A).
- Proposer's combustion turbine generator experience shall include at least ten (10) units of 17 MW or greater capacity within the last five (5) years having operated greater than 5,000 hours.
- To demonstrate Proposer's qualifications to provide the Goods and Special Services, each Proposer must submit with Proposal a fully completed Qualification Form. Failure to submit a completed Proposer's Qualification Form may lead to the Proposer being deemed as non-responsive. The information supplied by the Proposer on the Proposer's Qualification Form will be used to ascertain the Proposer's history, reputation, organization and capacity for satisfactory and faithful performance of their work and work of a similar character and will not otherwise be made public, except as provided by law.
- PVSC may make such additional investigation as it deems necessary to determine the qualifications of Proposer to perform the Work and Proposer shall furnish to PVSC all such information and data for this purpose as PVSC may request. PVSC reserves the right to reject any proposal if the evidence submitted by, or investigation of, such Proposer fails to satisfy PVSC that such Proposer is properly qualified to carry out the obligations of the Agreement, and to complete the Work contemplated therein.
- An initial review will be performed of all proposals confirming the Proposer and Proposer's Power Generation System meets the qualifications as stated in the RFP. Any proposal deemed to not have met the qualification will not be considered further.

### 3.4 Written Proposal

Prospective Firms must submit a written proposal in a format specified by the PVSC. The required format is detailed in Section 5.

### 3.5 Softcopy version of RFP

Prospective respondents who have obtained printed copies of this RFP and who have provided accurate and current contact information (mailing address, fax number, e-mail address) to the Division of Purchasing, may request a softcopy version of this RFP. Softcopy versions will be provided as a PDF file only.

### 3.6 Definitions

The following definitions shall apply to and are used in this Request for Proposal (RFP):

"PVSC" - refers to the Passaic Valley Sewerage Commission.

"RFP" – refers to this Request for Proposals, including any amendments thereof or supplements thereto.

"Competitive Contracting" – refers to the process being utilized as a guide by PVSC in evaluating proposals and awarding the subject Contract.

"Proposers" or "Respondents" – refers to the interested persons and/or firm(s) that submit a Proposal.

"Contractor" or "Seller" - refers to the Proposer to which the contract is awarded.

# SECTION 4: GENERAL TERMS AND CONDITIONS

### 4.1 Rights of the PVSC

The PVSC reserves, holds and may exercise, at its sole discretion, the following rights and options with regard to this RFP and the procurement process in accordance with the provisions of applicable law:

- a. To conduct investigations of any or all of the Respondents, as the PVSC deems necessary or convenient, to clarify the information provided as part of the Proposal and to request additional information to support the information included in any Proposal.
- b. To suspend or terminate the procurement process described in this RFP at any time (at its sole discretion.) If terminated, the PVSC may determine to commence a new procurement process or exercise any other rights provided under applicable law without any obligation to the Respondents.
- c. To reject all Proposals pursuant to Law.

### 4.2 Disposition of RFP

Upon submission of a Proposal in response to this RFP, the Respondent acknowledges and consents to the following conditions relative to the submission and review and consideration of its Proposal:

All Proposals shall become the property of the PVSC and will not be returned.

All Proposals will become public information at the appropriate time, as determined by the PVSC (in the exercise of its sole discretion) in accordance with law.

### 4.3 Cost of Proposal Preparation

Each Proposal and all information required to be submitted pursuant to the RFP shall be prepared at the sole cost and expense of the Respondent. There shall be no claims whatsoever against the PVSC, its officers, officials or employees for reimbursement for the payment of costs or expenses incurred in the preparation of the Proposal or other information required by the RFP.

### 4.4 Buy American

While N.J.S.A. 40A:11-18 provides that only manufactured and farm products of the United States, whenever available, must be used in such work, PVSC may, in its reasonable discretion consider foreign products based on cost quality and other factors, as compared to American-made products. Delta Chemical Corp. vs. Ocean County Utilities Authority, et al, 231 N.J. Super. 180, 196 (Law Div. 1988), rev'd in part, aff'd in part, 250 N.J. Super. 395 (App. Div. 1991).

#### 4.5 Equal Employment Opportunity/Affirmative Action and Business Registration Certificate Requirements

The Contractor is required to comply with requirements of P.L. 1975, c. 127, the Law Against Discrimination and with N.J.A.C. 17:27-1.1 et seq, and N.J.S.A. 10:5-31, the Affirmative Action Rules.

A party responding to this RFP must indicate what type of business organization it is e.g., corporation, partnership, sole proprietorship, or non-profit organization. If a party is a subsidiary or direct or indirect affiliate of any other organization, it must indicate in its proposal the name of the related organization and the relationship. If a party responding to this RFP is a corporation it shall list the names of those stockholders holding 10% or more of the outstanding stock.

#### 4.5.1 Equal Employment Opportunity/Affirmative Action Requirements

Firms are required to comply with the provisions of N.J.S.A. 10:5-31 and N.J.A.C. 17:27 et seq. No firm may be issued a contract unless it complies with these affirmative action provisions. The Mandatory Equal Employment Opportunity/ Affirmative Action Language for Goods, Professional Services and General Service Contracts, Exhibit A summarizes the full required regulatory text.

Goods and Services (including professional services) Firms/contractors shall submit to the public agency, after notification of award but prior to execution of a goods and services contract, one of the following three documents:

- a. A photocopy of a valid letter that the contractor is operating under an existing Federally approved or sanctioned affirmative action programs (good for one year from the date of the letter); or
- b. A photocopy of a Certificate of Employee Information Report approval, issued in accordance with N.J.A.C. 17:27-4; or
- c. A photocopy of an Employee Information Report (Form AA302) provided by the Division and distributed to the public agency through the Division's website at: http://www.state.nj.us/treasury/contract\_compliance to be completed by the contractor, in accordance with N.J.A.C. 17:27-4.

The Firm's attention is also called to Section 5.1 of this document which contains the required information and forms. For information on EEO/AA requirements and forms only, please contact RFP Point of Contact identified in the Notice of Inviting Proposals section.

### 4.5.2 Business Registration Certificate

P.L. 2009, c. 315 (Chapter 315) amends and supplements the business registration provisions of N.J.S.A. 52:32-44 which impose certain requirements upon a business competing for or entering into a contract with a local contracting agency whose contracting activities are subject to the requirements of the Local Public Contracts Law (N.J.S.A. 40A:11-2).

Firms are required to comply with the requirements of P.L. 2009, c. 315 (Chapter 315) which include submitting a copy of their Business Registration Certificate (BRC), issued by the NJ Department of the Treasury, prior to contract award.

### 4.6 Public Law 2005, Chapter 51, formerly Executive Order No. 134 (2004)

<u>Requirements</u>. In order to safeguard the integrity of New Jersey State Government procurement by imposing restrictions to insulate the award of State contracts from political contributions that pose the risk of improper influence, purchase of access, or the appearance thereof, by Public Law 2005, C.51 (hereinafter, "Chapter 51") requires the submission of the Certification and Disclosure Form the Statement of Ownership in Attachment A. The terms and conditions set forth in this Section are material terms of this procurement and any Agreement with PVSC resulting herefrom.

<u>Definitions.</u> For the purpose of this Section, the following definitions shall be in force:

- a) Contribution means a contribution reportable by the recipient under "The New Jersey Campaign Contributions and Expenditures Reporting Act." P.L. 1973, c. 83 (C.19:44A-1 et seq.), and implementing regulations set forth at N.J.A.C. 19:25-7 and N.J.A.C. 19:25-10.1 et seq. As of January 1, 2005, contributions in excess of \$300 during a reporting period are deemed "reportable" under these laws for all contracts awarded in excess of \$17,500.00 after October 15, 2004.
- b) Business Entity means any natural or legal person, business corporation, professional services corporation, Limited Liability Company, partnership, limited partnership, business trust, association or any other legal commercial entity organized under the laws of New Jersey or any other state or foreign jurisdiction. It also includes (i) all principals who own or control more than 10 percent of the profits or assets of a business entity or 10 percent of the stock in the case of a business entity that is a corporation for profit, as appropriate; (ii) any subsidiaries directly or indirectly controlled by the business entity; (iii) any political organization organized under 26 U.S.C.A. Section 527 that is directly or indirectly controlled by the business entity, other than a candidate committee, election fund, or political party committee; and (iv)if a business entity is a natural person, that person's spouse or child, residing in the same household.

Pursuant to Chapter 51, all business entities which have been awarded a State contract after October 15, 2004, in an amount in excess of \$17,500, have a continuing obligation to disclose all contributions made during the term of such contract.

Such disclosures are to be submitted to PVSC using the standard certification and disclosure form, which may, be downloaded from the Division of Purchase and Property's website.

Questions regarding Public Law 2005, Chapter 51 (N.J.S.A. 19:44A-20.13-20.25, superseding Executive Order 134 (2004)) including whether all "principals" of the respondent have submitted the necessary forms should be directed to the Department of the Treasury, Division of Purchase and Property, <u>http://www.state.nj.us/treasury/purchase/execorder134.shtml</u>.

# 4.7 Notice To All State Vendors: Set-Off For State Tax

Please be advised that, pursuant to L. 1995, c. 159, effective January 1, 1996 and codified at N.J.S.A. 54:49-19 and N.J.S.A. 54:49-20, and notwithstanding any provision of the law to the contrary, whenever any taxpayer, partnership or S corporation under contract to provide goods or services or construction projects to the State of New Jersey or its agencies or instrumentalities, including the legislative and judicial branches of State government, is entitled to payment for those goods and services or construction projects, at the same time a taxpayer, partner or shareholder of that entity is indebted for any State tax, the Director of the Division of Taxation shall seek to set off that taxpayer's, partner's or shareholder's share of the payment of that indebtedness. The amount set off shall not allow for the deduction of any expenses or other deductions which might be attributable to the taxpayer, partner or shareholder subject to set off.

The Division of Taxation may initiate procedures to set off the tax debt of a specific vendor upon the expiration of ninety (90) days after either the issuance by the Division of a notice and demand for payment of any state tax owed by the taxpayer or the issuance by the Division of a final determination on any protest filed by the taxpayer against an assessment or final audit determination. A set-off reduces the contract payment due to a vendor by the amount of that vendor's state tax indebtedness or, in the case of a vendor-partnership or vendor S-corporation, by the amount of state tax indebtedness of any member-partner or shareholder of the partnership or S corporation, respectively N.J.A.C. 18:2-8.3.

The Director of the Division of Taxation shall give notice of the set-off to the taxpayer, partner or shareholder and shall provide an opportunity for a hearing within thirty (30) days of such notice under the procedures for protests established under N.J.S.A. 54:49-18. No requests for conference, protest or subsequent appear to the Tax Court from a protest permitted under N.J.S.A. 54:49-19 shall stay the collection of the indebtedness. Interest that may be payable by the State to the taxpayer, pursuant to L. 1987, c 184 (N.J.S.A. 52:32-32) shall be stayed.

# 4.8 Authority to Audit or Review Contract Records

Per N.J.S.A. 52:15C-14(d) et seq., the Engineer shall maintain all documentation related to products, transactions or services under this contract for a period of five (5) years from the date of final payment. Such records shall be made available to the New Jersey Office of the State Comptroller upon request.

# 4.9 Integrity Oversight Monitor Act

Respondent agrees to ensure that proper internal controls are in place such that projects are in compliance with the requirements of Integrity Oversight Monitor Act, P.L. 2013, Chapter 37 (N.J.S.A. 52:15D-1 et seq.).

The Integrity Oversight Monitor Act was enacted authorizing the deployment of oversight monitors in the implementation of recovery and rebuilding contracts, resulting from Superstorm

Sandy and other major storms in NJ, in order to prevent, detect, and remediate waste, fraud, and abuse.

# 4.10 Notice of Executive Order 125 Requirement for Posting of Winning Proposal and Contract Documents

Pursuant to Executive Order No. 125, signed by Governor Christie on February 8, 2013, the Office of the State Comptroller ("OSC") is required to make all approved State contracts for the allocation and expenditure of federal reconstruction resources available to the public by posting such contracts on an appropriate State website. Such contracts are posted on the New Jersey Sandy Transparency website located at:

### http://nj.gov/comptroller/sandytransparency/contracts/sandy/

The contract resulting from this project is subject to the requirements of Executive Order No. 125. Accordingly, the OSC will post a copy of the contract, including the project, the winning Firm's proposal and other related contract documents for the above contract on the Sandy Transparency website.

In submitting its proposal, a proposer may designate specific information as not subject to disclosure. However, such proposer must have a good faith legal and/ or factual basis to assert that such designated portions of its proposal (i) are proprietary and confidential financial or commercial information or trade secrets or (ii) must not be disclosed to protect the personal privacy of an identified individual. The location in the proposal of any such designation should be clearly stated in a cover letter, and a redacted copy of the proposal should be provided.

The State reserves the right to make the determination as to what is proprietary or confidential, and will advise the winning proposer accordingly. The State will not honor any attempt by a winning Firm to designate its entire proposal as proprietary, confidential and/or to claim copyright protection for its entire proposal. In the event of any challenge to the winning proposer's assertion of confidentiality with which the State does not concur, the proposer shall be solely responsible for defending its designation.

# 4.11 Meaning or Intent of RFP

Should any difference arise as to the meaning or intent of this RFP, Proposer shall request clarification from PVSC. PVSC's decision shall be final and conclusive.

# 4.12 Contract Form

If selected to provide equipment and services, it is agreed and understood that the successful Respondent shall be bound by the requirements and terms contained in this RFP and the final contract and the forms as presented in Attachments E and F with regard to services performed, equipment supplied, payments, indemnification, insurance, termination, provisions governing assignment of the Contract and any applicable licensing provisions.

It is also agreed and understood that the acceptance of the final payment by Contractor shall be considered a release in full of all claims against the PVSC arising out of, or by reason of, the work done and materials furnished under this Contract.

#### 4.12.1 Compliance with Contract Form and Technical Specifications

The Proposer shall state that the submitted proposal agrees and complies with the terms and conditions and all technical requirements of this RFP or list such Proposer exceptions. If exceptions are taken, it is required the Proposer first propose modifications to the contract terms and specifications and then provide itemized exceptions with applicable cost pricing for evaluation purposes. A blank statement that Proposer's commercial terms and conditions shall apply in lieu of the Contract Form will not be acceptable. Failure to comply with this requirement may be cause for elimination of the Proposer's proposal from consideration.

#### 4.12.2 Contract Security

Article 5 of Section P-00700 Standard General Conditions for Procurement Contracts and in the Supplementary General Conditions set forth PVSC's requirements as to Performance and Payment Bonds (Specification Section P-00600). When the successful Proposer delivers the executed Contract to PVSC, it must be accompanied by the required Maintenance, Performance and Payment Bonds and Insurance.

#### 4.12.3 Contract to be Assigned

Proposer's attention is directed to the provisions of Paragraph 10.2 of Section P-00500 Contract Agreement, which provide for the future assignment of this Contract for furnishing Goods and Special Services covered by RFP to an Installation Contractor to be selected by PVSC after the date of execution of this Contract. Timing of the assignment is set forth in the Agreement. Forms documenting the assignment of the Contract and for the agreement of the Proposer's surety to such assignment are included as attachments to the Agreement.

### SECTION 5: WRITTEN PROPOSAL FORMAT

Proposals must address all information requested in this RFP. Proposals which in the judgment of the PVSC fail to meet the requirements of the RFP or which are in any way conditional, incomplete, obscure, contain additions or deletions from requested information, or contain errors may be rejected.

#### 5.1 Mandatory Content

Each proposal submitted must contain the following sections:

- Proposal Transmittal Letter
- Cover Sheet
- Table of Contents
- Qualification Form (P-00400)
- Executive Summary
- Organization chart demonstrating the Proposer's understanding as the sole entity responsible to furnish the equipment comprised of the Power Generation System. Organization chart shall illustrate the project organization that the Proposer would put in

place to execute the project with an illustration of the relationship between and amongst the Proposer and equipment suppliers.

- Project Approach
  - Proposer's approach/plan to meet the requirements and objectives of the RFP
  - Proposer's delivery schedule of required submittals and equipment
- Power Generation System
  - Combustion Turbine Generator Set Description, including Exhaust Stack and Emissions Control Equipment
  - o Gas-Fired Black Start Generator Set Description
  - Fuel Gas Compressor Description
  - Electrical & Instrumentation Controls Description
- Technical Documentation
  - Technical Documents Required with Proposal (P-00350)
- Contract Form and Technical Specifications
  - Commercial Comments and Clarifications
  - Technical Comments and Clarifications
- Pricing
  - o Cost Proposal Form
  - Itemized Exceptions Cost Pricing (Add/Deduct)
- Mandatory Forms
  - Two-Year Chapter 51/Executive Order 117 Vendor Certification and Disclosure of Political Contributions
  - o New Jersey Business Registration Certificate
  - Proposal Security (P-00301)
  - Consent of Surety (P-00302)
  - Proposer's Affidavit (P-00303)
  - Non-Collusion Affidavit (P-00304)
  - Statement of Ownership (P-00305)
  - Affirmative Action Affidavit (P-00306)
  - Acknowledgement of Receipt of Changes to RFP Form (P-00307)
  - Disclosure of Investments Activities in Iran (P-00406)

All proposals submitted in response to the RFP shall utilize the form of correspondence (Proposal Transmittal Letter, appended to Attachment A) hereof as the transmittal letter of such proposal. There shall be attached to said transmittal letter succeeding pages setting forth the remainder of the proposal.

To meet the requirements of the RFP, the form of attachments or certifications set forth herein shall be fully completed and executed.

### **SECTION 6: SCOPE OF SERVICES**

The natural gas-fired standby power generation facility is required to support the entire PVSC electric load allowing the WWTF to function indefinitely upon loss of the utility electric supply. As such, the successful respondent shall furnish and deliver 34-Megawatt (net electrical output) Power Generation System in accordance with the Technical Specifications as presented in Annex A, consisting of, but not limited to:

- Combustion Turbine Generators,
- Exhaust Stacks and Emission Controls,
- Fuel Gas Compressors and
- Gas-Fire Black Start Generators.

Additionally, successful proposal shall also provide:

- design services consisting of system design,
- shop drawings,
- rigging and installation instructions,
- preservation and storage instructions,
- commissioning spare parts, and
- operations and maintenance manuals.

Additionally, successful proposer shall perform and provide services for

- shop testing,
- installation oversight,
- commissioning support,
- performance testing support and witness, and
- equipment and operational training of PVSC staff.

#### **SECTION 7: PROPOSAL EVALUATION**

PVSC's objective in soliciting Proposals is to enable it to select a Respondent that will provide high quality and cost-effective services to PVSC. PVSC will consider Proposals only from Respondents that, in PVSC's sole judgment, have demonstrated the capability and willingness to provide high quality services to PVSC in the manner described in this RFP.

An initial review will be performed on all proposals submitted to determine responsiveness to the following requirements:

- 1. minimum qualifications that must be met as required by the RFP,
- 2. functional technical requirements of the project, and
- 3. any technical and commercial exceptions proposed that PVSC may consider unacceptable.

#### 7.1 Evaluation Procedure

Proposals will be evaluated initially on the basis of the written response to the RFP. The top three proposals may be invited to make an oral presentation to the Evaluation Committee. If oral presentations are made and after such presentations. The Evaluation Committee will rank the top three proposals and submit an evaluation to the Commissioners for consideration.

#### 7.2 Written Response Evaluation

There will be seven (7) criteria by which proposals will be evaluated. Each criterion will bear a certain weight, and the extent to which the criterion is met or exceeded will be determined by the committee.

<u>Cost</u> – Power Generation System will be evaluated on the total cost written on the Cost Proposal Forms submitted with the Proposal. Cost may be adjusted based on Add/Deduct(s) for exceptions within proposal.

<u>Adherence to the Terms and Conditions of the Contract</u> – The nature and extent of the clarifications and exceptions stated in the Proposer's proposal shall be considered in the evaluation of the proposal. At PVSC's discretion, contract terms and conditions may be adjusted to a mutual acceptable revision of the terms and conditions in the final executed contract. Clarifications that are unacceptable to PVSC, may cause for the proposal to be rejected.

<u>Adherence to Technical Specifications</u> – The nature and extent of the clarifications and exceptions stated in the Proposer's proposal shall be considered in the evaluation of the proposal. Exceptions or clarifications that could prevent the Power Generation System from achieving its performance requirements will be cause for rejection of proposal as determined by PVSC.

<u>Delivery Schedule</u> – The ability to deliver the Power Generation System to the Site in accordance with the overall project schedule as described in Section P-00500 Contract Agreement and as coordinated by PVSC. The delivery of submittals, the cost for equipment long term storage and the ability to meet schedule milestones will be factored into evaluation.

<u>Project Execution</u> – The ability to demonstrate Single Source Responsibility for the entire Power Generation System will be compared against the project approach to ensure the Power Generation System components are delivered on time, coordinate with each other and are properly integrated with the scope of the project as required by the specifications. The ability to demonstrate project management and engineering capabilities and quality assurance programs required to coordinate and deliver all project components will be factored into the evaluation.

<u>Quality of Service</u> – The capability of the Proposer's support systems will be evaluated and will consider the number of Service Representatives and their locations relative to Newark, New Jersey as well as locations of part and equipment warehouses and any other factors that affect overall service response time. Equipment historical availability will also be evaluated.

<u>Installation Requirements</u> – Since space is a premium at the WWTF, installed cost will be factored into the evaluation including building size, foundation, other structural costs and required system auxiliary equipment; as well as the physical arrangement of equipment as to ease of installation, maintenance procedures and operational requirements will be evaluated.

### 7.3 Response Weights

For each of the above written response criteria, the committee will determine the extent to which the requirements are fulfilled. The maximum possible Evaluated Score of **700 Points** is weighted for each evaluation criteria as follows:

•	Cost:	70 Points
•	Adherence to the Terms and Conditions of the Contract:	20 Points
•	Adherence to the Technical Specifications:	20 Points
•	Delivery Schedule:	10 Points
•	Project Execution:	10 Points

•	Quality of Service:	5 Points
•	Installation Requirements:	5 Points

Each criterion will be weighted by the extent to which the requirements are met. Each criterion will be scaled by the Evaluation Committee between 1 to 5 with 5 being the highest. The scale rating will then be multiplied by the weight to produce a Weighted Score for each criterion. The Weighted Score of all criterion will then be summed to provide a total Evaluated Score. The Evaluation Committee will then rank the Respondent by total Evaluated Score and the top three respondents with the highest score will be identified.

### 7.4 Oral Presentations

The oral presentations can include presentation aids, e.g. PowerPoint. The presentations will be held in a conference room at PVSC 600 Wilson Avenue Newark, NJ 07105 and will be scheduled during the month after receipt of the proposals.

# 7.5 Final Evaluation and Report of Committee

The Committee will prepare a report listing the names of all Respondents who submitted proposals and ranking these Firms in order of evaluation. The Evaluation Committee will rank the top three proposals and submit an evaluation to the Commissioners for consideration.

# SECTION 8: CONTRACT AWARD AND EXECUTION OF THE CONTRACT

# 8.1 Contract Award

The Passaic Valley Sewerage Commissioners will vote to accept the proposal of a Respondent within sixty (60) days of the receipt of proposals, except that the proposals of any Firms who consent thereto, may, at the request of PVSC, be held for consideration for such longer period as may be agreed. All Proposers must state in their Proposal that Proposer will consent to an extension of the time period to award the Contract, except that the proposals of any firms who consent thereto, may, at the request of PVSC, be held for consideration for such longer to an extension of the time period to award the Contract, except that the proposals of any firms who consent thereto, may, at the request of PVSC, be held for consideration for such, same longer period as may be agreed.

# 8.2 Execution of the Contract

When PVSC gives a Notice of Award to the Successful Proposer, it will be accompanied by the required number of unsigned counterparts of the Agreement with all other written Contract Documents attached. Within ten (10) business days thereafter Proposer (Successful Proposer) shall sign and deliver the required number of counterparts of the Agreement and attached documents to PVSC with the required Bonds. Thereafter, PVSC shall deliver one (1) fully signed counterpart to Proposer.

# **8.3** Failure to Execute Contract

If Successful Proposer shall fail or neglect to sign and execute the Agreement and bonds with ten (10) business days after Notice of Award, such failure or neglect may be deemed to be an abandonment and breach of Contract by the Proposer and shall be just cause for an annulment of the award and action for breach of contract. Upon such abandonment, PVSC shall have the authority to make an award to another Proposer or re-advertise the RFP. In addition, PVSC may exclude Proposer from submitting on subsequent PVSC projects for such a period, as the PVSC may deem appropriate.

It is understood and agreed by said Proposer that, upon notice of said failure, the surety shall pay the PVSC the amount provided for the Proposal Guarantee in accordance with the provisions of the RFP and PVSC shall be entitled to collect on any certified checks, or Performance and Payment Bonds posted as security for execution.



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ELECTRIC MACHINERY MFG. COMPANY TAG: I.II B CERTIFIED TEST RESULTS (Synchronous Mechines) ED-75 SERIAL NO. TEMP. C 517.C · AMPS. PHASE FREQ. VOLTS 11 PM #R HP David **X W** APH. FLD. 27725281 80 80 6442 267 3 60 13200 1200 8000 .0 SERVICE FACTOR 1.05 CUST. NO. CB-63102 PRODUCTS C ME TOME 1 WATER TREATMEN ALLEY 1 100 10 10 13200) = 28,54 2 2.62% Z 8 = STANDARD COMMERCIAL TESTS 6,104,440 0.69% 748 I MIN. 80 CY. HIGH POTENTIAL TEST OF 27400 VOLTS ON ARMATURE, AND 2500 ÖK VOLTS ON FIELD, TESTS. DK - FIELD AMPL SEE OND-LOAD AND 1233 OFULL-LOAD, AIR CAP 814 POLARITY OF FIELD COLLS CHECKS. EXCITER FIELD AMPS AT NO LOAD 1.52, FULL LOAD MARK 3.2 10000 MEGS ATZ3 C RES. - STATOR 950 MEGS AT 23°C, ROTOR INSULATION WITH TEST COLLENTER KINGS SATURATION, EFFICIENCIES AND LOSSES IERE IIS RIETHOD TESTS A 5280 8040 10560 11880 13200 13944 14520 15660 3460 ARM VOLTAGE OPEN-CHICUIT 59.6 70.2 82.8 91.4 ICC 29. 44 22, SATURATION FIELD CURRENT 310 350 190 267 ARMATURE CURRENT 225 SHORT-CIRCUIT 97 832 110.2 58.5 FIELD CURRENT 35,64 KW LOSSES AT RATED LOAD CORE 172 LOAD 4/4 2/4 STRAY LOAD 1432 PRIC. & WIND. 35.86 97.86 97.63 96.9 EFFICIENCY FINE EXCITER 3.7 ARMITER 26.4 45E FIELD I'R 14,9 TESTED ON 4 TEMPERATURE TEST (ZERO P.F. METHOD) DELTA CONNECTION TEST B MAXIMUM TEMPERATURE RISE C 11 TEST CONDITIONS ARM. COILS ARM. CORE FLD.COILS FLD. AMPS. HRS. RUN FLD. VOLTS ARM. VOLTS ARM, AMPS, жw 52 Z5 44.8 62.6 4 μ d 5538 462 Ľ 44. 42 1 25 TEMPERATURE RISE CORRECTED TO RATED CONDITIONS W RES, ---METHOD OF TEMPERATURE MEASUREMENT DETECTOR THROPLE L ్స SPEED - TORQUE TEST rected to Full-Valtage) TESTS C 95 2 4 6 0 PER UNIT SPEED .44 85 -96 29 58 .50 PER UNIT TORQUE RATED FULL LOAD TORQUE 35000 PT. 4.03 PER UNIT STARTING CURRENT 0 4 161% PULLOUT TORQUE OK - VIBRATION (MILS): BALANCE VERTILAL-RADIAL AXIAL 0 15 128 h .27 FRONT .34 .48 REAR APPROVED RELEASED FOR FABRICATION (Ka)= 1.14 REACTANCE SYNCHRONOUS FOR GENERAL DESIGN & LAYOUT ONCE VENDOR IS NOT RELIEVED OF RENPONSIBILITY DA ACCURACY OF DIMENSIONS, PERFORMANCE, DESIGN OF DETAILS OR ANY GODE REQUIREMENTS  $\mathcal{D}$ tir Products and Chomicale SPECIFIER ALD A REACTANCES (DERNED) Xd' 28, Xd ",18 79 8 HAR MIL DATE CENTIFIED CORRECT BY DESIGNING ENGINEER 7-15-RES and the second second a second second \* ... and share 

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OWNER COPY SUBMISSION REVIEW IS FOR GENERAL COMPLIANCE WITH CONTRACT DOCUMENTS. NO RESPONSIBILITY IS ASSUMED FOR CORRECTNESS OF DIMENSIONS OR DETAILS APPROVED HEF. NO.5.15-10 CONT. NO. 483 AP-RO ATD A HOTED RESUBMISSION NOT REQUIRED NAMECERTIFIED TEST RESULTS CORRECTIONS NECESSARY RESUBMISSION REQUIRED SPEC. SEC. NO. ITEM 5.15 NOT APPROVED ACTION NOTED ABOVE IS AUBURCT TO ALL CONTRACT REQUIREMENTS. ANTON AAN-NR BY M.N.G CHARLES A. MANGANARO SEE ENSINEER'S NOTES CAMCE 2DATE 5-22-79 REF. NO.5.15-6 DATE 5-22-79 BY M.N.G No. A Carlo 1.80 





# Sync-Rite<sup>™</sup>

Industry leading synchronous motor starting control





Microprocessor-Based Sync-Rite™



Installed on Split Rectifier Assembly

### Sync-Rite<sup>™</sup> Filter



- When paired with a SCR, Sync-Rite<sup>™</sup> Filter provides reliable protection of rotor field during motor starting
- Allows the use of field discharge resistors for extra pull-in torque
- Proven solution that's been in service since the dark ages

# **Features:**

- Sync-Rite™ reliably applies main field on any Synchronous Motor
- Microprocessor applies field at the optimal phase angle
- Speed potentiometer replaced with solid-state controls
- Upgraded solid-state electronics
- Red and Green lights indicate synchronizing status
- Interchangeable with all legacy
   Sync-Rite™ models
- Rectifier wheel design is compatible with all synchronous motor manufacturers
   Reduces spares with common
- parts across all motors
- Guaranteed in-stock

## Sync-Rite<sup>™</sup> Universal



following:

- Sync-Rite™
- Sync-Rite™ Filter
- Assembled Rectifier Wheel

For more information, please contact: E-mail: service-em@weg.net Phone: 24 Hour Customer Support: +1 (612) 247-9232



### ELECTRIC MACHINERY COMPANY

800 Central Avenue NE Minneapolis, MN 55413 United States Tel: +1 (612) 378 8000 Fax: +1 (612) 378 8051 www.electricmachinery.com

Transforming Energy into Solutions www.weg.net/us



am



CERIFIED FOR: WORIMINGTON COMPRESSORS, INC. P.O. BOX 69 BUFFALO, N.Y. 14240

CUANTITY: 12

TYPE "SMMB", HORIZONTAL, ENGINE INFE BRAINLESS SYNCHRONOUS MOTOR, WITHOUT BASE, BEARINGS OR SHAFT, MOTOR RATED AS FOLLOWS:

ORDER NO. 606 43993-BAX & 600 43

FOR: PASSAIC VALLEY SEWERAGE

0.0. St-79 NY-79

900 M.P., 706 KVA, 1.8 POWER FACTOR, 4160 VOLTS, 97.9 AMPS, 514 R.P.M., 80°C.TEMPERATURE RISE BY RESISTANCE, CONTINUOUS DUTY ABOVE A 50°C. AMBIENT TEMP., 1.0 SERVICE FACTOR, 3 PHASE, 60 HERTZ, CLASS "B" INSULATION. - WR<sup>2</sup> OF ROTOR (LB.FT.<sup>2</sup>) 3900. PR (KW PER ELECTRICAL RADIAN)= 1087.

WITH: TOTALLY ENCLOSED TOP MOUNTED COOLER SOLID HUB, SOLID RIM. FIELD WINDINGS SUITABLE FOR EXCITATION BEING SUPPLIED BY BRUSHLESS EXCITER, IDEAL S.O. 308467-478 SOLE PLATES WITH THE FOLLOWING:

SHIME, HARD DOWN BOLTS, & JACKSCREWS.

5.0. 308467-478

TYPE "FREA", SORTIONTAL, BRUSHLESS EXCITER FOR USE WITH THE ABOVE 900 H.P., SYNCHRONOUS MOTOR, IDEAL S.O. 3055-466-

EXCITER RATED: 13 NW, 125 WOLTS, 104 AMPS, 514 RPM, 80°C. TEMP.RISE CONTINUOUS BUTY, CLASS "B" INSUMATION.



# SYNCHRONOUS MOTOR DATA

kW	Frame	HP	kVA	PF	Volts	FL Amps	RPM	℃ Rise	SF
671	M4-15	900	706	1.00	4160	98	514	80	1.00

#### **Brushless Exciter**

kW	Volts	Amps	Exciter Field Volts	Exciter Field Amps
13	125	104	63	5.6

	Efficiency	Torque	
Load	Eff. at 1.00 P.F.	Full Load Torque	9196 lb-ft
100%	94.8%	Locked Rotor Torque	58 % FL torque
75%	94.6%	Pull-in Torque	68 %
50%	93.6%	Pull-out Torque	150 %

#### **Starting Data**

Locked Rotor Current	400	% FL current
Maximum Locked Rotor Time	5.0	sec
Acceleration Time at 100% Voltage	1.0	sec to 95% speed

#### **Number of Starts**

Two successive starts with the motor initially at ambient temperature or One start with the motor initially at rated temperature. Allow 20 minutes between additional starts.

Reactances						
Per Unit						
kVA Base	706					
Xd	1.125					
Хd	0.335					
X"d	0.205					
X2	0.221					
Хо	0.035					

Time Constants					
Seconds					
Tdo	0.910				
Τd	0.271				
T"do	0.033				
T"d	0.020				
Та	0.037				

## Resistance

Ohms at 25℃					
Stator	0.28401				
Field	1.395				



# **Synchronous Motor Starting Performance**



Speed	Motor Torque	Current	PF	Accel Time
0.00	0.58	4.00	0.199	0.01
10.00	0.63	4.05	0.212	0.13
20.00	0.69	4.01	0.227	0.25
30.00	0.76	3.96	0.246	0.36
40.00	0.85	3.89	0.269	0.46
52.00	0.97	3.77	0.304	0.56
60.00	1.03	3.63	0.328	0.63
70.00	1.10	3.38	0.363	0.71
75.00	1.11	3.22	0.377	0.75
80.00	1.07	3.01	0.385	0.78
85.00	0.97	2.77	0.376	0.83
90.00	0.80	2.51	0.342	0.88
93.00	0.68	2.37	0.311	0.92
95.00	0.62	2.28	0.293	0.95
97.00	0.60	2.14	0.300	0.98
99.00	0.56	1.64	0.349	1.02
100.00		1.00		1.02

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THOMAS TUCCI, JR. Chairman KENNETH J. LUCIANIN Vice Chairman MILDRED C. CRUMP Secretary

ELIZABETH CALABRESE DAVID S. CATUOGNO SCOTT M. HECK LUIS A. QUINTANA Commissioners SEATE CONNISS

GREGORY A.TRAMONTOZZI Executive Director

JOSEPH F. KELLY Clerk

"Protecting Public Health and the Environment" 600 Wilson Avenue Newark, New Jersey 07105 P (973) 344-1800

# ANNEX A – TECHNICAL SPECIFICATIONS

# **POWER GENERATION SYSTEM PROCUREMENT**

# **CONTRACT No. B129**

PASSAIC VALLEY SEWERAGE COMMISSION 600 WILSON AVENUE NEWARK, NEW JERSEY 07105

NJEIT Project No. S340689-23

By



489 Fifth Avenue 14<sup>th</sup> Floor New York, NY 10017

# **MARCH 2018**

# ENGINEER OF RECORD for CONTRACT No. B129 POWER GENERATION SYSTEM PROCUREMENT



**Design Engineer:** 



Project Management,		
Contract Requirements and	Signature	
Black Start Engine-Generator		
	Domenick A. Loschiavo	
	Printed Name	
	N.J. Professional Engineer - Lic. No. 24GE05243000	Seal
Mechanical:		
	Signature	
	David Modi	
	Printed Name	
	N.J. Professional Engineer - Lic. No. 24GE05333600	Seal
Electrical, Instrumentation		
and Controls:	Signature	
	Daron D. Dhalma	

Printed Name N.J. Professional Engineer - Lic. No. 24GE05245600 Seal

### PASSAIC VALLEY SEWERAGE COMMISSION NEWARK, NEW JERSEY

### POWER GENERATION SYSTEM PROCUREMENT

### CONTRACT NO. B129

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### 01100 - Technical Scope and Performance Requirements

#### 01100.1 Technical Scope of Work

The work under these specifications shall include furnishing the following:

- Three (3) 50% capacity Combustion Turbine Generator (CTG) Packages
- Three (3) Selective Catalyst Reduction (SCR) Exhaust Systems. The SCR Exhaust System shall include, but not be limited to ductwork, SCR catalyst, CO oxidation catalyst, CT expansion joint, insulation and lagging, instrumentation and controls, exhaust stack with silencer, and all other components needed for a complete functioning system. Gas flow through the SCR and CO catalyst will be in the vertical direction. Ammonia vaporization, dilution, injection equipment, and associated instrumentation and controls shall also be provided. Tempering air fans shall be provided as part of the base offering. High temperature catalyst may be provided as an OPTION in lieu of tempering air.

Note: The Seller's SCR Exhaust System shall accommodate future addition of single pressure, steam generating section(s) in the vertical gas path. The Seller's proposal shall include a description of the scope of supply and a description of the modifications required to add steam generating capability to the supplied exhaust system in the future.

- Three (3) 50% capacity Fuel Gas Compressor Packages. The Fuel Gas Compressor Package shall include, but not be limited to air-cooled gas compressors, electric motor, variable frequency drives, scrubbers & pulsation bottles, fan cooler, pulsation suppression study, and all other components needed for a complete functioning system.
- Two (2) 100% capacity Gas-Fueled Blackstart Generators.
- Balance-of-plant control system with overall plant-wide control and sequencing. This
  shall be an expansion of the CTG control system and is herein referred to as the
  Distributed Control System (DCS). The balance-of-plant DCS shall be of the same
  software and hardware platform as the CTG control system.

Supplied Equipment	Specification Technical Section
Combustion Turbine Generator	15560, 16031, 17101
Exhaust System	05135, 11506, 11507, 11508, 11509
Fuel Gas Compressors	15220, 17053
Blackstart Generators	15910, 17053
Distributed Control System	17101

In the event of technical conflicts, errors, or discrepancies, the detailed technical specifications, including this Section 01100 and all higher numbered sections, take precedence over Section 21000, Technical Supplemental Specifications.



The following Scope Matrix provides a summary breakdown of the Base Scope of Supply for the furnished equipment.

Scope	e Matrix		red	ation actor
ltem No.	Description	Seller	Not Requi	Install
1.	Equipment enclosure	Х		
2.	Metal equipment building for turbine/generator control panel(s), battery compartment(s), electrical equipment (e.g., motor control centers), excitation		Х	
3.	Inlet filter and associated support steel to grade or building roof.	Х		
4.	Evaporative cooler (NOT ALLOWED)		х	
5.	Inlet air heating/anti-icing system	Х		
6.	Permanent ladders, platforms and handrail for safe access to system components	Х		
7.	Exhaust expansion joint	Х		
8.	Exhaust transition duct	Х		
9.	Turbine and Generator Lube Oil System with reservoir, AC motor driven lube oil pumps, DC motor driven lube oil pumps, motors and starters, DC starter panel	Х		
10.	Lube oil coolers	Х		
11.	Fin-fan unit coolers	Х		
12.	Lube oil interconnecting piping and valves	Х		
13.	Lube oil for initial fill of system(s)			Х
14.	Final stage fuel gas filter/separator			Х
15.	Fuel gas electric dew-point heater		х	
16.	Fuel gas performance heater		Х	
17.	Off-line and/or on-line turbine wash system	Х		
18.	Water Mist or FM-200 fire detection and protection system	Х		

Scope	e Matrix		red	ation actor
ltem No.	Description	Seller	Not Requi	nstall. Contra
19.	Complete piping, valves and pipe supports between CTG enclosure and skid mounted equipment located on Seller's Mechanical Outline	Х		
20.	Instrumentation	Х		
21.	Turning gear/rotor turning device, motor and starter with complete automatic turning gear	Х		
22.	Design and supply of insulation and lagging for valves and equipment	Х		
23.	Turbine Generator control system, including remote workstations in control room (Note: the Balance-of-Plant DCS will be an expansion of the Turbine Generator control system (same hardware and software platform)	Х		
24.	Turbine Generator Supervisory Instruments (TSI) – vibration, speed, eccentricity, etc. (as required to protect and monitor the unit)	х		
25.	Unit batteries, charger and associated equipment	Х		
26.	Generator complete with all required auxiliary systems	Х		
27.	Generator bus duct			х
28.	Generator circuit breaker			Х
29.	Excitation system	Х		
30.	Automatic Voltage Regulator (AVR), including Power System Stabilizer (PSS) in accordance with 16031.2.10	Х		
31.	Generator neutral grounding equipment	х		
32.	Transducers	Х		
33.	Protective relay panel and protective relays including relay settings (Generator protection relays only)	Х		
34.	Power Potential Transformer for Static Field Excitation – Indoor Rated	Х		
35.	Isolation Transformer for Static Starting –Outdoor Rated		Х	
36.	Surge arrestors and capacitors (if required)	Х		

Scope	e Matrix		red	lation actor
ltem No.	Description	Seller	Not Requi	Install Contra
37.	Generator Step-up transformer		х	
38.	Unit Substation Transformers (generator terminal voltage to Buyer's low voltage)			Х
39.	Cable between NGR cubical and generator neutral connection (if required by Seller's design)	Х		
40.	Auto synchronization	Х		
41.	Local operator interface stations	Х		
42.	Remote operator interface stations	Х		
43.	All instrumentation and control devices, including control valves, transmitters, instrument fittings, power supplies, etc. required for complete and functional systems in Seller's scope of supply	Х		
44.	Skid mounted junction boxes, for equipment located on skids, to serve as interface points for external field wiring (except 480V motor power wiring)	Х		
45.	Permanent electrical wiring to connect equipment terminal boxes to the plant electrical system			х
46.	All necessary instrument, power and control wiring and raceways integral to any equipment furnished by Seller	Х		
47.	Instrument tubing, fittings, instrument valves and manifolds, instrument enclosures (as required) and supports for all skid mounted instruments and control devices	х		
48.	Instrument tubing, fittings, instrument valves (except manifolds), instrument enclosures and supports for all <u>non</u> -skid mounted instruments and control devices			Х
49.	Motor control center, and starters for Seller furnished equipment.	Х		
50.	Lighting internal to Seller furnished enclosures	Х		
51.	Plant lighting external to Seller furnished enclosures			Х
52.	Foundation design data for all Seller furnished equipment	Х		
53.	Embedments cast in the main concrete foundation pours			Х

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Scope	e Matrix		red	ation actor
ltem No.	Description	Seller	Not Requi	Contra
54.	All foundation interface components not cast in the main foundation pours, (includes those grouted in place)	Х		
55.	Anchor bolts, nuts, washers and lock-tabs			Х
56.	Grouting materials and the placing thereof			х
57.	All nuts, bolts, gaskets, special fasteners, backing rings, expansion joints, etc., required for field erection of components and equipment furnished under these specifications	Х		
58.	Exhaust stack	Х		
59.	Exhaust stack silencer	Х		
60.	Exhaust stack EPA test connections	Х		
61.	Permanent ladders, platforms and handrail for safe access to test connections	Х		
62.	CEMS connections (upstream and downstream of CO & SCR catalyst)	Х		
63.	EPA test connections	Х		
64.	Exhaust stack lightning protection			Х
65.	Exhaust stack damper (if required by Seller's design)	Х		
<mark>66</mark> .	Exhaust system flow model simulation (CFD)	Х		
67.	Aqueous ammonia storage tank & forwarding pumps			х
68.	Ammonia flow control skid, vaporizer, and dilution air blowers	Х		
69.	Ammonia injection grid (AIG)	Х		
70.	Interconnecting piping and pipe supports between ammonia flow control skid and ammonia injection grid	Х		
71.	Insulation and lagging of skid-mounted piping required for personnel protection	Х		
72.	Insulation of interconnecting piping between flow control skid and AIG			Х

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Scope	e Matrix		red	ation actor
ltem No.	Description	Seller	Not Requir	Install Contra
73.	SCR & CO catalyst and catalyst test coupons	Х		
74.	SCR & CO catalyst monorail and hoist system	Х		
75.	Catalyst installation			х
76.	Tempering purge air fan and ductwork	Х		
77.	Cold weather enclosure(s)	Х		
78.	Variable frequency drive	Х		
79.	Bridge crane and hoist		Х	
80.	Pulsation study	Х		
81.	Equipment enclosure		Х	
82.	Workstations (Operator, Supervisor and Engineering)	Х		
83.	Printers	Х		
84.	Console Furniture (for Workstations and Printers)	Х		
85.	Interface to Existing Plant Data Network	Х		S
86.	Integrated Ammonia Controls	Х		
87.	Supervisory Gas Compressor Control & Monitoring	Х		
88.	Supervisory Air Compressor Control & Monitoring	Х		S
89.	Supervisory Blackstart Generator Control & Monitoring	Х		
90.	Plant-wide Sequencing	Х		
91.	Balance-of-Plant Control and Monitoring	Х		S
92.	PSE&G SCADA Telemetry Interface	Х		S
93.	Continuous Emissions Monitoring System Interface	Х		S

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Scope	e Matrix		red	ation actor
ltem No.	Description	Seller	Not Requi	Install Contra
94.	Time Synchronization Equipment	Х		
95.	Technical field services representative	Х		
96.	Startup assistance	Х		
97.	Startup and commissioning spare parts	Х		
98.	Onsite training	Х		
99.	Performance testing			Х
100.	Attendance at design conferences at times and places selected by the Buyer	х		
101.	Electrical, control and instrumentation design for Seller- furnished equipment and systems	Х		
102.	Design of electrical and control systems wire termination points for the Seller's end of the interface with Buyer- furnished equipment and systems (raceway, cable and grounding design for Buyer-furnished equipment and systems is by others)	x		
103.	Design of wiring connections for Seller-furnished equipment including wire termination points and interconnecting cable schedule	Х		
104.	Finish painting of all equipment exterior to enclosures and accessible after final assembly			Х
105.	Finish painting of all equipment inaccessible after final assembly	Х		
106.	Touch up paint and procedures for use during installation of Seller equipment	Х		
107.	All crating/packaging and freight of any equipment furnished under these specifications	Х		
108.	Receiving, unloading, storing and installation of Seller- furnished equipment and materials			Х
109.	Foundations			Х
110.	Erection			х
111.	Home office construction support of Seller's equipment	Х		

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Scope	e Matrix	Seller	Not Required	Installation Contractor
ltem No.	Description			
112.	Operating personnel for startup and tests			Х
113.	All submittals required in the Schedule of Submittals for all Seller furnished equipment and systems	Х		
114.	As-built data including conformed to construction record drawings of each drawing submitted	Х		
115.	Performance information as required for design	Х		

#### 01100.1.1 Engineering Services

The Seller shall furnish all engineering and design required for the furnished equipment. The engineering and design services shall fully comply with the requirements of this specification. The following are the basic requirements:

**01100.1.1.1 General Engineering.** General engineering and design services to be provided by Seller shall include, but not be limited to the following:

- 1. Detailed design drawings, information and data as listed in the Schedule of Submittals.
- 2. Performance and acoustical guarantees.
- 3. Home office construction support.
- 4. Equipment and instrumentation identification with Seller's standard identification numbers.
- 5. Coordination with Buyer for the design and installation of Combustion Turbine Generator, SCR Exhaust System, Fuel Gas Compressors, Blackstart Generator, DCS and auxiliaries.
- 6. Drawings and data conformed to construction records.

**01100.1.1.2 On-Site Technical Direction.** Seller shall provide qualified personnel to advise Buyer and Installation Contractor personnel in the proper unloading, storage, erection, commissioning, startup and testing for the furnished equipment, including, as a minimum, the following activities and functions:

- 1. Participate in regularly scheduled on-site construction/commissioning meetings as required by the Contract and otherwise as reasonably requested by Buyer.
- Inspection, unloading and storage of the major components at the installation site and their placement on the foundation.
- 3. Guidance and pre-pour inspection of Buyer's combustion turbine generator foundation interface including foundation anchor-bolts and embedments.
- 4. Setting of the sole plates or fixators.
- 5. Setting of necessary shims between Buyer-supplied sole plates and the equipment.
- 6. Removal of shipping supports on the equipment.
- 7. Installation of the major equipment packages to the proper centerline and elevation.

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- 8. Alignment of the turbine and generator.
- 9. Alignment of the engine and generator.
- 10. The assembly, clearance and alignment, of all major parts to the extent that the same can be accomplished without dismantling.
- 11. Checkout of piping, control wiring and instrumentation lines between Seller provided equipment.
- 12. Checkout and initial operation of the equipment.
- 13. Sequencing and checkout of the combustion turbine generator controls, blackstart generator controls, gas compressor controls, ammonia system controls and balance-of-plant controls (including interfaces identified herein).
- 14. Installation and checkout of the generator and excitation/electrical systems.
- 15. Checkout and start-up of the generator protection relays.
- 16. Start-up of the equipment with Buyer's operating personnel.
- 17. Mark-up of Seller drawings to reflect the as-built condition of the supplied equipment.
- 18. Instruct the Installation Contractor and Buyer's operating personnel, at the site at the time of the work activity in accordance with the installation schedule, in the:
  - a. Conducting of such component and operating tests as required.
  - b. Initial starting and placing the equipment in good operating condition.
  - c. Seller's recommended procedure for regularly starting, operating and shutting down the equipment.
- 19. Provide interpretation, when requested by Buyer, of technical documents provided by Seller or its Subcontractors, including clarification(s) or omitted information.
- 20. Arrange technical advisory services for systems and equipment supplied by Subcontractors as deemed necessary by Seller and as required per the Contract.
- 21. Coordinate resolution of issues associated with Seller-provided equipment delivered to the site, including in-process inspections on the corrective action(s) as deemed necessary by the Seller.
- 22. Provide reports to Installation Contractor with observations made and any concerns identified.

#### 01100.1.2 Miscellaneous Materials and Services

Miscellaneous materials and services not otherwise specifically called for shall be furnished by the Seller in accordance with the following:

- 1. All nuts, bolts, gaskets, special fasteners, backing rings, expansion joints, etc., required for field assembly of components and equipment furnished under these specifications.
- 2. All piping integral to any equipment furnished under these specifications, except as otherwise specified. This includes all vents, drains, instrument piping and fittings, instrument manifolds, insulation (provided by Seller and installed by Buyer for Seller's scope), pipe supports, and other piping work required for a complete unit. Piping connection points shall be provided for each service at the edge of skids or equipment area. This includes fuel, air, drains, or any other piping systems.
- 3. All necessary connections for the Buyer's piping and instruments.
- 4. All necessary instrument, power and control wiring and raceways integral to any skid furnished under these specifications. This shall include terminal blocks and internal wiring to these terminal

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blocks for equipment requiring external connection. All skid mounted equipment terminal boxes for external connection shall be installed at the edge of the equipment within 5 feet from the ground. The terminal boxes for external connection shall be located to permit convenient access by the Buyer. All internal conduits and raceways shall be furnished and installed to junction boxes with the exception of motor power feeds, which will be direct connected.

- 5. Erection drawings, prints, information, instructions and other data for use by the Buyer's Engineering and Installation Contractor.
- 6. Detailed storage requirements for use by the Installation Contractor.

#### 01100.1.3 Training

Training of the Owner's personnel on the operation and maintenance of the equipment specified herein shall be provided by the Seller. The Seller shall provide both classroom and field training to familiarize Buyer personnel with the operation and maintenance of all aspects of the Seller provided equipment. At a minimum, the Seller shall provide their standard training program.

**01100.1.3.1 Training of Buyer's Personnel.** The Seller shall work jointly with the Installation Contractor to plan and schedule the training of Buyer personnel as it relates to the Seller's Equipment. The Installation Contractor will make any necessary arrangements with the Buyer to facilitate this training, and the Seller shall furnish the personnel and materials as specified herein and as may reasonably be requested by the Installation Contractor or the Buyer to facilitate the training that relates to the Seller's Equipment.

The Buyer will ensure that appropriate members of their operation and maintenance staff are made available for training, and these members of the Buyer's staff will perform the operation and maintenance procedures that are necessary during the training.

The training shall consist of both classroom and field instruction. The purpose of field instruction will be to reinforce topics covered in the classroom and to identify the location of any valves, pushbuttons, control panels switches, and other equipment required for operation; and to identify the location of any maintenance equipment such as grease fittings, oilers, isolation valves, safety lockout switches, and other similar equipment.

All training shall be conducted by qualified training specialists that are provided by the Seller and shall take place at the Project site at a place specified by the Buyer.

The Installation Contractor will coordinate the scheduling of the Seller's training services for the Seller's Equipment with the Buyer and the Engineer. A minimum of fourteen (14) days' prior notice of training shall be provided to the Buyer and the dates proposed for the training are subject to the approval of the Engineer and the Buyer.

A minimum of two (2) 8-hour training days shall be provided for each major component of the Equipment for the Power Generation System. Major components include:

- 1. Combustion turbine
- 2. Generator
- 3. CTG control system
- 4. SCR
- 5. Ammonia flow control and injection equipment
- 6. Gas compressor

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7. Blackstart generator

All of the training materials relating to the Equipment shall be provided by the Seller to the Installation Contractor for onward submittal to the Engineer and the Buyer. The Seller shall work jointly with the Installation Contractor to ensure that the training materials are submitted to the Engineer and the Buyer a minimum of fourteen (14) days prior to the scheduled training for the equipment.

Training shall be limited to no more than three (3) days per week. No training shall be conducted on Mondays or Fridays.

**01100.1.3.2 Video Recording of Training.** The Seller's training specialist shall meet with the Installation Contractor and the Engineer for a minimum of three (3) days to prepare training scripts and to video record the training sessions relating to the Equipment. The video recording shall be performed at the Project site at a suitable location that is designated by the Buyer. The Seller shall provide the video recording equipment and the services of qualified technicians to operate the equipment and prepare DVDs of the training sessions relating to the Equipment.

**01100.1.3.3 Lesson Plans.** The Seller shall prepare lesson plans for the training relating to the Equipment, and shall work jointly with the Installation Contractor to ensure that the lesson plans are submitted to the Buyer. The Seller shall furnish the lesson plans for the Equipment, which shall include specific information pertaining to each component, including controls. Lesson plans shall be prepared in full compliance with the following requirements.

Lesson plans shall be submitted to the Buyer for approval no less than sixty (60) days prior to the date that the training is to take place.

Lesson plans shall indicate the estimated duration of each segment of the training and the training audience that the instruction is to address. The training audience refers to the Buyer's mechanical operation and maintenance personnel and the Buyer electronic/electrical maintenance personnel, as appropriate.

Lesson plans shall indicate when training aids will be used or referred to during the course of instruction. The contents of the lesson plans shall include, but shall not be limited to, the following subjects: Equipment Description: Purpose and function of equipment and auxiliary equipment and systems, Physical arrangement of equipment components and electrical supply, General function of controls, including automatic and manual operation, interlocks, and shutdowns

Equipment Operation: Operating requirement for equipment to perform satisfactorily, Typical operating characteristics, Start-up and shutdown procedures, Use of controls.

Equipment Monitoring: Recommended routine instrument readings and operational checking, Early warning signs of developing operational or equipment problems, Procedures for handling non-routine problems such as alarms, power failures, component failures, etc.

Equipment operational trouble-shooting procedures.

Safety and Housekeeping: Safety features of the equipment, Safe practices and Housekeeping practices.

Description of the use of the O&M Manual.

Preventive Maintenance Requirements: Maintenance needs for equipment, Explanation of maintenance procedures that are described in the Designated Supplier's O&M Manual and are necessary for the


maintenance of the equipment, Outline or summarize procedures, Recommended schedule for performing preventive maintenance, Provide preventive maintenance record forms (if available)

Maintenance Inspection Program: Parts, components and areas of equipment to inspect for routine preventive maintenance, Recommended frequency of inspection, Inspection procedures, and Problem identification.

Maintenance Trouble-Shooting: Sections in O&M Manual detailing trouble-shooting procedures, Summarize trouble-shooting procedures, Testing equipment used in trouble-shooting, Demonstration of use of specialized testing equipment if supplied with equipment, Other testing equipment, Tests used to verify trouble-shootings findings.

Disassembly and Assembly: Summarize disassembly and assembly procedures, O&M Manual coverage of subject, Testing to verify success of corrective maintenance.

Equipment Calibration: Calibration needs and tolerances, Calibration equipment, O&M Manual listing of calibration ranges, tolerances and setting.

**01100.1.3.4 Training Aids.** Training aids shall be provided by the Seller and shall be used as an integral part of the training program. Training aids shall include text and/or pictorial handouts specific to the equipment supplied. Handouts shall be legible and printed on good quality stock. Handouts shall be submitted when lesson plans are submitted.

Additional training aids shall be furnished and used as necessary for maximum training effectiveness. The additional training aids shall consist of the following as appropriate.

- 1. Audio visual aids, films, videotapes, slides, overhead transparencies, posters, blueprints, diagrams, and catalogue cuts.
- 2. Models and samples, for example, cutaways, spare parts, tools, miniature models, equipment assemblies, and damaged parts.

The use of additional training aids shall be identified in the lesson plans, and a description of the additional training aids shall be given.

**01100.1.3.5 Qualification of Training Specialists.** The Designated Supplier shall furnish documentation of the qualifications of its proposed training specialists for approval fifteen (15) days prior to the date of proposed training. The documentation shall include the experience of the training specialists in operation and maintenance of the equipment and a summary of relevant training experience.

The qualifications of the training specialist will be subject to approval by the Buyer, and only those training specialists whose qualifications have been approved shall be permitted to conduct the training

### 01100.1.4 Startup Spares

The Seller shall provide one complete set of startup spare parts to include all items that may normally be required during the course of equipment erection, commissioning, and testing for the Power Generation System.

## 01100.1.5 Recommended Spares

The Seller shall submit a price list of recommended spare parts for the Power Generation System. Buyer may purchase any of the recommended spare parts for the listed price up to 2 years after delivery of the



equipment. The recommended spare parts list shall be a complete list for all equipment furnished through the first major overhaul.

## 01100.1.6 Special Tools and Lift Fixtures

The Seller shall provide all special tools and lift fixtures (including software) required for installation, checking, inspection, repair and maintenance of the equipment provided. Special tools, fixtures and appurtenances required to assemble, maintain or operate the equipment during continuous operation. Special lift fixtures are fixture and lifting rigs required for transport and offloading of the equipment. Special tools and lift fixtures will remain Buyer's property.

# 01100.1.7 Cargo Preparation and Shipping

Within thirty calendar days of the Effective Date, Seller shall give Buyer a shipping schedule with descriptions of the Work, anticipated shipping dates for the Work, anticipated number of shipments and points of origin of the Work. Seller agrees to give an updated shipping schedule to Buyer every thirty calendar days. Seller agrees to give Buyer notice of shipments involving ocean or air transit no less than forty-five calendar days before those shipments. For international shipments, the notice must contain shipper's export declarations and certificates of origin.

**01100.1.7.1 Packing and Packaging.** Seller shall package the Work to protect it from the rigors of shipment, transshipment, and multiple handlings, loadings, unloadings and storage. At a minimum, Seller shall:

- 1. Pack the Work in accordance with the standard practices of the industry and of the modes of transportation used to ship the Work.
- 2. Take "customary and usual" precautions to prevent damage from rain, moisture, humidity, condensation, mold, rust, corrosion, shock, and vibration.
- 3. Use Supplier's knowledge of the Work to provide supplementary packaging when customary and usual packaging may not provide sufficient protection.
- 4. Configure the Work to minimize cube and to prevent damage during shipment.
- 5. Secure and protect equipment with moving or rotating parts that might be damaged during shipment.
- 6. Provide vacuum packing, vapor-proof barriers, and desiccant when electrical or sensitive equipment or material may be exposed to rain, moisture, high humidity, or similar conditions.
- 7. Coat bright or machined surfaces required for precision fit with a rust-preventive compound.
- 8. Ensure the inside of parts and fittings are clean and free from metallic filings, machining debris,

and cleaning media such as blasting grit.

- 9. Protect pipes and fittings by capping both ends or by other proven methods. Pipes and tubing must be dry inside and will be inspected by Purchaser before shipment unless otherwise specified.
- 10. Adhere to the requirements of International Standards for Phytosanitary Measures, Publication No. 15 ("ISPM-15").
- 11. Consolidate small packages, cartons or loose items that require additional boxing or crating and skid/palletize such items on strong 4-way skids stamped with an ISPM-15 stamp. Skids must be shrink-wrapped and double-metal banded both ways. Each skid must be numbered and the quantity of boxes/units on the skids must be clearly indicated.



- 12. Pack hazardous materials in United Nations Specification packaging and in accordance with hazardous material regulations for the mode of transportation used.
- 13. Separately pack spare parts, tools, and any item shipped on a "borrowed" or a "returned" basis, such as testing instruments.

01100.1.7.2 Marks and Labels. Seller shall Mark and Label the Goods for Shipment.

- 1. Stencil marks on at least two opposite sides and ends of each shipping unit, such as a barrel, box, bundle, crate, pallet, skid, or loose items. Stenciled lettering shall be:
  - a. At least two inches high;
  - b. in black, indelible ink;
  - c. in block letters; and
  - d. clear enough to be read from at least fifty feet.
- 2. Apply standard symbols indicating care and precaution to be used in handling and storing the shipping unit.
- 3. If stenciling is not possible, Supplier shall use placards attached to the opposite sides and ends of the shipping unit. The contents of the placard must be formatted the same as if the marks were stenciled. The placard must be attached with studs or heavy gauge wire on at least two corners, or secured by such means that rough handling, wind, rain or other weather will not loosen or remove the placard. When stenciling is not practical for carton and palletized shipments, Supplier shall label the cartons or palletized shipments on at least two opposite sides.
- 4. For out-of gauge shipments, either heavy or over-dimensional, Supplier shall mark the center of gravity for the shipping unit and clearly indicate the lifting points.
- 5. Supplier shall clearly mark all packages that contain spare parts, tools, or borrowed equipment with marks indicating their uses, such as erection, commissioning, or start up. Supplier shall clearly mark all hazardous material with the appropriate symbols and placards. The minimum marks to be applied to each shipping unit are:
  - a. Project and client name.
  - b. Project number and specification number.
  - c. Net weight in kgs and imperial (each out to two decimal places).
  - d. Gross weight in kgs and imperial (each out to two decimal places).
  - e. Dimensions (L x W x H) in inches (out to one decimal place).
  - f. Country of destination.

# 01100.1.7.3 Shipping Documentation. Seller shall:

- 1. Attach a packing slip to each shipping unit. The packing slip must clearly identify the quantity and contents of the shipping unit to which it is attached.
- 2. Prepare a packing list for each shipment. The packing list shall:
  - a. Indicate the package number marked on the package and summarize the contents of the packing slips.
  - b. Identify which package numbers contain hazardous materials.
- 3. Prepare the bill of lading required for each shipment. Supplier shall arrange to have the following placed in the body of the bill of lading:

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- a. Description of hazardous materials on a separate line.
- Attach to the bill of lading a material safety data sheet for each hazardous material item in the shipment or a certification that material safety data sheets do not apply to materials furnished in the shipment.

**01100.1.7.4 Handling, Loading and Unloading.** Seller is responsible for loading the Work safely onto the truck, trailer, flatbed, container, railcar, aircraft or ocean vessel and securing it to withstand the rigors of transportation, transshipment, and multiple handlings, loadings and unloadings. These obligations include, but are not limited to, the following:

- 1. Blocking and bracing any shipping unit or its components that may move while in transit.
- 2. Loading the Work on skids or pallets as much as possible to allow for safe and efficient handling with standard equipment.
- 3. Designing and providing a handling frame or saddles to support large pieces of the Work to be transported or stored. Any angles, bars, channels, etc., used for shipping purposes and requiring removal before installation must be painted yellow and clearly identified by stenciling "Remove Before Installation" in a contrasting color.
- 4. For Work requiring saddles but that is shipped to intermediate delivery points without saddles, securing the Work to the saddles after placement of the Work onto saddles by the responsible party in order to allow safe and efficient handling of the Work.
- 5. Advising Buyer in advance of any non-standard unloading that may require cranes, winches, or any other special equipment.

### 01100.2 Drawings and Technical Attachments

This article lists the drawings and other technical attachments that have been prepared for the work under these specifications.

#### 01100.2.1 Engineer's Attachments

The following listed attachments shall be part of the Contract Documents.

Drawing No. or Other Designation	Rev. No.	Title
193946-SK-E001	А	PVSC Standby Power Generation Facility Overall One-Line Diagram
193946-SK-M001	А	PVSC Site Arrangement
193946-SK-M002	А	PVSC Power Building Plan
193946-SK-M003	А	PVSC Building Sections
193946-SK-K001	А	Control System Architecture
Motor Data	-	8000HP and 900 HP Motor Data Sheets

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# 05135 - Steel Stack Designed by Seller Datasheet

Table 1 - General		
Gene	ral	
1	Application	Steel Stack Designed by Seller.
2	Stack erection	By Installation Contractor
Codes and Standards		
3	Code compliance	Use the jurisdictionally approved code editions and addenda for all codes. Use the most recent edition and addenda in effect at the date of this document if none are jurisdictionally mandated unless it conflicts with this specification. The Buyer's specifications govern when they conflict with a non-mandated code.
4	Steel stack general standards	ANSI, ASME, ASTM, AISC, AWS, OSHA.
5	Materials, fabrication, and erection	AISC 325-11. Steel Construction Manual, Fourteenth Edition.
6	Stack design and construction	ASME/ANSI STS-1 – 2011: Steel Stacks.
7	Wind and seismic design loads	ASME/ANSI STS-1 – 2011: Steel Stacks.
8	Stack flue gas sample connections	US Federal EPA

Table 2 - Products		
Materials		
9	Stack plates, bars, angles, and appurtenant materials not otherwise designated in areas with temperatures less than 750 °F	ASTM A36 steel, shop prime and finish painted. Minimum yield point of 36,000.
10	Interior insulation and liner shall be provided for the stack when operating temperatures will exceed 750 °F	As required by Supplier's design.
11	Insulation and lagging	Manufacturer standard
Documentation Requirements		
12	Calculations	Submit the design calculations for the stack indicating all assumptions and references used.
13	Drawings	Prepare and submit detailed fabrication and erection drawings for all materials furnished.
14	Engineer's seal	Drawings and calculations shall be sealed by a professional structural engineer registered in New Jersey.
Stack Details		
15	Steel stack function	Combustion turbine generator (CTG) exhaust
16	Steel stack configuration	Round

17	Steel stack height (from grade)	100' – 0"
18	Stack support arrangement	Supported by Seller's equipment
19	Exhaust gas maximum velocity at design exhaust gas flow, ft/s	By Seller
20	Design exhaust gas flow	By Seller
21	Shop applied coatings	Exterior surfaces shall be prime coated per Section 21000. Finish coat shall be performed in the field by Others.
22	Maximum allowable sound level, dbA @ 3 ft	85
23	CTG Exhaust gas constituents	By Seller
Stack	Requirements	
24	Design loads	Include both along-wind and across-wind effects. Include seismic loads as required by the site and the specified codes.
25	Foundation	A reinforced concrete foundation including anchor bolts and embedments will be provided by Buyer. Provide foundation requirements needed to accommodate the stack. Provide the forces and moments required for the foundation design.
26	Holes and other field connection provisions	Shop check for accuracy and proper fit. Ensure the units will fit when assembled in the field. Mark all separate pieces as they are indicated on the erection drawings. Matchmark connections where required, either with notations on the drawings or by necessity of proper identification and fitting in the field.
27	Circular steel stacks	Use rolled plates, fitted and welded into concentric sections which can then be assembled and erected into a cylindrical stack.
28	CEMS connections (at CTG exhaust)	Stainless steel pipe with 4" Type 316 stainless steel ANSI 150# flange, blind flange, and bolts with Monel nuts. Provide platform with ladder access from grade. Quantity: 1
29	CEMS connections (each stack)	Stainless steel pipe with 4" Type 316 stainless steel ANSI 150# flange, blind flange, and bolts with Monel nuts. Locate in a plane at right angles to the stack. Quantity: 1
30	EPA test connections (each stack)	Stainless steel pipe with 6" Type 316 stainless steel ANSI 150# flange, blind flange, and bolts with Monel nuts. Locate in a plane at right angles to the stack and spaced 90° apart. Quantity: 4
Source: 05135, 2016, v1.1 Steel Stack Designed by Seller Page 19 of 270		



31	Sampling platform	Provide a full circle platform around the stack for transverse sampling of flue gasses in the stack to determine SO <sub>2</sub> , NO <sub>x</sub> , CO, and particulates. At minimum, provide ladder access to the platform from Power Building roof level.
32	Interior Insulation and Liner	Provide when operating temperatures will exceed 750 °F, or as required by the Seller's design.
33	Exterior Personnel Protection	An insulated thermal barrier or expanded metal fence for personnel protection shall be provided at any location (i.e., test port and lighting platforms) where personnel might come into contact with the SCR exhaust system.
34	Silencer	Efficient silencing equipment shall be provided for the unit to limit the operating noise level to the specified values. The exhaust silencer shall be composed of absorbent material suitably clad between perforated metal sheets or shall be of other acceptable type. The attenuators shall be of Type 409 stainless steel materials. The design of the attenuators shall be such that components or parts of the attenuators cannot become detached and obstruct or pass through the gas passages. The stack height shall be sufficient enough to allow for a length of straight stack section downstream of the silencer that is required by the environmental regulatory authority for emissions compliance testing.

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# **11506 - Selective Catalytic Reduction System**

# 11506.1 General

### 11506.1.1 Scope of Supply

Scope of supply shall include furnishing the selective catalytic reduction (SCR) system indicated on the Selective Catalytic Reduction System Specification Sheets included at the end of this section.

## 11506.1.2 Not Used

### 11506.1.3 Performance and Design Requirements

Performance and design requirements are covered on the attached Selective Catalytic Reduction System Specification Sheets.

### 11506.1.4 Codes and Standards

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

Work	In Accordance With
Piping	ANSI/ASME B31.1, Power Piping Code
Model test	ICAC Procedure EP-7

### 11506.1.5 Technical Attachments

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

### 11506.1.6 Supplemental Specifications

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

# 11506.2 Products

The SCR system equipment and materials addressed herein include the following as needed for a complete functioning system:

Reactor (catalyst housing), including inlet and outlet ducts.

Reactor access.

Catalyst support frames.

Catalyst seals.

Catalyst protection grids.

Catalyst removal/replacement system.

Ammonia injection grid and distribution devices.



Source: 11506, 2014, v2.0

Flue gas distribution devices.

Controls and instrumentation.

Ammonia flow control and dilution air skid.

In addition to the materials and equipment listed above, information pertaining to the system design criteria and bases, system operating requirements, performance guarantee parameters and testing, and SCR system control philosophy are also presented herein.

Access provisions shall consist of stairs, platforms, walkways, handrails, guardrails, and ladders necessary to provide complete and convenient access for operation, inspection, testing, and maintenance of major or multiple pieces of equipment in accordance with OSHA.

# 11506.2.1 Guarantees, Reliability Demonstration, and Tests

**11506.2.1.1 General**. The SCR system shall be designed for continuous operation at the specified conditions, while handling 100 percent of the exhaust gas generated by operation of the combustion turbine at any specified condition from minimum load up to its maximum continuous rating.

**11506.2.1.2 Guarantees**. Performance of the SCR system shall be guaranteed as described herein.

Compliance with performance guarantees shall be demonstrated during performance guarantee tests of the combustion turbine and standby facility.

**11506.2.1.2.1 Rated capacity operation**. The SCR system shall be guaranteed to operate satisfactorily and reliably for continuous periods at 100 percent maximum continuous rating.

**11506.2.1.2.2** Acoustical performance requirements. The SCR system shall not exceed the acoustical limits specified herein as measured in accordance with the procedures of the most current referenced codes and standards. The requirements specified herein apply to the cumulative noise emitted from the entire SCR system including, but not limited to, the CO and NOx catalysts, ductwork, stack, stack exit, and auxiliary components. The acoustical performance requirement is for each unit individually.

**Near-Field Noise Emissions.** The SCR system shall not exceed the spatially-averaged Aweighted sound pressure level listed in the SCR Specification Sheet along the equipment envelope at a height of 5 feet above the ground and all personnel platforms during normal operation. The equipment envelope is defined as the perimeter line that completely encompasses the equipment package at a distance of 3 feet from the equipment face. Normal operation excludes start-up, shutdown, and upset conditions.

**11506.2.1.2.3** Suitability for continuous dispatched operation (operational performance guarantee). The SCR system shall be guaranteed to operate safely and reliably, without undue maintenance or operator attention, while meeting all stated performance limits required by this specification on a continuous basis throughout the entire operating load range without degrading overall unit availability.

**11506.2.1.2.4 Minimum load operation**. The SCR system shall be guaranteed to operate satisfactorily and reliably for extended periods at 50 percent load.

**11506.2.1.3 Tests**. This article covers tests to be conducted on the exhaust system to demonstrate compliance with guaranteed requirements.

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

Tests	In Accordance With	Conducted By
Exhaust gas flow rate	40 CFR 60, Appendix A, Method 2	Buyer
Particulate matter	40 CFR 60, Appendix A, Method 5 or Modified Method 5 or EPA Method 201 or EPA Method 202	Buyer
NO <sub>x</sub>	40 CFR 60, Appendix A, Method 7E	Buyer
CO <sub>2</sub> or O <sub>2</sub>	40 CFR 60, Appendix A, Method 3	Buyer
Carbon monoxide	40 CFR 60, Appendix A, Method 10	Buyer
Volatile organic compounds	40 CFR 60, Appendix A, Method 18 and 25A	Buyer
Ammonia slip	US EPA Conditional Test Method 27 (CTM-027)	Buyer

# 11506.2.1.3.1 Not Used.

**11506.2.1.3.2 Test responsibility**. Tests conducted to determine compliance with the performance guarantees shall be binding on the parties of this Contract.

All required initial formal and final formal performance guarantee tests shall be conducted by a qualified independent testing laboratory mutually acceptable to the Seller and the Buyer.

The Seller shall provide test ports where required on all equipment supplied under this Contract. The number and type of test ports shall be consistent with the applicable regulatory agency's requirements. If not stated by the applicable regulatory agency, the United States EPA requirements shall be utilized. All test ports shall be specifically identified on the Seller's drawings, which shall be subject to Buyer's approval.

The cost of the initial formal and final formal performance guarantee tests and the availability demonstration run shall be borne by the Buyer whether successful demonstration of compliance with the performance guarantees is achieved or not.

The Buyer's operating and maintenance personnel shall operate the air quality control systems during all required availability demonstration runs and initial formal and final formal performance guarantee test periods. Only those operation and maintenance duties that are normally assigned to operation and maintenance personnel shall be performed. Operating and maintenance personnel shall not be responsible for modifications to equipment, disassembly to replace defective components, or inordinate maintenance for continued operation of equipment that is experiencing unacceptable wear rates.

The Seller shall provide, at Seller's cost, personnel to observe the initial and final performance guarantee tests and to provide technical assistance and advice to the Buyer's operating and maintenance personnel. The test may be attended by personnel from the Buyer and Seller.



The Seller shall complete the following:

- 1. Identify all test connections on drawings.
- 2. Provide information, data, and suggested test procedures for the Buyer's approval.

Should any one of the required tests (i.e., the initial formal performance guarantee test, the final formal performance guarantee test, or the availability demonstration run) show that the systems have failed to meet their performance guarantees, then the Seller shall immediately proceed with modifications to the systems until the required level of performance is met. All costs for the modifications, including labor and materials and the cost of performing additional tests to prove that the systems meet the guarantees, shall be borne by the Seller. Unavailability of the SCR units for testing shall in no way relieve the Seller of the responsibility for the tests.

**11506.2.1.3.3 Model test**. The following describes the computational fluid dynamics (CFD) modeling requirements for the SCR Exhaust System. "SCR Exhaust System" shall be defined as all ductwork, catalysts, and equipment from the CT exhaust flange to the stack outlet.

Test objectives shall include the following:

- Determination of the arrangement of the reactor, ammonia injection grid (AIG), SCR catalyst, CO oxidation catalyst, associated ductwork, and the shape and location of gas distribution devices necessary to obtain uniform gas flow conditions through the load range and to minimize pressure losses.
- Demonstrating that the velocity profiles at the inlet to the AIG, the inlet to the SCR catalyst, the inlet to the CO oxidation catalyst, and the system test ports meet the requirements of this specification and the operational requirements of the Seller's SCR system and oxidation catalyst system design.
- 3. Demonstrating the temperature and velocity distributions at the inlet of the CO oxidation catalyst and the SCR catalyst.

A computer flow model based on CFD shall be developed in order to confirm the proper temperature and velocity distributions at the catalyst inlet face are achieved. The mesh for the CFD model shall consist of a minimum of five million cells. Cartesian coordinate meshes shall not be accepted.

Velocity, temperature, and ammonia dispersion modeling shall be performed through CFD modeling. The AIG shall be accurately represented, including all the AIG pipes inside the exhaust gas path. Inaccurate representations of the AIG, only intended to simulate the exhaust gas pressure drop, shall not be accepted.

Gas flow distribution and ammonia distribution tests shall be completed for 50 and 100 percent of the full load design flow conditions.

The model shall be tested in the turbulent flow regime with gas flow rates determined by the Seller.

The Seller shall provide a test procedure for approval by the Buyer/Engineer.

The Seller shall provide a final report describing the modeling scale parameters, the test procedures, and summarizing the CFD model test results.

The Seller shall be responsible for determining and furnishing all gas flow vaning, straightening, or distribution devices required by the SCR Exhaust System. The required devices shall be based on the model tests described herein. The Seller shall notify the Buyer/Engineer of all required gas flow vaning, straightening, or distribution devices. All gas flow vaning, straightening, or distribution devices shall be located within the limits of the scope of equipment supplied under these specifications. No gas flow vaning, straightening, or distribution devices shall be designed in the duct section between the CTG exhaust outlet flange and the exhaust transition duct inlet. The required devices shall be included in the model test report that shall be developed.

The model shall be retained by the Seller until the final performance test has demonstrated that the SCR Exhaust System has met the performance guarantees.

# 11506.2.1.3.4 Not Used.

**11506.2.1.3.5** Availability Demonstration Run. The adequacy of the air quality control systems for continuous operation shall be demonstrated by an availability demonstration run in parallel with availability testing of the combustion turbine and standby facility.

The rated capacity of the systems and the minimum load operating capability shall be demonstrated as specified under the guarantee defined on the Selective Catalytic Reduction System Specification Sheets as part of the availability demonstration run.

Successful runs shall be defined as being within the guaranteed emission limits.

The operating loads may vary between the points identified on the Selective Catalytic Reduction System Specification Sheets. There will be extended periods of operation at the maximum continuous rating.

If the availability demonstration run is interrupted as a result of malfunction of the balance-of-plant equipment unrelated to the SCR equipment, the run shall be stopped. The run shall be restarted once the balance-of-plant equipment is available for restart. The running time shall be cumulative over such balance-of-plant problems.

The Seller shall provide all replacement parts and be responsible for all necessary repair work on the systems to permit the availability demonstration run to be completed.

The running time shall, in any case, be cumulative if at any time the availability demonstration run is terminated by breakdown of Seller-provided equipment as a result of the failure of the Buyer to follow the Seller-provided and Buyer-approved maintenance and operating instructions. Specific causes of run interruption that will allow the running time to be cumulative include, but are not limited to, the following:

- 1. Failure or insufficiency of plant services to the SCR system.
- 2. Damage to the SCR system as a result of improper operation or performance of other plant equipment.
- 3. Lack of proper maintenance of the SCR system in accordance with the Sellerfurnished written procedures approved by the Buyer.
- 4. Plant operating conditions that vary from the design basis on which the equipment is offered.
- 5. Breakdown, stoppages, or inadequacy of the Buyer's equipment or operation of which affects Seller's equipment.

Source: 11506, 2014, v2.0

Normal maintenance shall be performed on auxiliaries located outside the major equipment at any time, provided it does not adversely affect system performance or increase emissions above the regulatory emissions compliance limits. During operating interruptions, the Seller shall be entitled to access the internal portion of any of the process equipment for the purpose of removing, inspecting, replacing, or repairing any equipment or work that the Seller determines has impacted or may impact availability, provided such access and repair does not negatively impact or delay restart of the equipment.

**11506.2.1.3.6 Formal performance guarantee tests**. Formal performance guarantee tests shall be conducted at any operating condition specified by the Buyer between the specified range of minimum and maximum operating conditions.

Test objectives shall include determination of compliance with the generated limits for the specified SCR system performance and guarantees.

The Buyer shall provide certification of final acceptance upon the delivery and review of the final performance guarantee test report that indicates the equipment has met all performance guarantees.

# 11506.2.2 Remedies for Deficient Performance

Should any of the performance guarantee tests or the reliability demonstration test indicate that the SCR system has failed to meet the required guarantees, then the Seller shall correct equipment by adjustment or repairing in place or, at its option, by replacement of defective parts including catalyst so that the equipment is capable of meeting the performance guarantees. The system shall be considered accepted if, during testing, the tests show that the guarantees have been fulfilled.

Should any of the performance tests not meet the performance criteria, retesting shall be performed upon 30 days' notification to the Buyer.

Should the performance guarantee requirements not be achieved during performance testing or retesting, certain remedies may be acceptable to the Buyer. Seller-proposed remedies must be demonstrated in operation on similar type applications and, in the opinion of the Buyer, have the potential for remedying the deficient performance. In no case can use of a remedy compromise the guaranteed values for applicable emissions performance (i.e., NO<sub>x</sub>, ammonia slip, opacity, carbon monoxide, and hydrocarbon emissions). It shall be the responsibility of the Seller to recommend an appropriate remedy to the Buyer based on a thorough technical analysis of the remedy's potential effectiveness and successful application history. However, it will be solely at the Buyer's discretion as to acceptance of a proposed remedy. The Buyer and Seller shall agree on the acceptable remedies and document them, along with their implementation lead times.

### 11506.2.3 SCR Reactor

This article covers the design and construction requirements for the SCR reactor provided by the Seller. The following items are described herein:

- 1. Reactor (catalyst housing).
- 2. Test ports.
- 3. Reactor access.
- 4. Gas distribution devices.

**11506.2.3.1 Reactor**. The reactor shall be furnished with all required internal supports for catalyst, catalyst loading, thermal expansion, pressure loading, and internal access. Thermal expansion and



Source: 11506, 2014, v2.0

pressure loading design shall take into account emergency shutdown and the full range of anticipated steady-state and transient operation.

Catalyst shall be oriented for an exhaust gas flow direction as specified on the Selective Catalytic Reduction System Specification Sheets.

Access to the reactor (ladder, stairs, and platforms) shall be provided as required for maintenance.

Each catalyst layer shall have exterior access provisions to allow complete and convenient internal inspections.

**11506.2.3.2 Gas Distribution Devices**. The Seller shall provide all gas distribution devices or turning vanes that are recommended by the model study. The gas velocity distribution at the reactor outlet shall be controlled to meet the guaranteed requirement specified.

# 11506.2.4 Tempering/Purge Air Blower

One 100 percent capacity tempering/purge air blower shall be provided to reduce the temperature of the exhaust gas prior to reaching the SCR and/or CO oxidation catalysts. The blower shall also be used in conjunction with the CTG crank air flow to provide adequate air changes through the SCR exhaust system ductwork and stack to comply with NFPA requirements for exhaust system purge. The blower shall be sized by the Seller to provide adequate ambient air (at any temperature within the design ambient temperature range) into the exhaust gas to meet the catalysts manufacturer's requirements and the NFPA purge requirements. The blower shall be sized to ensure a minimum of five (5) air changes can be achieved in less than or equal to 5 minutes. The entire volume included in the scope of supply (from the CTG exhaust flange through the stack exit) shall be accounted for in determining the volume of air to be changed five (5) times within five (5) minutes.

The tempering/purge air blower shall be single-speed blower, furnished complete with motor, inlet and outlet dampers, and ancillary equipment as needed for a complete and functional system. The blower shall be designed for continuous operation. The blower shall be sized with 20% flow and 10% pressure margin. The blower motor shall be sized to allow continuous operation at all potential operating points along the blower curve. The blower and motor shall also be capable of multiple starts per hour, if required.

The blower shall include a pneumatic or backdraft damper installed on the outlet of the blower. These dampers shall be designed for open/close service with fail-closed provisions. These dampers shall also be provided with travel stops to allow tuning of blower discharge flow. Backdraft damper leakage shall not cause reverse rotation of out-of-service tempering air blower. Manual inlet dampers shall also be provided for blower isolation purposes.

High temperature catalyst may be provided as an OPTION in lieu of tempering air.

### 11506.2.5 Controls and Instrumentation

The Seller shall provide engineering services and documentation to allow the SCR/ammonia control to be implemented in the CTG control system (not a separate programmable logic controller). The CTG control system is referred to as the Distributed Control System (DCS) throughout this document. The Seller shall provide all instrumentation necessary to implement a complete SCR control and monitoring system within the DCS.

The Seller shall furnish documentation defining the recommended operation of the SCR/ammonia system. The documentation shall identify all interlocks, alarms, automatic trip conditions, sequence functions, modulating control functions, and operator interfaces required to safely and efficiently operate the equipment supplied under this Contract. The Seller shall document all digital (on-off) control functions in a format conforming to ISA Standard S5.2 "Binary Logic Diagrams for Process Operation." The Seller



Source: 11506, 2014, v2.0 Selective Catalytic Reduction System

shall document all modulating (regulatory) control functions in a format conforming to ISA (SAMA) Standard RC22-11 "Functional Diagramming of Instrument and Control Systems." System operation descriptions and a control input/output (I/O) list shall also be provided.

**11506.2.5.1 Control and Instrumentation Devices**. The Seller shall provide all instrumentation associated with the SCR/ammonia injection system to include, but not be limited to, the following functional areas of control:

- 1. Modulating control.
- 2. Digital control.
- 3. Required alarms.
- 4. Performance monitoring of the SCR including:
  - i. Aqueous and vaporized ammonia flow control and shutoff valve position
  - ii. Aqueous and vaporized ammonia pressure, temperature, and flow rate
  - iii. Inlet and outlet flue gas temperatures
  - iv. Catalyst pressure drop
  - v. Dilution air pressure, temperature, and flow rate
- 5. Local indication.

The Seller shall furnish all instrumentation and pressure instrumentation valves in accordance with this article and Supplemental Specifications located in Section 21000. Instrumentation housings shall be NEMA 4X. The devices furnished shall facilitate control and monitoring through the DCS.

Scope of Supply	
SCR housing	Yes
Catalyst support grid within reactor	Yes
Structural steel	As required by the Seller's design
Ammonia vaporization and injection system (in accordance with Section 11508 - Ammonia System)	Yes
Ammonia receiving and storage system	No
Exhaust gas monitoring system	No, gas monitoring equipment furnished by Others.
Access provisions per OSHA	Yes
Weather enclosure	No
Exhaust gas distribution devices and baffles	As required by Seller's design
Casing insulation and lagging	Yes
Expansion joints	Yes
Catalyst removal system (monorails, trolleys, and hoists)	Yes
Ductwork	Yes
Reactor bypass dampers	No
Tempering/purge air blower	Yes, 1 x 100%
General Conditions	
Exhaust gas flow direction through reactor	Vertical
Fuel	Natural gas
Unit load, percent MCR	50 to 100
Minimum inlet temperature, °F	By Seller
Maximum inlet mass flow, lb/h	By Seller
Maximum inlet volumetric flow, scfm	By Seller
Maximum inlet pressure, psig	By Seller
Minimum inlet pressure, psig	By Seller
Maximum gas velocity, ft/s	By Seller
Maximum exhaust gas excursion temperature, °F	By Seller
Guaranteed Performance Requirements	
Maximum rated capacity of SCR Exhaust System, exhaust gas flow rate, lb/hr	By Seller
Near-field noise emissions as defined in 11506.2.1.2.2	85 dBA

# Selective Catalytic Reduction System Specification Sheet

Exhaust Stack Emissions Guarantees (per unit)		
	Value <sup>(1)</sup>	Units
NOx	2.5	ppmvd @ 15% O <sub>2</sub>
со	3.0	ppmvd @ 15% O <sub>2</sub>
VOC	4.0	ppmvd @ 15% O <sub>2</sub>
SO <sub>2</sub>	0.0034	lb/MMBtu (HHV)
Ammonia slip	5.0	ppmvd @ 15% O <sub>2</sub>
(1) Guarantee maximum values for normal (50% to 100% CTG load) operating ca	onditions)	
Additional Exhaust Stack Emissions (per unit)		
Seller to provide estimated emissions value for each of the constit	uents listed bel	ow:
	Value	Units
PM <sub>10</sub>	By Seller	lb/MMBtu (HHV)
1,3-Butadiene	By Seller	lb/MMBtu (HHV)
Acetaldehyde	By Seller	lb/MMBtu (HHV)
Acrolein	By Seller	lb/MMBtu (HHV)
Benzene By Seller Ib/MMBtu (		lb/MMBtu (HHV)
Ethylbenzene By Seller Ib/MME		lb/MMBtu (HHV)
Naphthalene	By Seller	lb/MMBtu (HHV)
Polycyclic Aromatic Hydrocarbons (PAH)	By Seller	lb/MMBtu (HHV)
Propylene Oxide	By Seller	lb/MMBtu (HHV)
Toluene	By Seller	lb/MMBtu (HHV)
Xylenes	By Seller	lb/MMBtu (HHV)
Formaldehyde	By Seller	lb/MMBtu (HHV)
Notes		
<ol> <li>Building roof height is 60'-0" above grade. Exclusive of exhaust stack, the Seller's equipment must not exceed this height.</li> </ol>		
<ol> <li>Seller's equipment to accommodate future addition of single pressure, once-through steam generating section with vertical gas path, not to exceed the limitations of Note 1.</li> </ol>		

# 11507 - Catalyst for Selective Catalytic Reduction

# 11507.1 General

# 11507.1.1 Scope of Supply

Scope of supply shall include the catalyst as indicated in Article 11507.1.3.

### 11507.1.2 Not Used

### 11507.1.3 Performance and Design Requirements

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

Description of Supply	
Selective catalytic reduction (SCR) catalyst supplied	As part of the SCR exhaust system
Scope of Supply	
Catalyst modules	Yes
Catalyst support structure	Yes
Catalyst casing	Yes
Include room for spare layer	No
Catalyst monorail	Yes
Catalyst loading hoist	Yes
Performance Requirements	
Minimum catalyst life of initial catalyst charge (from first fire), hrs	5,000 or 60 months from first fire (which occurs first)
Emission limits	Refer to Section 11506.
Design Requirements	
Туре	Seller's choice of homogeneous or plate type
Exhaust gas flow direction through catalyst	Vertical
Exhaust Gas Conditions	Exhaust gas conditions are per the Seller's combustion turbine performance

### 11507.1.4 Not Used

### 11507.1.5 Test Requirements

Test requirements are defined in Section 11506.2.1.3.

# 11507.1.6 Technical Attachments

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



# 11507.1.7 Supplemental Specifications

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

# 11507.2 Products

### 11507.2.1 Design Conditions

The catalyst shall be designed for safe and effective operation to achieve the guaranteed NO<sub>x</sub> and ammonia slip emission rate as specified in Section 11506.

All guarantees shall be met over the entire range of operating conditions specified. The Seller shall be responsible for the design, manufacture, and supply of the catalyst in full accordance with all applicable laws or statutes established by any governing regulatory agencies. The Seller shall be responsible for developing operating and maintenance procedures for the catalyst in full accordance with all applicable laws or statutes established by any governing regulatory agencies.

The design of the SCR catalyst shall be guaranteed to meet the emission limits specified in Section 11506 without requiring cleaning (except periodic maintenance), regeneration, catalyst addition, or replacement for the required catalyst life.

### 11507.2.2 Operational Requirements

The SCR catalyst system components shall be designed to operate at specified performance for all fuel, operational conditions, NO<sub>x</sub> values, and exhaust gas constituents defined herein.

#### 11507.2.3 Catalyst

The catalyst shall be either a homogeneous extruded material or it shall be supported on a metallic or ceramic monolithic base material. The bonding procedure used and the design of the catalyst cells shall be such that delamination of the catalyst from the support material or permanent deformation of the support material shall not occur due to stresses induced by the design seismic, pressure, thermal, or chemical conditions, or combinations thereof.

The catalyst modules shall be constructed either as one-layer modules or as modules that can be placed one above the other in accordance with the direction of gas flow specified. The catalyst modules shall be capable of supporting all other subsequent catalyst modules required to be stacked directly on the lower modules. No intralayer supports will be provided.

Appropriate seals shall be provided with the catalyst to prevent leakage of any of the exhaust gas around the catalyst modules. The sealing mechanism shall be capable of a service life equal to or greater than the catalyst without degradation in the seal performance.

Catalyst shall be shipped to the site inside weatherproof packaging to prevent degradation of the catalyst.

Prior to fabrication, the Seller shall test specimens of the catalyst to be used to determine specific surface and activity. The results of these tests shall be documented and submitted to the Buyer for approval.

The Seller shall provide an expected catalyst addition/replacement plan that is based on the guaranteed life of the catalyst. This plan shall include the following:

The sequence in which the catalyst layers should be replaced, added, or moved.

The time periods between catalyst replacements, additions, or moves.

The quantity of catalyst that should be replaced, added, or moved.

In order to monitor catalyst life and performance, test elements shall be provided and installed in the catalyst beds. In addition to the test elements installed in the catalyst bed, the Seller shall supply an additional catalyst sample to be placed in the Buyer's file. All catalyst test elements, including the sample for the Buyer's files, shall be from the same lot as the installed catalyst. Under normal operating conditions, one of these samples will be tested to evaluate catalyst activity and physical properties as the catalyst ages.

The Seller shall provide a list of catalyst poisons and operating conditions that may reduce catalyst life, performance, or structural integrity. The list of poisons shall include the maximum quantities of poisons allowed (either individually or in combination) and the testing method which will be used as a basis for determining poison levels.

#### 11507.2.4 Disposal of Catalyst Material

The Seller shall indicate whether or not he will accept return of spent catalyst when the catalyst is replaced by the Seller. The Seller's cost for this service will be quoted at the time of catalyst replacement and not in the Seller's proposal.

#### **11507.2.5** Performance Guarantee Requirements and Tests

The system performance parameters listed in Section 11506 shall be guaranteed. All guarantees are to be achieved simultaneously.

Equipment and resources required for the initial performance tests will be provided by the Buyer. The Seller shall provide a representative to witness the initial performance test. The details of the performance test procedure will be developed by the Buyer and submitted to the Seller for review. The final procedures will be approved by both the Seller and the Buyer.

The following performance curves submitted with the proposal will be used by the Buyer to correct the guarantee points to actual tested conditions. The performance indicated shall be guaranteed:

- Flange-to-flange pressure loss through the SCR catalyst system, including the limits of Seller-furnished accessories versus inlet exhaust gas flow rate for the quantity of catalyst originally furnished. Curve shall take into consideration the effects of particulate accumulation and other potential deposits on the catalyst.
- 2. NO<sub>x</sub> reduction, in percent, versus exhaust gas temperature. Curve shall be provided at maximum exhaust gas flow rate.
- 3. NO<sub>x</sub> reduction, in percent, versus SCR inlet NO<sub>x</sub> concentration.

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# 11508 - Ammonia System

# 11508.1 General

## 11508.1.1 Scope of Supply

Scope of supply shall include furnishing the ammonia system indicated on the Ammonia System Specification Sheet(s) included at the end of this section.

#### 11508.1.2 Items Furnished by Others and Interfaces

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

- 1. Power and control wiring to connect the specified termination points on the ammonia system to the plant electrical and control systems.
- 2. Aqueous ammonia storage tank and forwarding system.

#### 11508.1.3 Performance and Design Requirements

Performance and design requirements for the ammonia system are indicated on the Ammonia System Specification Sheets included at the end of this section.

### 11508.1.4 Codes and Standards

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

Work	In Accordance With
Design and materials for use and installation in hazardous areas	NFPA 70 and NFPA 497, and as further described in Article 11508.2
Flanged and butt weld valves	ANSI/ASME B16.10 and ANSI/ASME B16.34
Piping	ASME B31.1
Structural skids	ANSI/AWS D1.1
Vaporizer - air/ammonia mixing	NFPA
Vessels	ASME Boiler and Pressure Vessel Code, Section VIII, Division I, except that all pressure vessels shall be hydrostatically tested to 1.5 times the design pressure in accordance with ASME B31.1

### 11508.1.5 Materials

The following materials shall be used:

Component	Material

Component	Material
Piping and piping components in contact with vaporized ammonia	Type 316 SS

#### 11508.1.6 Technical Attachments

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

#### 11508.1.7 Supplemental Specifications

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

# 11508.2 Products

Seller's design and materials furnished herein shall meet all requirements for use in and installation in an area classified as Class I, Division 2, Group D, as defined in NFPA 70 and NFPA 497. The Seller shall not interpret NFPA requirements to the contrary of requiring classification, such as claiming exemption via NFPA 497 Sections 3-3.1(a) and 3-3.2(a), irrespective of the installation location or details.

### 11508.2.1 General

The ammonia vaporization and injection system shall be utilized for the vaporization and injection of aqueous ammonia.

## 11508.2.2 Guarantees

Performance of the ammonia vaporization and injection system shall be guaranteed as indicated in the Ammonia System Specification Sheets.

#### 11508.2.3 Code Requirements

The ammonia vaporization and injection system shall meet all requirements listed in Article 11508.1.4.

### 11508.2.4 Design

The ammonia vaporization and injection system shall be designed by the Seller for safe vaporization of aqueous ammonia. The ammonia vaporization and injection system shall be adequately sized to provide the maximum amount of ammonia plus at least a 10 percent design margin. The Seller shall be responsible for design and fabrication of the ammonia vaporization and injection system in full accordance with all applicable country, state, and local regulation and code requirements. Operating and maintenance procedures established for this equipment shall also be developed in full accordance with all applicable federal, state, and local regulation and code requirements.

The Seller-furnished equipment shall be designed to be located in an indoor location.

All piping and piping components in contact with vaporized aqueous ammonia shall be constructed of Type 316 stainless steel.

### 11508.2.5 Ammonia Area Monitors

The Seller shall supply an area ambient monitoring system for continuous ammonia vapor monitoring at the ammonia vaporization skid and ammonia injection location. Each ammonia monitor shall be capable of monitoring ambient ammonia levels in the 1 to 100 ppm range with a minimum  $\pm 5$  percent accuracy and  $\pm 2$  percent repeatability of reading.

Each ambient monitor shall be provided with both visual and audible alarms. A visual alarm shall constitute a rotating white light fixture that is activated by the visual alarm contact. Each ambient monitor shall have a test button and LED display as a minimum. An audible alarm shall constitute a self-contained (within the ammonia monitor) audible alarm that is activated by the audible alarm contact. In



addition, the ammonia monitor/audible alarm equipment shall be provided with a silence button, accessible from the front of the ammonia monitor/audible alarm equipment.

Each ambient monitor shall be standard equipped with a 4 to 20 mA output.

# 11508.2.6 Ammonia Injection System

The ammonia injection system shall evenly distribute the ammonia/air mixture across the cross section of the duct casing and throughout the exhaust gas stream prior to the SCR catalyst. In addition, the injection grid shall be located downstream of the supplied oxidation catalyst.

The ammonia injection grid shall be designed for safe and effective operation to achieve the guaranteed ammonia supply rates over the full load range based on the technical requirements. The Seller shall be responsible for design and construction of the ammonia injection grid in full accordance with all applicable federal, state, and local regulations and code requirements. Operating and maintenance procedures established for this equipment shall also be developed in full accordance with all applicable federal, state, and local regulation and code requirements.

The injection grid shall be designed and arranged to ensure uniform mixing between the ammonia and the exhaust gas stream. The injection grid shall be designed with multiple injection branches. The ammonia injection system shall be designed with a maximum number of independently adjustable ammonia injection zones. Each ammonia injection zone (branch) shall be adjustable from the exterior of the duct.

Each branch of the ammonia injection grid shall be designed such that it is provided ammonia from a common supply manifold located at a distance away from the exhaust gas duct so that adjustments and maintenance can be conducted without congestion. The manifold shall be designed to allow for isolation of any leaks that might occur. Each injection zone shall include flow orifices, injection nozzles, and independent flow rate adjusting valves necessary to allow maximum tuning flexibility. Valved connections for a magnehelic type differential pressure measurement instrument shall be provided on each branch of the injection grid. Valved test connections shall be located for ease of access, and valved test connections for each ammonia injection grid shall be located at one control panel. The test connections shall be routed to a common panel at an accessible location near the flow rate adjusting valves. Five magnehelic type differential pressure measurement instruments shall be provided for each ammonia injection grid.

The injection grid shall be properly supported to prevent thermal distortion and damage due to vibration induced by the exhaust gas flow. The injection grid shall be designed for maximum thermal expansion, and the design shall consider maximum thermal expansion without cooling provided by the flow of ammonia and dilution air.

### 11508.2.7 Ammonia Vaporization and Mixing System

The ammonia vaporization system shall be designed by the Seller for safe vaporization of aqueous ammonia (at the vaporization skid location). The vaporizers shall be equipped with adequate insulation to ensure that the surface temperature of the insulated vessel does not exceed 140° F.

**11508.2.7.1 Dilution Air Blower**. The dilution/conveying air blower shall be furnished complete with inlet air filters/silencers, motors, flow control valves, and ancillary equipment as needed for a complete and functional system. There shall be one dilution air fan with 100 percent capacity with the capability of meeting all system turndown requirements.

Refer to Section 21000 for additional motor requirements.

11508.2.7.2 Dilution Air Heat Exchanger.	The dilution air heat exchanger shall be designed to use
electric heat for heating dilution (vaporization	ı) air.

**11508.2.7.3** Air and Ammonia Mixing (Vaporization Chamber). The ammonia shall be diluted and mixed with conveying air prior to injection into the exhaust gas stream. The resultant air and ammonia mixture shall typically contain between 2 and 5 percent ammonia by volume for all load conditions, and in no case shall contain more than 8 percent ammonia by volume.

## 11508.2.7.3.1 Not Used.

**11508.2.7.3.2** Air and ammonia mixing (aqueous). Aqueous ammonia shall be atomized in the vaporizer through the use of dual fluid nozzles. The atomizing medium shall be compressed air.

The vaporizer shall be designed and equipped to ensure that no entrained liquid (aqueous ammonia or water) droplets exit the vaporizers. The number, size, and capability (turndown) of the vaporizers shall consider the operating range requirements specified on the Ammonia System Specification Sheets. Sufficient redundancy shall be taken into account by the Seller to ensure that overall plant availability is supported.

### 11508.2.7.4 Not Used.

**11508.2.7.5 Operation and Control**. The ammonia vaporization system shall be designed for both manual and complete automatic control. The Seller shall supply a complete instrumentation and controls designed for unattended operation with periodic operator checks. The ammonia vaporization system shall be designed and controlled adequately to follow all changes of the NO<sub>x</sub> mass flow without exceeding NO<sub>x</sub> or ammonia slip emission guarantees. The ammonia vaporization controls shall be incorporated in the combustion turbine control system (not a separate programmable logic controller). The combustion turbine control system is referred to as the distributed control system (DCS) throughout this document.

These general requirements are the minimum control capability requirements of the controls. The Seller's recommended controls shall include and coordinate the capabilities described in the following articles as a minimum and may include additional capability as required by the Seller's design.

**11508.2.7.5.1 Ammonia vaporization control**. The ammonia vaporization system shall be designed for both manual control and automatic control.

In the manual mode, the following equipment shall be opened, closed, started, or stopped through appropriate operator interface devices in the power plant control room:

- 1. Ammonia vaporizers.
- 2. All air- or motor-operated valves.

In the automatic mode, the controls shall automatically control the operation of the ammonia pumps and ammonia vaporizers to maintain the preset ammonia delivery temperature and pressure.

When the system is in manual mode, a local manual control shall be provided at each item of equipment. This local control shall allow the operator to control system power at the equipment location after control is transferred from the control room. Modulating control will be from the control room only.

On failure of an operating vaporizer or during automatic shutdown of a vaporizer, the vaporizer inlet valve shall automatically close.

**11508.2.7.5.2** Conveying air fan control. The conveying air fan system shall be designed for both manual control and automatic control.



In the manual mode, the following equipment shall be opened, closed, started, or stopped through the appropriate interface devices in the control room:

- 1. Conveying air fans.
- 2. All air- or motor-operated flow control dampers.

In the automatic mode, the controls shall automatically operate the conveying air fans. The conveying air fans shall automatically provide dilution air at the required flow rate to the air/ammonia mixing chamber.

The flow of conveying air shall be controlled to provide the dilution of ammonia specified on the Ammonia System Specification Sheets by automatic operation of a flow control damper in the common outlet of the conveying air fans based on the required ammonia injection rate.

**11508.2.7.5.3 Ammonia injection control**. The ammonia injection system shall be designed for both manual control and automatic control.

In the manual mode, the following equipment shall be opened, closed, started, or stopped through the DCS operator workstations in the control room:

- 1. Damper drives.
- 2. All air- or motor-operated valves.

In the automatic mode, the controls shall automatically control the conveying, mixing, and injection of ammonia. The controls will receive input signals for unit load,  $NO_x$  concentration at the inlet to the SCR catalyst, and  $NO_x$  concentration at the outlet of the SCR catalyst. Optionally, the Seller may also elect to provide an input signal for the ammonia concentration at the outlet of the SCR catalyst.

**11508.2.7.5.4 Ammonia injection rate determination**. The rate of ammonia injection shall be determined from the inlet NO<sub>x</sub> concentration and the unit load signal based on the preset NH<sub>3</sub>/NO<sub>x</sub> molar ratio and the desired outlet NO<sub>x</sub> concentration input by the operator. The unit load signal shall be used to indicate inlet exhaust gas flow rate. The rate of ammonia injection shall be adjusted downward to maintain the required outlet NO<sub>x</sub> concentration at the lowest possible ammonia injection rate. The rate of ammonia injection shall be adjusted upward if the outlet NO<sub>x</sub> concentration exceeds the target NO<sub>x</sub> emission rate.

If the outlet ammonia concentration signal is provided, the ammonia injection rate shall be adjusted downward to maintain the preset ammonia slip limit. If the desired outlet  $NO_x$  concentration cannot be achieved without exceeding the preset ammonia slip limit, the ammonia slip shall be alarmed and shall be minimized while maintaining the desired outlet  $NO_x$  concentration.

**11508.2.7.5.5 Ammonia injection rate control**. The flow of ammonia to the air/ammonia mixing chamber shall be controlled by automatic modulation of control valves on the ammonia flow control skid. The actual flow of ammonia shall be measured downstream of the ammonia control valve and used to automatically adjust the control valve position.

During startup, injection of ammonia shall not be instituted until the following conditions have been met:

The exhaust gas temperature at the inlet to the SCR is at SCR operating conditions.

The exhaust gas temperature at the outlet of the SCR catalyst is at SCR operating conditions.



The ammonia injection control valve shall stop flow of ammonia to the SCR under any of the following conditions:

The exhaust gas temperature at the SCR reactor outlet is below the precipitation temperature for ammonium bisulfate for the fuel being fired.

The exhaust gas flow rate is below the minimum low load operation level.

The ratio of ammonia to conveying airflow is greater than 8 percent by volume.

**11508.2.7.5.6 Injection shutoff valve control**. The injection shutoff valve shall automatically close when the conveying airflow is less than the preset minimum operating flow or if the exhaust gas is below the minimum acceptable operating temperature.

**11508.2.7.6 Coriolis Flowmeter**. The Seller shall provide a Coriolis flowmeter as part of the ammonia flow control and vaporization skid with a 4 to 20 mA output to the DCS.



Item	Status
Scope of Supply	
Ammonia area monitoring equipment	Yes
Ammonia injection system	Yes
Ammonia vaporization system	Yes
Dilution air heaters	Yes
Dilution air blowers	Yes
Feed pumps	No
Vaporization chamber	Yes
Instrumentation (including Coriolis flowmeter)	Yes
Skid mounted	Yes
Skid enclosure	No
Operating Parameters	
Ammonia type	
Aqueous ammonia	Yes
NH <sub>3</sub> percentage by weight	19
Ammonia required, gpm	By Seller
Injection grid ductwork dimensions, I x w x h, in.	By Seller
Equipment Guarantee	
Vaporized ammonia supply rate, lb/h	By Seller
Design Requirements	
Ammonia area monitors	
Number per injection grid	1
Number per ammonia vaporization skid	2
Alarm equipment system	Audible alarm, visual alarm, and remote alarm to DCS
Ammonia injection system	
Injection grid is downstream of oxidation catalyst	Yes
Model study - injection grid area	Yes, per Section 11506.2.1.3.3

# Ammonia System Specification Sheet



Item	Status
Ammonia inlet pressure at boundary	
Maximum, psi	By Seller
Minimum, psi	By Seller
Ammonia Vaporization Design Requirements	
Number of ammonia vaporizers per unit	1
Percentage capacity	100
Туре	Electric
If electric type	Mechanical atomization (Seller's standard design)
Number of dilution air blowers per unit	1
Percentage capacity	100
Voltage	480VAC
Number of dilution air heaters per unit	1
Percentage capacity	100
Voltage	480VAC
Number of mixing chambers per unit	1
Percentage capacity	100
Ammonia supply pressure to injection grid, psi	By Seller

# 11509 - Oxidation Catalyst System

# 11509.1 General

## 11509.1.1 Scope of Supply

Scope of supply shall include furnishing the oxidation catalyst system as indicated on the Oxidation Catalyst System Specification Sheets included at the end of this section.

## 11509.1.2 Not Used

#### 11509.1.3 Performance and Design Requirements

Performance and design requirements for the oxidation catalyst system are covered on the attached Oxidation Catalyst System Specification Sheets.

#### 11509.1.4 Not Used

#### 11509.1.5 Materials

The following materials shall be used:

Component	Material
Casing	ASTM A588, ASTM A36

#### 11509.1.6 Not Used

#### 11509.1.7 Test Requirements

Test requirements are defined in Section 11506.2.1.3.

#### **11509.1.8 Technical Attachments**

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

#### 11509.1.9 Supplemental Specifications

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

### 11509.2 Products

#### 11509.2.1 General

The oxidation catalyst shall be located upstream of the ammonia injection grid of the SCR system. All guarantees shall be met for all conditions listed in Section 11506.

The design of the oxidation system shall be guaranteed to meet the emissions limits specified in Section 11506 without requiring cleaning (except during periodic maintenance), regeneration, or replacement for the required catalyst life.

#### 11509.2.2 Operational Requirements

The oxidation catalyst system components shall be designed to withstand the maximum exhaust gas pressure and temperatures as determined by the Seller.

### 11509.2.3 Catalyst

The catalyst shall be supported on a metallic or ceramic monolithic base material. The bonding procedure used and the design of the catalyst's cells shall be such that delamination of the catalyst from the support material or permanent deformation of the support material shall not occur as a result of



stresses induced by the design seismic, pressure, thermal, or chemical conditions, or combinations thereof.

In order to monitor catalyst life and performance, test elements shall be provided and installed in the catalyst beds. Each layer of catalyst shall have multiple test elements. In addition to the test elements installed in the catalyst bed, the Seller shall supply five additional catalyst test elements to be placed in the Buyer's file. All catalyst test elements, including the sample for the Buyer's file, shall be from the same lot as the installed catalyst. These samples will be tested to evaluate catalyst activity and physical properties as the catalyst ages.

The Seller shall provide a list of catalyst poisons and operating conditions that may reduce catalyst life, performance, or structural integrity. The list of poisons shall include the maximum quantities of poisons allowed (either individually or in combination) and the testing method which will be used as a basis for determining poison levels.

The catalyst shall be provided with the module support frame which shall be designed to reduce thermal stress by allowing for thermal expansion between the catalyst modules, support frame, and casing.

#### 11509.2.4 Casing

Access shall be provided for removal of catalyst test elements and to allow cleaning of the catalyst during periodic maintenance intervals. The internal structure of the casing or transition piece shall allow complete access to both sides of the catalyst reactor without removal of internal structures.

The catalyst casing shall include all required internal supports for catalyst loading, thermal stress, and earthquake loading. The casing shall be designed to withstand the maximum flue gas pressure.

Removable access covers of sufficient size shall be incorporated into the casing to allow installation and removal of the SCR and oxidation catalyst modules without the need for cutting or welding any of the casing components. Access doors shall be located on both upstream and downstream sides of the catalyst. Doors shall be pressure tight with bolted closure. The Seller shall provide all necessary stairs, platforms, and guardrails to allow access to the access doors.

The casing and ductwork shall be designed in accordance with the following deflection criteria:

<u>Plate Span</u>. Casing platework shall be designed to limit deflections to 1/100 of the span of plate between stiffeners, taking advantage of multispan continuity where appropriate for normal operating conditions.

<u>Stiffener Span</u>. Casing stiffeners shall be designed to limit deflection to 1/240 of the stiffener span for normal operating conditions. Stiffeners shall be assumed to approximate an unrestrained pinned condition at exterior ends and a full continuity where continuous over interior supports.

<u>Load Requirements</u>. Casing normal operating conditions shall include full dead load (defined as the actual weight of plates, pipe trussing, and stiffeners) plus pedestrian live loading and normal interior pressure loadings as normal operating conditions.

The casing design shall ensure a uniform gas flow profile at the inlet to the catalyst section. The gas velocity profile entering the catalyst module and the maximum temperature stratification shall be as required by the catalyst manufacturer. Sampling ports shall be provided to verify these parameters.

Stainless steel or chrome-moly plate material shall be used for components with operating temperatures greater than 750° F. Carbon steel plate material shall be used for components with operating temperatures up to and including 750° F.



#### 11509.2.5 Monorail

If a monorail is required on the attached Oxidation Catalyst System Specification Sheets, all required platforms, stairs, ladders, and support steel shall be provided to support the installation and removal of catalyst.

# 11509.2.6 Insulation, Liner, and Lagging

The casing shall be insulated and lagged in the shop to the maximum feasible extent. Any surface that will be inaccessible during or after erection shall be shop insulated and lagged. The casing shall be insulated to minimize heat loss.

The internal insulation shall be designed to withstand water washing operations. All insulation materials shall be asbestos free and noncorrosive. Insulation materials in contact with austenitic stainless steel shall be inhibited and of a low halogen content to prevent stress corrosion cracking.

#### 11509.2.7 Performance Guarantee Requirements and Testing

The system performance parameters listed in Section 11506 shall be guaranteed. All guarantees are to be achieved simultaneously.

Equipment and resources required for the initial performance tests will be provided by the Buyer. The emissions test methods used to demonstrate guarantees will be as specified in Article 11506.2.1.3. The Seller shall provide a representative to witness the initial performance test. The details of the performance test procedure will be developed by the Buyer and submitted to the Seller for review. The final procedures will be mutually agreed upon by both the Seller and the Buyer.

The following performance curves shall be submitted by the Seller with the proposal and will be used by the Buyer to correct the guarantee points to actual tested conditions. The performance indicated shall be guaranteed by the Seller:

- 1. Flange-to-flange pressure loss through the oxidation catalyst system, including the limits of Seller-furnished casing and accessories versus inlet flue gas flow rate for the quantity of catalyst originally furnished. Curve shall take into consideration the effects of particulate accumulation and other potential deposits on the catalyst.
- 2. Conversion of CO as a function of temperature, gas flow rate, and CO inlet emissions. The curve shall apply to the following ranges:

Minimum	Maximum
Minimum inlet CO	Maximum inlet CO
Minimum flue gas temperature minus 10 percent	Maximum flue gas temperature plus 10 percent
Minimum flue gas flow rate minus 10 percent	Maximum flue gas flow rate plus 10 percent


# **Oxidation Catalyst System Specification Sheets**

Description of Supply	
Oxidation catalyst supplied	As part of the SCR exhaust system
Scope of Supply	
Catalyst modules	Yes
Catalyst support structure	Yes
Catalyst casing	Yes
Include room for spare layer	No
Transition/spool piece	No
Catalyst monorail	Yes
Catalyst loading hoist	Yes
Insulation and lagging	Yes
Design Criteria	
The location for the oxidation catalyst has been selected by the Buyer	No
The final location for the oxidation catalyst shall be determined by the Seller.	Yes
If yes, the minimum catalyst operating temperature must be, °F	By Seller
Exhaust gas flow direction through catalyst	Vertical
Performance Requirements	
Minimum catalyst life of initial catalyst charge (from first fire), hrs	5,000 or 60 months from first fire (whichever occurs first)
Emission limits	Refer to Section 11506.
Exhaust Gas Conditions	Exhaust gas conditions are per the Seller's combustion turbine performance



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# 15220 - Reciprocating Fuel Gas Compressor Datasheet(s)

	Name: Fu	el Gas Booster			
Gene	General				
1	Number required	3 x 50% capacity (2 runni supply compressed gas f	ing compressors to or 2 running CTG's)		
2	Fuel gas compressor ID number(s)	LATER			
3	Parallel operation required	Yes			
4	Guaranteed maximum sound level, dBA @ 3 ft	85			
5	Installation location	Outdoor			
6	Maximum dimensions	24 feet wide x 48 feet lon	g		
7	Elevation, ft	Per Section D100			
8	Ambient temperature range, °F	Per Section D200			
9	Hazardous area rating per NFPA 70, NFPA 497 and NEC. Seller shall not claim hazardous area exemption via NFPA 497 Sections 3-3.1(a) and 3- 3.2(a), irrespective of the installation location or details.	Class I, Division 2, Group Extent of hazardous area determined by Seller.	D classification to be		
10	Pulsation suppression study required	Digital pulsation control a be performed by a party t upon by the Seller and Bu approach shall be an Acc Piping Restrain Analysis with Forced Mechanical F an empty bottle arrangem requirements of API 618	nd pulsation studies shall hat is mutually agreed uyer. The design pustic Simulation and Plus Mechanical Analysis Response Analysis under nent, conducted per the Design Approach 3.		
11	Torsional analysis required	Yes			
Opera	ating Conditions and Performance Requ	uirements			
12	Inlet gas operating temperature, °F	50 Min	120 Max		
13	Inlet gas operating pressure, psig	5 Min	45 Max		
14	Inlet gas design temperature, °F	130			
15	Inlet gas MAWP, psig	60			
16	Discharge gas pressure control range, psig	By Seller, as needed to s requirements. Assume B pressure drop between co CTG inlet is 50 psi.	atisfy CTG inlet pressure alance of Plant piping ompressor outlet and		
17	Guaranteed capacity, each compressor, with specified inlet conditions, scfm	By Seller, as needed to s	atisfy CTG demand.		

18	Inlet gas temperature for Guaranteed capacity, °F	50		
19	Inlet gas pressure for Guaranteed capacity, psig	5		
20	Gas compressor cooling method	Air-Cooled		
21	Note: Inlet and discharge pressures are boundary.	defined at the Seller/Buyer connection points at skid		
Code	s and Standards			
22	Gas compressor design and construction	API Standard 11P		
23	Compressor skid piping	ANSI B31.3 or B31.1		
24	Shop operational tests of fuel gas compressors	Mfg. Standard		
25	Pressure vessels – pulsation suppression devices, separators, heat exchangers, lube oil coolers, intercoolers, and aftercoolers			
26	Piping flanges	ASME B16.5		
Testi	ng and Guarantees			
27	Operational test – Each compressor unit shall be shop tested by the Seller to verify mechanical integrity and proper function of control systems. Compressors shall operate without excessive vibration or noise.			
28	Shop hydrostatic tests shall be conducted by the Seller on pulsation suppression devices, separators, and heat exchangers			
29	After installation of the compressors, tests will be performed by the Buyer to check the performance, and determine actual performance when operating within the Buyer's plant and piping systems. Seller shall provide a technically qualified person to advise on testing procedures and to witness the test. If the compressors fail to perform as required to meet the combustion turbine guaranteed performance requirements, the Seller shall modify the compressors as required to achieve the guaranteed performance. Following such modifications, the compressors shall be retested. The entire expense of the additional terms with the verify the modifications are putted to verify the modifications and the verify the seller shall be retested.			
30	Performance parameters to be guaran	iteed by Seller		
31	Capacity at the design discharge pr conditions.	essure with the specified inlet design		
32	Power input at the design point and	maximum horsepower requirement.		
Desig	n Attributes			
33	Fuel gas compressor type	Horizontally opposed, motor driven, lubricated, heavy-duty, low-speed, double acting, reciprocating type		
34	Maximum prime mover speed, rpm	1800		
35	Sound attenuation enclosure required Yes, if required to meet guaranteed sound levels.			
36	Weather proof enclosure required	Yes, with space heaters.		



37	Bridge crane and manual hoist required	Νο
38	Compressor assembly	Each compressor, drive motor, and all accessories completely factory assembled on a common, fabricated steel base, ready for installation.
39	Compressor piping	
40	Provide each compressor with inter gas outlet, drains, vents, and instrur	nal piping to single point connections for gas inlet, ment air supply.
41	Compressor performance capabilities	
42	Suitable for operation at any gas de time limit.	mand rate from zero to maximum capacity without
43	Provide a constant discharge gas p	ressure.
44	Provide pockets, unloaders, and/or control and to allow the compressor	recirculation, as necessary for compressor capacity to start unloaded.
45	Compressor cooling system types	
46	<u>Air-Cooled.</u> Forced draft gas-to-air ancillary motor.	coolers, shaft driven or belt driven from an
47	Compressor cooling system requirements	
48	Completely contain each cooling sy skid, arranged to allow space for ins	stem and all auxiliaries within each compressor stallation and ease of maintenance.
49	Provide cooling for lube oil, cylinder as required.	s, recirculation, interstage coolers, and aftercoolers,
50	Compressor lubrication system	
51	Divider block mechanical lubricator lubrication.	systems shall be used for cylinder and packing
52	Pulsation suppression requirements	
53	Provide inlet and discharge pulsatio pressure pulsations to acceptable le	n suppression devices to limit the discharge evels per API 618.
54	Provide two inspection openings for	each device.
55	Provide two vent, drain, pressure, a	nd temperature connections for each device.
56	Liquid separators	
57	Provide a liquid separator for each o	compressor inlet.
58	Liquid separators shall be vane type fuel gas.	e line separators to remove entrained liquid from the
59	Provide each vessel with an automa necessary controls.	atic drain valve for the discharge of liquids, with all
60	Provide a cleanout connection and	a vent connection for each vessel.
Elect	rical and Controls	
61	Power Supply	4160V
62		Vee
	Drive motor required	Tes
63	Motor starter required	Yes

64	Motor starter type	Variable Frequency Drive; Refer to section 16093 for VFD specifications
65	Motor starter disconnect	Yes
66	Motor wiring for Buyer provided starting devices (not applicable if starters furnished by Seller)	NA
67	Control Power	125VDC
<mark>68</mark>	Control panel enclosure	Suitable for hazardous area classification
69	Space heaters for electrical/control components exposed to ambient conditions and not rated for ambient conditions required	Yes
70	Control wiring for Buyer provided starting devices (not applicable if starters furnished by Seller)	Hardwired input and output contacts at the Seller's control system to interface with the Buyer's starting equipment.
71	Controls	
72	Provide a complete control system f functional requirements. Seller sha components to form systems whose requirements.	or each compressor, to meet the specified Il be responsible for selection and connection of performance is in accordance with specification
73	Each compressor control system sh equipment, control components, an control system.	all include all necessary primary measuring d final drive devices for a complete functional
74	Compressor control system functional requirements	
75	The compressor loading will vary fro Changes in demand may be sudder The control systems shall include th Constant discharge pressur Unloading during compress Protection of equipment.	om zero flow to full rated flow of the compressor. n and large. le following operating and design considerations: re operation. or motor start.
	The control system shall automatica meeting the gas flow requirements.	ally adjust to maintain constant gas pressure while
76	Control devices	
77	Provide compressor programmable Section 17053 – Programmable Log	logic controller (PLC) systems in accordance with gic Control System.
78	The compressor controls shall inter	ace with the distributed control system (DCS).
79	Provide all control devices required interlock the functions, to annunciat mounted on piping and equipment f include, but not be limited to, solence switches, level switches, relays, tim gas detector(s), indicating lights, co	to perform the control functions specified, to e, and to indicate, including components to be urnished under separate specifications. This shall bid gas control valves, control valves, pressure e delays, transducers, controllers, motor starters, ntrol switches, and push buttons.
80	Install all control devices in local pa make such installation impractical. which require either electrical, pneu	nels unless the functional requirements for a device Devices installed in the local panels, and those matic, or process external connections, shall be

	tubed or wired to suitable panel tern	ninal blocks or bulkhead connectors.		
81	Compressor operation			
82	Provide a complete packaged contro unattended, automatic starting, stop its auxiliaries either locally or remote	bl system for each compressor for complete, ping, loading, and unloading of the compressor and ely.		
83	Information and controls shall be av facility.	ailable to allow safe operation from a remote control		
84	Each compressor control system sh isolated dry contacts from the DCS interlocks, sequencing, alarms, and system shall be furnished. The com of necessary permissives to ensure shall provide continuous monitoring operating and shall trip the compress conditions. The compressor control with communication between compre functioning of any two compressors.	all be capable of starting and stopping from single and from the network interface. All control protections necessary for a complete control pressor control system shall provide for monitoring safe starting of the compressors. Each system of necessary permissives while the compressor is sor motor upon detection of unsatisfactory systems shall be designed for parallel operation, ressor control systems as required for proper		
85	Each compressor control system sh modes: <u>Local Manual</u> . Manual start/sto control papel through the DCS	all be designed for operation in the following control p operation by the operator from the local		
	Remote Manual Start/stop operation by the operator from the DCS			
	Remote Automatic. Automatic start/stop operation based on fuel gas			
	pressure through the DCS.			
	Provide complete details of the prop proposal.	losed control and monitoring system in the		
86	Compressor annunciation system			
87	Provide a local human machine inte enables the Buyer's personnel to tro system outage.	rface (HMI) based annunciation system that bubleshoot each compressor following a forced		
88	Provide soft alarm contacts for remo One contact shall close whenever a requires immediate local inspection. a condition exists which, in the opini hours. All devices that actuate eithe the local HMI to facilitate the Buyer's	ote indication of alarms for connection to the DCS. condition exists which, in the opinion of the Seller, A second soft alarm contact shall close whenever on of the Seller, requires local inspection within 12 er of the aforementioned contacts shall seal in on s personnel in troubleshooting.		
89	Device tags	Per Supplemental Section Q400		
Mater	ials			
90	All materials	Manufacturer's standard for the specified operating conditions		
91	Materials not allowed	Asbestos, products containing asbestos, products containing mercury		
Notes				
92	Refer to Section 21000 for additional mot	tor requirements.		

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# 15560 – Small Combustion Turbine/Generator(s)

Gene	ral Requirements			
1	Number required	Three (3) x 50% capacity		
2	CTG identification number(s)	LATER		
3	Combustion turbine type	Industrial or aeroderivative		
4	Technology	By Seller		
5	Cycle	Simple		
6	Design life, years	30		
7	Primary fuel	Natural gas		
8	Annual fired hours	1000		
9	Secondary fuel	None		
10	Anticipated unit operation	Attended		
11		Emergency Standby		
12	Number of starts per year			
13	Cold (after > 72 hour shutdown)	50		
14	Warm (between 8 and 72 hours after shutdown)	1		
15	Hot (within 8 hours of shutdown)	1		
16	Combustor technology	Dry low NO <sub>x</sub>		
17	Location, storage at site before installation	Outdoor		
18	Location, installed	Indoor		
19	Elevation, ft	Per Section D100		
20	Ambient temperature range, °F	Per Section D200		
21	Relative humidity range, percent	Per Section D200		
22	Maximum allowable sound level, dbA @ 3 ft	85		
23	Electrical hazardous area installation	Yes. Extent of hazardous areas to be determined by Seller.		
24	Electrical hazardous area rating	Class I Div. 2 Group D		
Acce	ssory Equipment			
25	Compressor wash system (one wash system per compressor)	Off- and/or On-line		
26	Fire detection and protection system (per CTG)	Water Mist (FM-200 may be proposed if Seller's Equipment cannot support water mist)		
27	Unit enclosures	Mfg. standard		
28	Inlet air filtration system	Replaceable filters		
29	Inlet air duct and silencer	Required		
30	Inlet air duct location	Building roof (33'-0" above grade, 3'-0" above roof)		

31	Ventilation air inlet & outlet ductwork	By Seller		
32	Ventilation air inlet & outlet location	Building roof (33'-0" above grade, 3'-0" above roof)		
33	Exhaust ductwork	By Seller		
34	Exhaust expansion joint	By Seller		
35	Exhaust stack (per Section 05135)	By Seller		
36	Provision for future addition of bypass damper	Not required		
37	Fuel gas filter/separator (per CTG)	By Others		
38	Lube oil coolers	Mfg. standard		
39	Fin-fan unit coolers	Mfg. standard		
40	Fin-fan cooler location	Building roof (28'-0" above grade, 3'-0" above roof)		
41	Generator and excitation system complete with all required auxiliary systems	By Seller		
42	Generator circuit breaker	By Others		
43	Generator Cable Feeder	By Others		
44	Unit auxiliary transformer (generator terminal voltage to Buyer's medium voltage)	By Others		
45	Unit low voltage transformer (Buyer's medium voltage to Buyer's low voltage)	By Others		
46	Unit batteries, battery charger, and associated equipment	By Seller		
47	Vibration monitoring system	By Seller		
Addit	ional Requirements			
48	Winterization required	No		
49	Shutdown corrosion protection	No		
50	Weather protective louvers on cooling system air intakes and discharges	Yes		
51	Tropical climate design required	No		
52	Sea-coastal environment	No		
53	Inlet anti-icing equipment	Yes		
54	Dust	No		
55	Spare parts required	Yes		
56	56 Access provisions shall consist of stairs, platforms, walkways, handrails, guardrails, and ladders necessary to provide complete and convenient access for operation, inspection, testing, and maintenance of major or multiple pieces of equipment in accordance with OSHA.			
Perfo	ormance Criteria			
Note: and H define	The Seller's equipment must be able to operate IVAC conditions defined in Section D200. Perfo ed herein.	throughout the entire range of environmental rmance will be evaluated at the load cases		

57	7 Net Electrical Output per Block <sup>(1)</sup> (at Guarantee Conditions), MW							
58	Minimum			17				
59	<sup>(1)</sup> Auxiliary load per Block shall include one (1) CTG auxiliary, one (1) SCR Exhaust System auxiliary, and one (1) fuel gas compressor.							
60	Load Case 1			1		2	3	
61				Guara Case	ntee			
62	Load poir	nt		Summ	er	Average	Winter	
63	Fuel			Natura	l Gas	Natural Gas	Natural Ga	as
64	Evaporat	ive cool	er	N/A		N/A	N/A	
65	Inlet air c	hilling		N/A		N/A	N/A	
66	Chilled ai	ir tempe	rature, °F	N/A		N/A	N/A	
67	Power augmenta	ation		N/A		N/A	N/A	
68	Dry-bulb temperat	ure	°F 99			55	17	
69	Barometr pressure	ic	psia	14.7		14.7	14.7	
70	Relative humidity		percent	40		50	60	
71	Inlet pres loss	sure	in. H <sub>2</sub> O	Mfg. st	tandard	Mfg. standar	d Mfg. stand	ard
72	Exhaust pressure	loss	in. H <sub>2</sub> O Mfg. st		tandard	Mfg. standar	d Mfg. stand	ard
73	Generator lagging (overexcited) 0.85 power factor		0.85		0.85	0.85		
74	Special p	erforma	nce consideration	s		•		
75	Power au	igmenta	tion		Not allowed			
76	Evaporat	ive cooli	ing		Not allowed			
77	Inlet air chilling			Not allowed				
78	Fuel gas heating			Yes (heat of compression)				
79	Temperature of fuel to combustion turbine package		turbine	Gas temp will meet Seller's minimum requirements				
80	0 Guaranteed Emission limits from 50 percent load to maximum load and all ambient conditions							
81					Natural G	ias		
82	NOx	ppmvd	@ 15% O <sub>2</sub>		By Seller			
83	CO	ppmvd	@ 15% O <sub>2</sub>		By Seller			
84	SOx	ppmvd	@ 15% O <sub>2</sub>		By Seller			
85	VOC ppmvw			By Seller				
86	Total PM (filterable + condensable)			By Seller				



Perfo	rmance Requirements and Guarantees
87	"Net Electrical Output Guarantee" shall mean the guaranteed net electrical output of the Equipment as tested and corrected in accordance with applicable ASME Performance Test Codes (PTC) and these specifications with the Combustion Turbine Generator at Base Load. Gross output shall be measured at the generator terminals. Net electrical output shall be the gross electrical output minus equipment auxiliary power in the Seller's scope. The Seller guarantees that the Net Electrical Output Guarantee under the conditions specified and as determined during the Performance Tests shall be not less than 17 MW per Block. Net Unfired Heat Rate Guarantee" shall mean the guaranteed net heat rate of the Equipment as tested and corrected in general accordance with applicable ASME Performance Test Codes and these specifications with the CTGs at Base Load. The Seller guarantees that the Net Unfired Heat Rate Guarantee under the conditions specified and as determined during the Performance Tests shall be not greater than (by Seller) Btu/kWh-LHV (lower heating value) basis.
88	The units shall start the necessary loads to operate the wastewater treatment plant in an islanding condition. The Seller shall perform and submit a calculation illustrating the ability of two combustion turbine generators operating to start the wastewater treatment plant electric motors. The units shall be operating in parallel under islanding mode with no assistance from electrical utility. A detailed start-up sequence will be provided by Engineer. At a minimum, the units will be able to start and accelerate an 8,000 hp motor while the two combustion turbine generators combined are loaded at 20 MW, a 900 hp motor when the combustion turbine generators are loaded at 25 MW, and a 100 hp motor when the combustion turbine generators are loaded at 32 MW. Motor data for the 8,000 hp and 900 hp motors are provided in section 01100.2.1.
89	The calculation will account for the existing electrical distribution components within the facility, including all impedance between the generator terminals and the wastewater treatment plant's electric motors. An electrical model file of the existing electrical distribution system utilizing the Electrical Power System Analysis Software (ETAP) will be made available to Seller to assist in development of the calculation. The model file is in ETAP version 14.1.0.
90	If deficiencies are noted in the calculation, the Seller shall work with Buyer and Engineer to identify corrective actions. If the deficiency is determined to be within the Buyer's electrical distribution system, Buyer shall be responsible for making necessary repairs. If, in the opinion of the Buyer and Engineer, the most effective solution is to modify the combustion turbine generator package to overcome limitations of the distribution system, a change order will be negotiated. If, in the opinion of the Buyer shall make adjustments as necessary to resolve the deficiency. If the Seller declines to make the adjustments, Buyer may elect to terminate the contract and Seller will be compensated only for the engineering time expended in the development of the calculation.
91	Performance guarantees
92	Each combustion turbine generator shall operate safely, reliably, and without undue maintenance or operator attention. Guarantees shall be such as can be met in everyday operation under all specified operating conditions. All guarantees shall be at the continuous (base) site rating load capability of the combustion turbine generators, unless otherwise noted.
93	The following performance guarantees shall be provided when burning any of the specified fuels. For the purpose of evaluating guarantee compliance, each unit shall be deemed "new



and clean" for any and all tests, provided that the tests are conducted within 6 months of initial operation or before 200 hours of fired operation (whichever occurs first). All hours of fired operation accumulated during the Capability Test and any time lost to a result of Capability Test failures are excluded from this requirement. All guarantees listed below shall be met simultaneously: Electrical Capability. The continuous (base) load net electrical capability of each combustion turbine generator shall be guaranteed to be not less than that stated in the Technical Proposal. The guarantee shall allow for all losses and combustion turbine unit auxiliary loads at specified conditions while operating on the specified fuel(s). Heat Rate. The continuous (base) load net heat rate (LHV basis) shall be guaranteed to be not more than that stated in the Technical Proposal for operation on the specified fuel(s). Starting Time. The normal and fast cycle starting times shall be guaranteed not to exceed the times stated in the specifications sheets. Starting times are defined as starting from cold standby to continuous (base) load capability, including synchronization. Minimum Load Operation. Each combustion turbine generator shall be guaranteed to operate satisfactorily, without structural damage to the unit, in daily load swings from 10 percent of the continuous (base) load capability to the full continuous (base) load capability of the unit at the rate of load change stated in the Technical Proposal. Reliability. Each combustion turbine generator shall successfully operate for a continuous 72 hour period as determined by the Reliability Test. Acoustical Performance (Noise) Limits. The noise levels emanating from each combustion turbine generator at all capacity levels shall be guaranteed not to exceed the limits specified herein. Exhaust Emissions. All exhaust emissions rates shall be guaranteed not to exceed the specified emissions rates at all loads between 50 percent of the continuous (base) load capability to the full continuous (base) load capability of each unit for the specified fuel(s) over the full range of specified ambient conditions. 94 Acoustical performance guarantees 95 Each combustion turbine unit shall not exceed the Acoustical Performance Requirements specified in accordance with the listed codes and standards. The acoustical performance shall be based upon the equipment furnished under this 96 Contract operating at any specified load under normal operating conditions over the entire specified range of ambient conditions. Compliance shall be based on not exceeding the maximum allowable sound levels specified herein and measured in accordance with the referenced standards, including background sound level corrections and excluding any correction for measurement uncertainties. 97 Near field sound pressure levels shall be met on an average basis at a distance of 3 feet in the horizontal plane from the combustion turbine generator enclosures and 5 feet above the ground and above all personnel platforms/walkways. Near field sound pressure levels are referenced to 20 µPa. Load range and operational requirements 98 99 In addition to meeting the specified performance guarantees of this section, the equipment furnished shall be designed to meet the following specified requirements: Operation at loads from 10 percent to the continuous (base) load for an unlimited time period at any ambient condition within the range specified. Satisfactory operation without damage or undue wear to the unit in daily load swings

	from 10 percent of continuous (base) load capability to the peak load capability of the			
	<ul> <li>Satisfactory operation on the specified fuels across the full range of ambient</li> </ul>			
	conditions specified herein.			
	Capable of normal cycle starts with minimal performance degradation.			
100	Substantial completion guarantees			
101	For the following guarantees, the minimum performance levels indicated in the Contract Documents must be achieved in accordance with the technical sections of the Contract Documents to achieve Substantial Completion. All guaranteed minimum performance levels shall be achieved without invalidating or adversely affecting any other guaranteed performance levels conditional to achieve Substantial Completion. Guaranteed CTG Net Electrical Output. Guaranteed CTG Net Heat Rate.			
	Guaranteed Acoustical Performance (Noise) Limits			
102	Final completion guarantees			
103	For the following guarantees, the guaranteed performance must be achieved in accordance with the technical sections of the Contract Documents to achieve Final Completion, or performance liquidated damages shall apply in accordance with the Contract Documents. • Guaranteed CTG Net Electrical Output • Guaranteed CTG Net Heat Rate • Guaranteed Reliability			
104	To the extent that any adjustments are made following Substantial Completion to facilitate successful completion of the tests in accordance with the technical sections of the Contract Documents, these adjustments shall not invalidate or adversely affect performance or emissions in the guaranteed load range for tests completed prior to Substantial Completion.			
Inspe	ection and Testing Requirements			
105	A complete set of inspections and tests, beginning with factory fabrication tests and concluding with field performance tests, shall be conducted as specified.			
106	Material testing and inspection			
107	<ul> <li>The Seller shall, upon the Buyer's request, supply complete information regarding the materials used in each combustion turbine unit. Complete information shall include, but not be limited to, items such as material certificates, NDE results, X-ray certificates, boresonic inspection results, and test reports produced by the Seller's subvendors and subcontractors. Information requests may include, but not be limited to, the following components: <ul> <li>Shafts</li> <li>Rotors</li> <li>Gear trains</li> <li>Turbine and compressor wheels</li> <li>Turbine and compressor blades, and vanes/nozzles</li> <li>Combustor liners and cans</li> <li>Combustor transition pieces</li> <li>Turbine and compressor shells</li> <li>Instrumentation and controls</li> </ul> </li> <li>In lieu of submitting the requested material testing and inspection records to the Buyer, the Seller can make the records available for the Buyer's review at the Seller's manufacturing</li> </ul>			
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	facility.
108	Factory tests
109	All equipment and components of the combustion turbine shall be factory tested in accordance with the Seller's standard methods and procedures as necessary to ensure high quality materials and equipment, reliable and safe operation, and long life. Copies of the Seller's quality assurance programs, manufacturing test descriptions, and preshipment operating test descriptions shall be available at the factory in advance of the start of fabrication, along with a listing of the test reports to be provided to the Buyer, and a schedule for each test report submittal. Actual copies of representative turbine and generator test reports shall also be provided.
110	A schedule of expected factory test dates shall be provided. Prior notice shall be given by the Seller to the Buyer before any factory tests in accordance with the Schedule of Submittals. Fuel for all shop testing shall be furnished by the Seller.
111	<ul> <li>The Buyer shall have the right to observe all factory testing of the combustion turbine generator unit(s). A detailed description of the Seller's factory testing program shall be submitted with the proposal. The factory testing program shall generally include the following. Specifically, the tests noted with an asterisk may be witnessed: <ul> <li>Compressor and turbine rotor balance. (*)</li> <li>Control system function checkout and software demonstration, including video display unit (VDU) graphics.</li> <li>Preshipment inspection. (*)</li> </ul> </li> </ul>
112	Unit commissioning
113	Following the erection of the combustion turbine generator and auxiliaries, a systematic, comprehensive commissioning program will be completed by the Buyer, with technical direction provided by the Seller. The Seller shall provide a comprehensive commissioning manual to the Buyer, which shall include all necessary commissioning procedures, instructions, drawings, and test forms. The commissioning manual shall be specifically prepared for the furnished combustion turbine generator unit(s). Draft and final copies of the manual shall be submitted to the Buyer in accordance with the Schedule of Submittals.
114	At the completion of initial commissioning activities, the Seller shall certify that each unit is prepared for completion of the Final Commissioning Tests.
115	Final commissioning tests
116	Final commissioning tests will be conducted by the Buyer, with the assistance of the Seller, and in accordance with test procedures and forms to be developed by the Seller and mutually agreed upon. The Buyer will furnish the operators, startup power, and fuel. The purpose of these tests will be to verify each unit's guaranteed operational capabilities. Such tests shall be binding on the parties of this Contract to determine compliance with the guarantees. All measurements shall be with unit instruments, factory calibrated insofar as practical. Data shall be recorded using the computer system, except that the Buyer reserves the right to manually measure and record data as deemed appropriate. Manual data shall take precedence over electronically gathered data.
117	<ul> <li>The final commissioning tests for each combustion turbine generator are anticipated to include, but not be limited to, the following:         <ul> <li><u>Starting System Functional Checkout.</u> Verification that the starting system is set up correctly and capable of all intended design functions including acceleration, deceleration, and sustaining proper speed of the combustion turbine generator for purge, light-off, and water washing operations.</li> <li><u>Starting Reliability</u>. Ten consecutive successful starts from various initial conditions</li> </ul> </li> </ul>

	(cold versus hot starts) using the primary fuel, followed by loading to various generation levels.
	<ul> <li><u>Startup Sequence Time</u>. Demonstration of the startup time for normal and fast start cycles.</li> </ul>
	<ul> <li>Load Change Rate. Demonstration of the normal and maximum rates of load change (kW per minute) listed in the proposal data.</li> </ul>
	<ul> <li>Unit Trip as a Result of Overspeed. Mechanical bolt and electronic.</li> </ul>
	• Stable Operation. No variance in unit load at minimum load (10 percent).
	Exhaust Emissions
	The emissions tests shall be considered preliminary. As such, the emissions tests may be conducted without following all specific requirements of the emissions test procedures such as length of test runs. Test methods and procedures for sample collection shall be followed.
118	The intent of these preliminary emissions tests shall be to provide a preliminary indication of exhaust emissions levels prior to conducting formal, binding emissions tests as specified herein.
119	The fire protection system shall be tested to demonstrate proper performance as determined by the Buyer and the local fire marshal. If applicable, the Seller shall be responsible for the cost of the extinguishing agent consumed during testing and shall furnish and apply the final charge of the agent. Should the test fail, the Seller shall be responsible for making corrections and adding the necessary extinguisher charge after the completion of a successful test.
120	The Seller shall, at the Seller's expense, make corrections and modifications as necessary to achieve the guaranteed capabilities, as stated in the Technical Proposal and as specified above. Any required unit corrections or modifications and subsequent retesting shall precede the performance tests.
121	At the completion of the final commissioning tests, the Seller shall provide complete commissioning records to the Buyer.
122	The commissioning records shall satisfy all internal quality assurance/control requirements of the Seller. Final sign-off of the Commissioning Records Report by the Seller's commissioning manager shall include the Seller's certification that the unit is ready to begin emissions and performance testing.
123	Emissions tests
124	Stack emissions tests will be conducted on each combustion turbine/SCR exhaust train following the completion of the final commissioning tests. The emissions tests will be conducted by the Buyer, or by an independent testing contractor with the assistance of the Seller, in accordance with test procedures to be developed by the Buyer and mutually agreed upon at least 30 days prior to the scheduled test date. The Buyer will furnish operators, startup power, and fuel. The appropriate regulatory authority may witness the tests.
125	The purpose of the emissions tests will be to demonstrate that the unit(s) meet the Seller's emissions guarantees for all specified fuels and unit load levels. The emissions tests will also serve as compliance tests to demonstrate that the unit(s) comply with all regulated emissions limits contained in the unit operating permit/air permit. The emissions tests shall be binding on the Seller to determine compliance with guarantees.
126	Test instrumentation and methods shall be in accordance with the appropriate standard method for each specified pollutant. Measured data and calculated results will be deemed absolute values for determining unit performance and compliance with guarantees. Consideration of testing tolerances or measurement uncertainties shall not be permissible.

127	All references to particulate matter (PM, PM <sub>10</sub> , or TSP) herein refer to US EPA Reference Method 5 or equivalent. Performance shall be based on the front half portion of the Method 5 sampling train which includes sulfuric acid mist and, if required by the regulatory agency, the back half portion, which includes all condensable particulate matter. Particulate mass emissions shall be calculated using US EPA Reference Method 2 for determining exhaust gas velocity, unless an alternative has been given prior approval by the regulatory agency for this installation. All particulate matter performance data shall be representative of these methods and procedures.
128	The dates for conducting the emissions tests shall be mutually agreed upon by the Seller, Buyer, and the regulatory authority. If possible, the tests shall be conducted within 7 days of the performance tests, at conditions closely matching the performance test conditions.
129	The Seller shall, at the Seller's expense, make unit repairs and modifications as necessary to bring all emission levels into compliance with the emissions guarantees. Subsequent to those modifications, the emissions tests shall be repeated at the Seller's expense except for Buyer-furnished energy, fuel, and normal operating personnel.
130	Any required repairs and modifications shall be completed in a manner that is convenient to the Buyer. The schedule for repairs and modifications shall be subject to review and approval by the Buyer, and such corrective measures shall be completed as soon as practical following the initial emissions test.
131	The Seller will have the right to review the Buyer's test data, test calculations, and test report.
132	Performance tests
133	Performance tests will be conducted on each combustion turbine generator following the successful completion of the emissions final commissioning tests. The combustion turbine generators shall still be considered to be in like-new condition upon completion of the final commissioning tests. Performance tests will be conducted by the Buyer, or by an independent testing contractor with the assistance of the Seller, in accordance with test procedures to be developed by the Buyer and mutually agreed upon at least 30 days prior to the scheduled test date. The Buyer will furnish operators, startup power, and fuel. The purpose of the tests will be to demonstrate that unit performance meets the guaranteed performance stated in the Technical Proposal for each specified fuel. Such tests shall be binding on the Seller to determine compliance with guarantees. All measurements shall be with standard unit instruments, calibrated insofar as practical. Data shall be recorded using the computer system, except that the Buyer reserves the right to manually measure and record data as deemed appropriate. Manual data shall take precedence over electronically gathered data. Measured data will be deemed absolute values for computing unit performance. Consideration of testing tolerances or measurement uncertainties shall not be permissible.
134	The date for conducting the test shall be mutually agreed upon by the Buyer and the Seller. If possible, tests shall be conducted within 30 days of initial operation of the combustion turbine generators unless prevented by final commissioning or emissions test failures.
135	Performance tests shall be in general accordance with the most current revision of the ASME Performance Test Code PTC 22 "Gas Turbine Power Plants" or mutually agreed upon procedure, subordinate to the terms of the performance test procedures and this specification, in that order of precedence. Code technicalities shall not invalidate these tests.
136	Tests will be conducted on each specified fuel at the specified guarantee basis conditions, insofar as practical. Correction curves supplied by the Seller with the proposal will be used to adjust unit performance, with no tolerance allowances, from test conditions to the guarantee basis conditions. The correction curves shall be legible and shall be approved by the Buyer prior to testing. Performance items to be established during these tests are
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	anticipated to include, but not be limited to, the following:		
	<ul> <li>Net electrical output at rated conditions.</li> </ul>		
	<ul> <li>Auxiliary power consumption for all Su</li> </ul>	pplier-furnished equipment.	
	<ul> <li>Net heat rate at continuous (base) cor after an unsuccessful performance te</li> </ul>	ditions. (Increase of turbine inlet temperature st shall not be permitted.)	
	<ul> <li>Exhaust flow and temperature</li> </ul>		
	<ul> <li>Exhaust emissions.</li> </ul>		
	Noise levels.		
	Reliability		
137	The Seller shall, at his expense, make unit rep each item listed above into compliance with th rate and generator output (capability) meet the Subsequent to those modifications, the perform expense, except the costs for Buyer-furnished	airs and modifications as necessary to bring e performance guarantees, even if the heat e guaranteed values prior to such corrections. mance tests shall be repeated at the Seller's energy, fuel, and normal operating personnel.	
138	Combustion turbine generator alterations and modifications shall be completed in a manner that is convenient to the Buyer. The schedule for alterations and modifications shall be subject to review and approval by the Buyer, and such corrective measures shall be completed as soon as practical following the initial performance test.		
139	The Seller will have the right to review the Buy corrections, and test results.	er's test data, test calculations, test	
140	Reliability Tests		
141	The Reliability Test shall be conducted to demonstrate that the CTG Unit operates reliably over the Reliability Test Period, 72 hours. The Reliability Test must be performed as a requirement to achieve Final Acceptance, and shall be performed concurrently with the Buyer's overall reliability test for final acceptance of the Facility.		
142	During the Reliability Test, Buyer will have care, custody and control of the operating Facility and will restore any failed equipment in a timely fashion. The Buyer can at its discretion shutdown and restart the CTG Unit. Such shutdowns and start-ups may be done at any time during the Reliability Test. While shutdowns and restarts are not necessarily anticipated in connection with the Reliability Test, rather continuous operation is expected during the Reliability Test Period, Buyer may at its sole discretion shutdown and restart the unit.		
143	In order to successfully complete the Reliability Test, the CTG Unit must operate for applicable continuous Reliability Test period described above (i) without an interruption, a forced outage or a forced reduction in power output below 90 percent of the demand set by Buyer, and (ii) while in compliance with the Emissions Requirements, Noise Requirements, and all other terms and conditions set forth in the Agreement and in the Test Protocols and Procedures.		
144	If a forced outage or forced reduction in power occurs that is not due to the Seller's equipment, the test shall be suspended until the unit can be returned to operation at which time the test shall be continued and run until the prescribed hours of operation have been achieved. In addition, the successful completion of the Buyer's Facility Reliability Test will also constitute successful completion of the combustion turbine generator's Reliability Test.		
Code	Codes and Standards		
145	Combustion turbine and all accessory equipment	AISC, AISI, ANSI (including ANSI B133.1-12, Procurement Standards for Gas Turbines), ASME, ASTM, AWS, HI, IEEE, NEC, NEMA, AGMA	

146	Combustion turbine performance test	ASME PTC 22 or mutually agreed upon standard	
147	Design and materials for use and installation in hazardous areas	NFPA 70 and NFPA 497, and as further described herein	
148	Flammable gas alarm system	Underwriters' Laboratories (UL) approved	
149	All electrical equipment associated with fuel system	NFPA 70 Article 501	
150	Emission test instrumentation and test methods	US EPA or mutually agreed upon standard	
151	Gas turbine installation sound emissions	ANSI B133.8/ISO 6190	
152	Measurement of sound pressure levels of gas turbine installations for evaluating environmental noise using the survey method	ISO 6190	
153	Fire protection equipment, controls, and accessories	NFPA 12, 70, 72, 750, 850, and 2001; UL listed; Factory Mutual (FM) approved	
154	Vibration	ISO 7919-4	
155	Purge, startup, and shutdown requirements	NFPA 85	
Desig	n and Construction Requirements - General		
156	Seller's design and materials furnished herein shall meet all requirements for use in and installation in an area classified as hazardous, as defined in NFPA 70 and NFPA 497, when such design and/or materials will be used in proximity to a potential leak source of flammable or combustible gas or liquid as defined in NFPA 497. Materials which shall be classified as hazardous include, but are not limited to, natural gas (methane), propane, ammonia (aqueous), and fuel oil with volatile constituents. Seller shall not interpret NFPA requirements to the contrary of requiring classification, such as claiming exemption via NFPA 497 (1997) Sections 3-3.1(a) and 3-3.2(a) or NFPA 497 (2004) Sections 5.4.1 and 5.4.2, irrespective of the installation location or details.		
Starti	ing System		
157	Each combustion turbine generator unit shall be furnished with all equipment, materials, and accessories required for starting the unit. If "blackstart" capability is specified herein the combustion turbine shall be able to start and run with no electrical sources outside of the Seller's scope of supply.		
158	Starting requirements (maximum time from standby to baseload on any specified fuel):		
159	Normal start, minutes	Mfg. standard	
160	Fast start, minutes	10	
161	Blackstart required	Yes	
162	Electric motor driven starting system		
163	Rated voltage, volts	460	
164	Rated frequency, hertz	60	
165	Maximum operating voltage, volts	506	
166	Minimum operating voltage, volts	414	



167	Minimum motor starting voltage, volts	368
168	Seller to furnish power switching equipment	No
169	Electric motor driven starting system	
170	A complete system of system controls and a 3 furnished as specified herein.	-phase, squirrel-cage induction motor shall be
171	All stator winding materials shall have a Class F thermal classification and shall use a vacuum-pressure impregnation (VPI) system. Six (two per phase) resistance type temperature detectors shall be furnished for the stator winding. All multi-turn form-wound stator coils shall have adequate turn-to-turn insulation to enable them to pass the Figure 2, Alternative Coil Impulse Voltage Withstand Envelope, which is described in IEEE Standard 522.	
172	The motor shall have space heaters that shall be sized as required to maintain the motor interview.	be energized when the motor is idle and shall ernal temperature above the dew point.
173	All motors shall be furnished with an oversized terminal housings shall be acceptable to the B	terminal housing. Location and dimensions of uyer.
174	If specified herein for the Seller to furnish pow a standard package consisting of either metal- associated protective relaying. The Seller sha	er switching equipment, the Seller shall furnish clad switchgear or motor controllers and Il provide the protective relay settings.
175	<ul> <li>The Seller shall provide the following information: <ul> <li>Motor information:</li> <li>Motor kW load versus time du cycle.</li> </ul> </li> <li>b) Motor nameplate data, including the instantion of the instantiation of the instant</li></ul>	tion to the Buyer: ring the complete combustion turbine starting he following: and current. nd 25 percent load. er factor. 25 percent load. (time versus current) for the motor in a cold ion at rated voltage and at minimum specified ermissible locked-rotor safe stall time in arting voltage should be shown on the curves. es (time versus current) for the motor in a cold motor starting at rated voltage and minimum wing.

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	g) For motor controllers with contactors protected by current limiting fuses:		
	i. Minimum and total clearing time versus current curves.		
	ii. Rated current, model number, and manufacturer.		
Ove	rspeed control		
176	In addition to the automatic speed governor furnished in conjunction with the control system specified herein, a separate emergency overspeed governor shall be furnished for the unit. These governors shall operate to close the emergency fuel trip valves.		
177	Equipment design shall allow testing of the overspeed protective devices.		
178	Additional protection against overspeed may be required in cases of stored heat or large stored volumes of high-pressure air.		
179	Redundant electronic overspeed governor systems shall trip the unit at 110 percent of rated speed and be hard-wired to the fuel shutoff valve.		
Turni	ng gear/rotor turning device		
180	Rotor turning gears or similar devices shall be furnished for the units to minimize thermal distortion of the rotors during unit cooldown and to permit rapid reloading of the units after a shutdown.		
181	Each turning gear shall be engaged and start automatically. A mechanical interlock or overrun between the starting and turning mechanisms shall be provided to prevent simultaneous operation.		
182	The Seller shall provide means for manually rotating the turbine and generator shafts.		
183	A jacking pump and turning gear oil pump shall be provided, if necessary.		
184	Necessary oil piping and appurtenances shall be included. Turning gear oil piping systems shall be in common with the turbine lubricating oil system. Turning gear oil piping systems shall be complete with all necessary pressure switches or other interlocks to prevent turning gear operation if lubricating oil pressure drops below that required for effective bearing lubrication. Suitable housings and safety guards shall be provided for all moving parts of the turning gear clutches. The turning gears shall have automatic engaging and disengaging mechanisms.		
185	If turning gears are not provided for the rotating parts of the combustion turbines, the features that prevent rotor and casing distortion during the cooling period after shutdown shall be included as stated in the Technical Proposal.		
Com	pressor Wash System		
186	A single skid mounted compressor wash system shall be furnished for the combustion turbine generator unit to remove blade deposits and restore combustion turbine performance. The compressor wash system shall be off-line and/or on-line. The wash system shall be furnished complete with all required pumps, detergent storage tanks, immersion heaters, piping, nozzles, instruments, and controls. The unit shall include the necessary piping and electrical connectors for connection with the combustion turbine. The turbine shall be furnished with all required equipment for compressor washing including, but not limited to, single point piping connection, stainless steel manifold and spray nozzles, valving, and drain connections. Interconnecting piping and wiring between the wash skid and the turbine unit will be furnished by Others. The wash system shall be described in the proposal regarding the type of system used, and water and chemical requirements (quality and quantity required),. The use of dry type cleaning agents such as ground up nut shells is not acceptable. A single-point drain connection from the combustion turbine shall be provided for disposal of off-line wash drains.		
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Fire D	Detection and Protection	
187	The fire detection and prevention system shall be designed to protect the combustion turbine, generator enclosure, and other enclosed accessory compartments that require active fire protection. Controls, agent, detectors, manual activation, alarms, strobes, and all accessories shall be furnished for all enclosed areas. The system shall be designed in accordance with NFPA, manufacturer, and site requirements and guidelines. The fire suppression system shall be man-safe in all occupiable space.	
188	The system will be designed, installed, and tested in accordance with the applicable codes. The Seller is also responsible to supply documentation detailing all of the inspection and testing requirements and frequencies that will be required for the fire protection equipment. All detection circuits, local alarms, remote alarms, trouble signals, and panel indicators shall be successfully tested prior to unit acceptance in the presence of the Buyer or Buyer's representative. System operation training shall be supplied to the Buyer.	
189	The following additional information to requirements relates to the particular type of suppression system selected for the turbine(s).	
190	FM-200 System	
191	The system shall be a total flooding fire suppression system with automatic detection and manual release capability. The system shall be a skid mounted package, complete with FM-200 tank(s), manifold, release mechanism, controls, and instrumentation. All components and accessories shall be listed and approved for use with the FM-200 systems.	
192	The FM-200 system shall be designed to achieve a minimum of 7.5 percent concentration within 10 seconds in all areas except the electrical control compartment, which requires 35 percent concentration during the coast-down time of the turbine. The percent concentration selected shall be accompanied with documentation verifying ability for extinguishment.	
193	Piping and tanks shall be securely supported, and account for the forces generated during discharge. Liquid level indicators, or engineer-approved equivalent, shall be installed on all tanks for verification of agent quantity. Strainers shall be provided with the necessary piping. Piping lengths shall be kept to a minimum.	
194	Water Mist System	
195	The system shall be a skid mounted package, complete with water and propellant tanks(s) (if required), release mechanism, controls, and instrumentation. All components and accessories shall be listed and approved for use with the water mist system. The water mist system shall be FM approved for gas turbine protection and capable of protecting the entire enclosure. The system shall have automatic detection and manual release capability.	
196	The water mist system shall be a low-pressure total flooding system. All piping and tubing shall be designed to withstand a working pressure of not less than 175 psi. The system must be capable of maintaining a noncombustible atmosphere for the duration of the turbine coast-down.	
197	The system can be a single or twin fluid media system. Cycling of water mist is required to minimize the water discharge in the enclosure and eliminate rapid cooling that can cause deformation of the casing and subsequent blade rubbing. Documentation shall be supplied specifying the total amount of water that would be applied during the release. The system shall be designed so that after a release, there is still sufficient water and propellant to extinguish new fire conditions.	
198	The system must be capable of extinguishing any fire, even when the fire is shielded from the direct spray. A release cannot cause damage to critical turbine components as a result of excessive cooling of the turbine casing.	
Unit Enclosures		
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199	Except as otherwise specified, all equipment shall be enclosed in a minimum number of prefabricated acoustic enclosures. The enclosures shall be constructed in a neat manner and shall present an attractive appearance.	
200	The unit enclosures shall be designed for indoor service.	
201	Sections of enclosures shall be removable as required for maintenance. Roof panels shall be sectioned so removal is limited to the area being worked on. Enclosures such as the combustion turbine enclosure that require substantial disassembly to perform major maintenance functions shall be capable of being disassembled in large sections to minimize the disassembly and assembly time. A description of this procedure shall be submitted with the Technical Proposal. No conduit, piping, air ducts, or accessories shall be mounted on removable panels. Air ducts shall be easily disassembled and independently supported and arranged so that the amount of ductwork that must be removed for unit maintenance is minimized.	
202	Enclosures shall be designed to permit easy accessibility to the equipment and to provide maximum protection for maintenance personnel. Two access doors shall be installed on all enclosures to provide easy access for inspection and maintenance of equipment. Enclosures shall be provided with pedestrian and equipment doors with locks. Pedestrian doors shall be equipped with panic type hardware.	
203	Ventilation dampers shall automatically close upon actuation of the fire protection system. The dampers shall be capable of manual testing.	
204	Enclosures shall be sufficiently leaktight to provide an envelope suitable for containment of the fire extinguishing agent.	
Inlet	Air Filtration Equipment	
205	The filters shall be elevated a minimum of 10.0 feet above ground to avoid the entrance of ground-borne dust.	
206	The filtration system shall be completely self-contained. All structural support legs and access facilities shall be provided. The unit shall consist of multiple filter elements located in a housing. The housing and the ductwork shall be enclosed with Seller's standard painted steel. All walkways shall have nonskid surfaces.	
207	All components upstream of the compressor intake shall be seal welded to prevent entrance of any fasteners or unfiltered air into the gas turbine compressor. There shall be no fasteners or objects in the inlet air path that can separate and enter the engine.	
208	Differential pressure transmitters or switches shall be fitted to measure the pressure drop across the filters and shall be adjustable to give an alarm at a preset pressure drop. The air intake shall be designed to withstand the pressure that could occur in the event of compressor surging. The Seller's control system shall trip the combustion turbine if the design pressure of the air intake is exceeded.	
209	All enclosures and ductwork will have peaked or pitched roofs to prevent the accumulation of rainwater. Internal airflow passages (i.e., the filter house) will be fitted with low point drains to prevent the accumulation of rainwater. Drains shall be of sufficient size so that they will not plug. In addition, all external or internal structural members will be configured to prevent the accumulation of rainwater or be provided with drainage holes/passages.	
210	Ladder and walkway or platform access to filter elements shall be provided for inspection and replacement of filters. The walls shall be filled with vermin proof, fire-resistant, and mildew-resistant acoustical insulation.	
Inlet Air Duct and Intake Silencers		
211	An inlet air duct shall be furnished, connecting the inlet air filter transition section to the	

	compressor inlet plenum. The inlet air duct shall be fabricated from carbon steel plate with external structural steel stiffeners. The inlet air duct shall be designed with as few shipped components as possible to minimize field erection requirements. Structural steel stiffeners shall be attached to the steel plate with continuous welding. Stitch welding is not acceptable. All joints shall be designed for seamless welding to prevent inflow of unfiltered air. No internal erection or alignment bolts will be permitted upstream of the turbine intake. Joints shall be seal welded after assembly. All interior ducting in, and downstream of, the evaporative cooler shall be coated with, or shall be, a corrosion-resistant material. The interior and exterior of duct shall be painted as specified in the attached Technical Supplemental Specifications.	
212	Efficient air intake silencing equipment shall be provided for each unit to limit the operating noise level as specified. The sound attenuator, fitted in the inlet plenum or ducting before the compressor, shall be composed of absorbent material suitably clad between perforated metal sheets or shall be of another acceptable type. The attenuators shall be of Type 304 stainless steel materials and the design of the attenuators shall be such that components or parts of the attenuators cannot become detached and obstruct or pass through the gas passages.	
Inlet a	air anti-icing system	
213	The Seller shall determine the precautions necessary to protect the inlet filters, duct, and compressor from effects of ice formation during cold periods. All necessary equipment, piping, valves, and controls to prevent icing in the inlet air system shall be supplied.	
214	The Seller shall define the conditions under which the inlet duct anti-icing system is required to operate.	
Insula	ation and Lagging	
215	Thermal insulation and lagging shall be provided as required to meet personnel protection requirements and to maintain guaranteed efficiencies. All items requiring insulation shall be insulated and lagged in the shop to the maximum extent practical. The thermal insulation system shall be the Manufacturer's standard.	
Exha	ust Ductwork and Expansion Joint	
216	Ductwork	
217	The general layout of the ductwork shall be as indicated on the Seller provided arrangement drawing, subject to Buyer review and approval. The stack and transition at the base of the stack shall not have any crevices where contaminants can concentrate.	
218	Ducts shall be designed to prevent pulsations and noise generation. Each exhaust duct module shall be furnished with manual drains.	
219	Turning vanes shall be provided in ductwork and the base of the exhaust stack to minimize the exhaust gas pressure loss.	
220	Expansion joints	
221	Expansion joints shall be provided in the exhaust ductwork and at equipment connections to accommodate the expansion associated with the high exhaust temperature from the combustion turbine. Expansion joints shall be of the Seller's standard design.	
Com	bustion Turbine Generator Control System	
222	Configuration	
223	The CTG control system shall be the Seller's standard microprocessor-based digital control system with local and remote operator work stations, expanded to accommodate the balance-of-plant (BOP) controls as described herein and in Section 17101 – Distributed	

	Control System. The CTG control system is referred to herein as the distributed control system (DCS). Refer to Section 17101 – Distributed Control System for additional requirements.	
224	General	
225	Local operator interface	Per 17101
226	Remote operator interface	Per 17101
227	Emergency hard-wired trip push buttons	Local – at CTG - by Seller
	(2 out of 2 contact trip logic)	Remote (new control room) – by Seller Remote (existing control room) – by Buyer
228	Droop/isochronous operation mode	Droop and isochronous
229	Each control system shall combine control of the combustion turbine and generator as an integrated function. Control features specified herein and in Section 16031 - Cylindrical Rotor Generator shall be accomplished by the control systems specified herein.	
230	The control systems shall be the Seller's standard except as modified by the requirements stated herein.	
231	Complete information on the control systems shall be submitted with the proposal. This shall include a bill of material; manufacturer description of principles of operation; description of hardware requirements and software protocol used to communicate control information between the combustion turbine control system and the generator power management system described in 16031 – Cylindrical Rotor Generator; and available options.	
232	Control system functions	
233	Each combustion turbine generator shall be furnished with an automatic control system suitable for unattended operation throughout the entire load range.	
234	Each control system shall be a complete, self-contained system designed for operation of the combustion turbine and generator locally and remotely from the control room.	
235	Control systems shall provide logic and protective functions for firing natural gas.	
236	Automatic tripping devices shall be provided to shut down the unit in an orderly and safe manner to prevent damage to equipment or harm to personnel.	
237	The combustion turbine control systems shall include a normal start and a fast start sequence if so specified herein.	
238	The control system shall include operator guides during startup and shutdown sequences utilizing VDU displays or guide messages and provide information displays for alarms, sequence status, data, and system diagnostics.	
239	The control system shall be a highly reliable system designed to minimize unit trip or loss of control functions resulting from single component failures. Primary field devices such as vibration detectors and valve limit switches are not required to be redundant.	
240	<ul> <li>The control system functions shall include the following three systems:</li> <li>Governing system.</li> <li>Protective system.</li> <li>Sequence logic.</li> </ul>	
241	Governing system	
242	The governing system shall be designed to con load including the following:	ntrol turbine startup, acceleration, speed, and

	<u>Startup Control</u> . The startup loop shall control the fuel flow for initial light-off, turbine warm-up, and rotor acceleration during turbine startup.	
	<u>Speed/Load Control</u> . The speed/load control loop shall take over the control of the fuel flow after the turbine has been brought to speed in the range of the synchronous speed. The control functions of this loop shall include speed matching, on-line speed control, and megawatt control.	
	The speed governing system shall be capable of droop speed control as specified herein. The steady-state speed droop shall be capable of adjustment within the range of 2 to 6 percent at the rated speed.	
	The speed governing system shall be capable of a fast response time in order to respond to system transients and maintain speed within the specified range.	
	When the generator is on-line, the output of the generator shall be controlled in response to the islanded grid frequency, in a net metering mode when in parallel with the utility grid or based on a load demand signal generated by the station control room operator (when either islanded or parallel to the utility grid). The three generators shall be configured to also work in a load-sharing fashion when multiple generators are on-line and in isochronous mode (islanded from the utility grid, but supporting plant loads).	
	A load limit (maximum or minimum) and rate-of-change limit control shall also be provided. The load limit of the combustion turbine shall be controlled manually by the operator or automatically during any unsafe operating condition of the combustion turbine.	
	<u>Inlet Guide Vane Control</u> . This control loop shall modulate the angular position of the air compressor inlet guide vanes to provide stable compressor operation at low speeds and maintain rated firing temperatures during normal on-line operation of the turbine generator.	
	<u>Temperature Control</u> . This loop shall limit the fuel flow if the turbine exhaust temperature operating limits are exceeded.	
243	All sensors and instruments required to measure operating parameters and to monitor equipment status necessary for execution of all required control functions shall be furnished. Redundant sensors and instruments shall be provided, as a minimum, to implement the governor controls and protection logic and allow for on-line testing and repair. All trip functions shall have redundant sensors, except for vibration probes which shall have single sensors with redundant signals.	
244	Transmitters, thermocouples, and other types of instrumentation required for measuring the controlled variables shall be furnished in accordance with the requirements of the Supplemental Specifications in Section 21000.	
245	Protective system	
246	The protective system shall provide the control logic necessary for protection of the turbine generator against potential damaging conditions and for execution of automatic tripping	

	actions on the occurrence of abnormal operating conditions including, but not necessarily limited to, the following:		
	<ul> <li>Exhaust overtemperature protection provided by thermocouples in the turbine exhaust.</li> </ul>		
	<ul> <li>Vibration protection using vibration sensors strategically located on the turbine and the generator.</li> </ul>		
	<ul> <li>Flame failure protection as sensed by flame detectors.</li> </ul>		
	<ul> <li>Overspeed protection provided by a redundant electronic speed sensing system using magnetic pickups. Consideration shall be given to underspeed protection where underspeed limitation may exist either in the combustion turbine or the driven load.</li> <li>Other operating conditions related to the operation of the turbine fuel system, lube oil system, and turbine generator accessories.</li> </ul>		
247	Sensing devices that trigger a turbine trip shall be redundant		
248	Consideration shall be given to the action performed by the control and safety devices in the event of control circuit failure. Controls and controlled devices shall move to the safest operating condition upon failure.		
249	An alarm and trip point list shall be developed for the turbine generator on the basis of the points listed herein as a minimum. Trip and alarm conditions shall be communicated for display to the existing plant DCS and to the control room:		
	COMBUSTION TURBINE GENERATOR ALARM AND TRIP POINTS		
	(A = Alarm only; A & T/A = Alarm on one level, trip and alarm on next level; T/A = Trip and alarm)		
	1. Manual emergency trip (T/A).		
	2. Manual stop (A).		
	3. Turbine and generator high bearing metal temperatures (A & T/A).		
	4. Turbine and generator high vibration (A & T/A).		
	5. Loss of flame (T/A).		
	6. Inlet air filter implosion doors open (A).		
	7. Inlet all filter high differential pressure (A).		
	8. Fuel supply pressure low (A & T/A).		
	9. Fuel supply temperature low ( $\Delta \& T/\Delta$ )		
	11 Fuel supply filters differential high (A)		
	12. Lube oil level low (A & $T/A$ ).		
	13. Lube oil high temperature (A).		
	14. Lube oil low temperature (A).		
	15. DC lube oil pump running (A).		
	16. DC lube oil pump overload (A).		
	17. High exhaust gas temperature (A & T/A).		
	18. High lube oil filter differential pressure (A).		
	19. Hydraulic oil pressure low (A & T/A).		
	20. Turbine overspeed (T/A).		
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	21. Loss of turning gear (where applicable) (A).
	<ol><li>Loss of governor control power (where applicable) (A/T).</li></ol>
	<ol><li>Fire extinguishing system actuated (A/T).</li></ol>
	24. Fire extinguishing system disarmed (A).
	25. Governor control system failure (T/A).
	26. Ignitor trouble (A).
	27. Generator stator current differential (T/A).
	28. Generator rotor ground (A).
	29. Generator stator ground fault protection (T/A).
	30. Exciter field overcurrent (T/A).
	31. Voltage regulator power supply failure (T/A).
	32. Negative sequence current (T/A).
	33. Loss of excitation (T/A).
	34. Generator stator coil high temperature (A & T/A).
	35. Overall generator and generator step-up transformer current
	differential (T/A).
	36. Generator air filter differential (if applicable) (A).
	37. Regulator blown fuse (if applicable) (A).
	38. Regulator on minimum excitation limit (A).
	39. Regulator on maximum excitation (A).
	40. Regulator overexcitation (T/A).
	<ol> <li>Generator main bus ground (only required if units are provided with a generator breaker) (T/A).</li> </ol>
	42. Unit overfrequency and underfrequency (T/A)
	43. Motor control center trouble (A).
	44. Vibration, axial and radial (A & T/A).
	45. Loss of generator space heaters (A).
	46. Regulator loss of control power (T/A).
	47. Regulator operating on backup VAR (if reguired) (A).
	48. V/Hz trip (T/A).
	49. Trip alarms for each motor driven fan and motor (A).
	50. Minimum excitation trip (T/A).
	51. Ac hydrogen seal oil pump failure (if applicable) (A).
	52. Dc hydrogen seal oil pump failure (if applicable) (T/A).
	53. Hydrogen leak (if applicable) (A).
	54. 20 spares.
250	Sequence logic
251	The sequence logic shall provide the sequencing required for the fast startup, normal
	startup, normal shutdown, and emergency shutdown functions. It shall allow, but not
	require, checks during a startup sequence to ensure that auxiliary equipment is operating
	before proceeding to the next step:
	1. Startup, Startup operation from the local control panel and the control
	room shall have three modes: manual, normal, and fast.
	i. Manual start shall require the operator to start the auxiliary
	equipment; initiate, hold, and advance the starting sequence (crank,

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purge, fire); and accelerate, synchronize, and bring the turbine generator to a desired load level.		
ii. Normal and fast startup shall require only a single action by the operator to start the required auxiliary equipment, initiate the complete starting sequence, come up to speed, apply generator field, attain synchronizing voltage, synchronize the generator, close the generator breaker, and bring the generator output to a target load. The target load and the rate at which the generator output is increased to the target load shall be manually adjustable by the operator.		
Provisions shall be included for an exhaust temperature control mode. This mode shall be used during low-load operations to provide more gradual warming of future HRSG piping and equipment. The mode shall be operator selectable, and include a temperature setpoint that can be adjusted.		
<ul> <li><u>Normal Shutdown</u>. Normal shutdown shall follow an orderly, safe, step-by-step procedure. This may be achieved by manual or automatic means. Means shall be provided to restore the equipment to the level required for the normal automatic start sequence.</li> <li>Upon actuating the normal shutdown control, the unit shall reject load gradually by a preset rate, open the generator circuit breaker, reduce speed to turning gear rate, engage the turning gear, and return to standby status.</li> </ul>		
by a preset rate, open the generator circuit breaker, reduce speed to turning gear rate, engage the turning gear, and return to standby status. <u>Emergency Shutdown</u> . Emergency shutdown must be capable of manual initiation and must also occur automatically as a result of automatic operation of protection devices. The system must cause the fuel shutoff valve to cut off the engine fuel supply. Normal shutdown sequence, as appropriate, should subsequently take place. Where practical, means shall be provided to prevent restart without corrective action.		
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	monitor machine variables which are necessary for proper operation of the turbine generator. Variables to be monitored shall include, as a minimum, fuel valve position, shaft speed, shaft vibration, exhaust gas temperature, bearing temperatures, generator temperature, wheel space temperatures, and IGV position. Primary detectors, transmitters, receivers, alarm contact units, and other accessories required for a complete system shall be provided. The Seller's proposal shall fully describe the proposed supervisory instrumentation system.		
260	Configuration		
261	Seller's standard system using DCS VDUs, printer, and long-term data storage unit	Yes	
262	Method of communication with DCS	Mfg. standard	
263	Vibration monitoring system		
264	A complete vibration protection system for each turbine and generator shall be furnished as specified herein. The system shall include both alarm and trip set points and indication of the vibration magnitude. Plugs shall be included at the control panel or locally at the sensors and transmitters to provide direct Buyer access to the analog vibration signals as specified herein.		
265	If an accessory gear is provided, one accelerometer shall be provided for its shaft.		
266	Configuration		
267	Seller's standard system using plant control system VDUs, printer, and long-term storage unit	Yes	
268	Method of communication with turbine control system	Mfg. standard	

# **15910 – Gas Fueled Black Start Engine-Generator**

### 15910.1 General

#### 15910.1.1 Scope

This section covers the furnishing of two natural gas fueled engine-driven electric generator units designated TBD and TBD. Each engine-generator shall be located inside the Power Building within the limits as indicated in the Drawings and specified herein.

The Seller shall be fully responsible to furnish a complete and coordinated package system. Each enginegenerator shall be a skid-mounted package unit consisting of engine-generator, generator controls, exhaust silencer/exhaust after treatment, remote radiators, auxiliary systems, emergency shutdown control station, and accessories as required for a complete operating system.

#### 15910.1.2 General

Equipment furnished under this section shall be assembled in full conformity with drawings, specifications, engineering data, instructions, and recommendations of the equipment manufacturer unless exceptions are noted by Engineer.

**15910.1.2.1** Seismic Design Requirements. Seismic design requirements for products specified herein shall be as indicated in Section 21000 Site Meteorological and Seismic Data.

**15910.1.2.2** Coordination. All equipment specified in this section shall be furnished through a single engine-generator manufacturer or supplier who shall be responsible for the design, manufacture, coordination, and operation of the entire system.

Each engine-generator unit shall be a standard product of the manufacturer and shall be a packaged type unit, fully shop assembled, wired and tested. If disassembly is required for shipping of the engine-generator unit, the engine-generator supplier shall reassemble the engine-generator unit onsite prior to installation.

Seller shall verify that each component of the system is compatible with all other parts of the system; that all piping, materials, and motor sizes are appropriate; and that all devices necessary for a properly functioning system have been provided.

Seller shall properly coordinate the work between the Suppliers of the equipment to be used with or connected to the engine-generator, to ensure that all provisions for mounting the accessories are included.

**15910.1.2.3 Governing Standards.** Except where modified or supplemented by these specifications, all equipment and materials shall be designed and constructed in accordance with the latest applicable requirements of the standard specifications and codes of ANSI, ASTM, NEMA, IEEE, EEI, EGSA, HEI, IFC, IBC, ISO, NFPA, SAE, STI, UL, and other such regularly published and accepted standards as well as state and local codes.

**15910.1.2.4 Identification.** All equipment, valves, devices, panels, and control equipment denoted by a symbol and an identifying number shall be provided with equipment identification tag or nameplate. Equipment specified herein shall be identified in accordance with the Equipment and Valve Identification section.

**15910.1.2.5 Manufacturer's Nameplates.** Each major component of equipment shall have the manufacturer's name, address, and catalog number on a nameplate securely affixed in a conspicuous place. The nameplate of a distributing agent only will not be acceptable.



**15910.1.2.6 Power Supply.** Site power supply provided will be 480 volts AC, 60 Hz, single phase for operation of the equipment and accessories unless otherwise specified. The engine (starting and controls) will operate from the power source per Section 11509.2.4.06.

**15910.1.2.7 Pipe Connections.** Unless otherwise permitted, pipe connections for 2 inch and smaller piping shall be threaded. Pipe threads shall conform to ANSI/ASME B1.20.1, NPT. Connections for 2-1/2 inch and larger piping shall be flanged. Flanges shall be flat face with ANSI B16.1, Class 150 diameter and drilling.

## 15910.2 Products

### 15910.2.1 Service Conditions

Each engine-generator unit shall be designed to operate under the service conditions (seismic design requirements including importance factors, ambient air temperature range, site elevation, etc.) defined in Supplemental Specification D100 Site Meteorological and Seismic Data in Section 21000.

Each engine-generator shall be suitable for "blackstart" and will be used as a power unit for selected electrical loads when the utility supplied power fails.

Each engine-generator shall automatically start and connect to the plant's electrical system from a signal from the Plant Control System or the Master Control when operating in Island mode without the Utility. Each unit shall be furnished with automatic synchronizing controls.

Each unit shall be furnished with all equipment required to allow it to operate alone or in parallel with the other new engine-generator and turbines. When operating in parallel, the units shall divide the load (kW and kvar) equally.

Fuel for each engine-generator will be furnished from the Owner's natural gas supply piping.

The engine-generator supplier shall provide the correct amount and grade of crankcase oil, coolant, and other fluids necessary for initial testing and operation.

**15910.2.1.1 Engine Mounting.** Each engine-generator shall be attached to an associated skid that shall be suitable for mounting on top of a reinforced concrete base. The skid shall be constructed of heavy duty steel, designed and built to resist deflection and to maintain alignment during lifting and operation during any range of operation. Mounting holes in the structural skid shall be suitably sized to accommodate thermal expansion of the unit and shall be drilled prior to setting the unit on the concrete pad.

### 15910.2.2 Performance and Design Requirements

Each engine-generator unit shall be designed for the operating conditions and requirements as follows:

Generator			
1	Tag numbers	TBD	
2	Minimum power rating capacity with accessories, for generator voltage output and service conditions specified herein.	To Be Determined by Seller	kW
3	Output frequency.	60	Hz
4	Output voltage.	4,160	VAC
5	Output power factor.	0.8	
6	Output phase and configuration.	Three phase, 3 wire, wye configuration with low-resistance neutral grounding resistor	

Engine			
7	Fuel supply.		
8	Туре	Natural gas	
9	Heating value	Per Section D300	
10	Supply pressure	2 to 5	psig
11	Engine maximum speed.	1,800	rpm
12	Alternator maximum speed.	1,800	rpm
13	Minimum piston displacement.	To Be Determined by	in <sup>3</sup>
		Seller	
14	Maximum Voltage Dip	See Performance Table	
General			
15	Blackstart required.	Yes	
16	Maximum engine-generator skid length	33'-4"	ft
	including gearbox if required.		
17	Maximum engine-generator skid width.	7'-6"	ft

Engine-generators with ratings in excess of current published data will not be acceptable.

Each engine-generator unit furnished shall be of a design that can be accommodated in the space as indicated on the drawings. All packaged equipment, interconnecting piping, electrical conduits, wiring, and connections shall be arranged in a manner allowing easy access for service, repair, or replacement.

Each engine-generator package system shall be electrically grounded.

Any special fittings or piping required for connection of fuel, cooling water, or exhaust shall be furnished and installed.

Each engine-generator shall, at a minimum, meet both the specified guaranteed emission requirements and the required Environmental Protection Agency (EPA), New Source Performance Standard emission regulations and shall be verified in writing by the engine-generator supplier. Field testing of actual emissions may be required as specified to verify compliance with the emissions requirements.

Each engine-generator shall be designed and be suitable to be operated during a power outage for a minimum of 4 continuous hours at rated capacity.

For permitting, warranty and maintenance operation, each engine-generator is intended to operate a maximum of 100 hours per year.

If the engine-generators requires any natural gas fuel pressure greater or equal to 5 psig, the area shall be rated for a Class I Division 2 Group D environment around any potential leak sources from the high pressure gas. The Seller shall provide drawings that identify gas leak sources and the extent of area classification associated with each leak source.

**15910.2.2.1 Performance Table.** Each engine-generator, without being in parallel with another enginegenerator or utility, shall satisfactorily start the following loads in the listed order, while meeting the specified voltage dip at the generator terminals.



<u>Load</u> <u>Step</u>	Load Description	Projected Demand	<u>Maximum</u> <u>Percent</u> <u>Voltage</u> <u>Dip %</u>
1.1	Building and HVAC Loads	300 kW	30
1.2	Gas Pressurization Skid (if required)	As required by Engine-Generator Manufacturer	30
2.	Natural Gas Compressor	As sized by Turbine Manufacturer	20
3.	Controls and Accessories Required for Turbine Startup	As sized by Turbine Manufacturer	20
4.	Emission Control Equipment for Turbine	As sized by Turbine Manufacturer	20

## 15910.2.3 Acceptable Manufacturers

Each engine-generator unit shall be from the same manufacturer, shall be identical, and shall be a current production model. The engine-generator shall be manufactured by Caterpillar, Cummins, Jenbacher, MTU, or equal.

The manufacturer of the engine-generator unit shall have a full-time, fully factory trained technical staff and an equipped 24 hour service facility having all personnel and all equipment required to maintain, repair, or overhaul the engine-generator unit and associated equipment. Service facility shall be within 250 mile radius of Point of Destination.

## 15910.2.4 Engine-Generator Unit

**15910.2.4.1 Engine.** Each engine shall be reciprocating 4-stroke cycle, spark ignition type engine type and shall be equipped with the following:

Dry type air cleaner with replaceable elements. After market accessories as required to meet the specified guaranteed emissions

**15910.2.4.2 Ignition System.** Each engine shall be equipped with a coil on plug ignition system of proven design. The system shall be comprised of three principal elements: ignition control module, coil on plugs, and spark plugs.

All high-tension leads shall be enclosed within the coil on plug. The low-tension leads connecting the ignition control module to the coil on plugs shall be shielded and protected by rigid conduit that is compatible with the system's operating characteristic and design.

All components shall be of a type and design suitable for the intended service and shall be suitable for dismantling and reinstallation by plant personnel without cutting of wires.

**15910.2.4.3** Alternator. Each engine-generator alternator shall be a 4 pole, revolving field design with temperature compensated solid state voltage regulator, brushless rotating rectifier exciter system, and drip-proof construction with amortisseur windings. The alternator shall be directly connected to the engine gear box. A semi-flexible disc coupling of proven design shall be provided to connect to the engine drive.

Frequency regulation shall be isochronous  $\pm 0.15$  Hz from no load to rated load. Voltage regulation shall be within  $\pm 2$  percent of rated voltage, steady state, from no load to full load. The momentary voltage drop shall not exceed the specified percent without starter coils dropping out or stalling the engine at any time when applying or starting the specified loads.

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The alternator shall have Class F insulation as defined by NEMA MG1-1.65 and temperature rise shall be within NEMA MG1-22.40 definition at rated condition.

Three current transformers shall be furnished and installed in a box on the generator for generator differential current protection. This requires all the winding leads to be brought outside the generator before forming the neutral. After the neutral is formed, a current transformer shall be provided in the box for generator ground fault relaying. The ground fault current transformer may be installed in the neutral grounding resistor as an alternative. The characteristics of the current transformers used for differential protection shall be coordinated with those supplied in the generator switchgear. Current transformer ratings are indicated on the Drawings and shall be coordinated by the coordination study.

The alternator conduit box shall be sized to accommodate the separate phase leads, neutral leads, current transformers, voltage surge arrestors and capacitors, and connections as indicated on the electrical one-lines.

The winding pitch shall be 2/3 pitch for use in paralleling with the utility or other units if desired.

Harmonic filters shall be provided where determined by the supplier for proper operation when powering solid-state motor starters.

An alternator winding heater shall be furnished as an integral part of the engine-generator unit. Alternator winding heater shall be rated 120 volts, single phase. The alternator winding heater control system shall include an interlock with the engine-generator unit so that the heaters are de-energized at all times that the generator field is energized. The supplier shall provide all internal alternator winding heater wiring and use branch circuit protection and shall be powered from the panelboard specified in paragraph 2-4.10 of this section.

**15910.2.4.3.1** Surge Protection. Each engine-generator shall be provided with a voltage surge system installed in the switchgear. Surge arrestors shall be station class arrestors.

**15910.2.4.4 Fuel System.** Each engine shall be furnished with a complete fuel gas train system suitable for attaching to piping from the natural gas distribution piping. The fuel gas train shall include but not be limited to pressure regulators, pressure relief valves, electrically operated valves, manual shutoff valves, excess flow control valve, strainer, all stainless steel flexible connections, flame arrestor, and with any equipment required by the engine to accept the specified fuel and pressure listed under Design Conditions paragraph and as required to meet NFPA 37 requirements. Fuel valves shall have stainless steel trim.

The fuel gas train shall include two electrically operated valves for shutoff of the fuel and shall be springclosed when de-energized to shut off the fuel supply on engine shutdown. The valves shall be dc powered and located upstream from the stainless steel flexible connectors in the fuel line, and shall open when engine start is initiated. A manual shutoff valve shall be located upstream from the electrically operated valves.

The excess flow valve shall be provided to restrict the flow of gas to each engine-generator by automatically closing in the event of a line failure due to line being completely cut, torn apart or otherwise separated. Excess flow valve shall be of an in-line type, with a manual by-pass, field adjustable, forged steel construction with a class 150 steel flanged end connection. Excess flow valves shall be Total Valve Model "2600" or equal.

The fuel system shall operate with the specified gas pressure and shall be furnished with any pressure reducing valves or other equipment required by the engine to accept the gas pressure as required. In the event that two stages of pressure reducing valves are required, both shall be provided by the Supplier. The pressure reducing valve or valves shall be constructed of suitable material for natural gas service and shall contain an internal pressure relieve valve. The pressure reducing valve shall be provided with vent cap assembly to prevent the entrance of rain, snow, and insects. Safety pressure relief valve shall be provided



downstream of the pressure reducing valves. The outlet of the pressure relief shall be piped outdoors by the contractor during installation.

A stainless steel flexible connection shall be provided for the fuel supply lines.

Pressure taps with stainless steel shutoff valves shall be provided at the inlet and outlet of the regulators and electrically operated valves, and at the inlet of the carburetor. Fuel pressure gauges shall be provided at the inlet of the regulator.

If a portion or all of the fuel gas needs to be provided above the pressure specified in paragraph 2.2 of this section, the engine-generator manufacturer shall supply a pre-combustion gas pressurization skid for each unit. The engine-generator must also be able to blackstart without the use of increased pressure gas and able to start the pre-combustion gas pressurization package and building and HVAC loads before receiving the higher gas pressure from the gas pressurization skid. The gas pressurization skid must be provide with stainless steel flexible connections for all gas connections.

If the engine-generators requires any natural gas fuel pressure greater or equal to 5 psig, the area shall be rated for a Class I Division 2 Group D environment around any potential leak sources from the high pressure gas. The Seller shall provide drawings that identify gas leak sources and the extent of area classification associated with each leak source.

The fuel system controls shall be as indicated in the control panel paragraph.

**15910.2.4.5 Exhaust Silencer.** Each engine-generator unit shall be furnished with a complete exhaust system including an exhaust silencer, all stainless steel exhaust piping, stainless steel bellows expansion joints, and accessories required for a complete operating system. The entire exhaust system shall be designed and sized by the engine manufacturer.

Expansion joints, anchors, hanger, and supports shall be provided for the exhaust piping so that no load is transmitted to the engine connections from the engine flexing, exhaust pipe weight, or thermal expansion.

The expansion joint in the vertical riser immediately above each engine exhaust connection shall be provided with a suitable flange on one end for attaching to the engine exhaust connection, and an 18 inch butt welded connection on the other end.

A wye type assembly shall be provided if the engine utilizes dual exhaust outlets, such that the exhaust from each engine shall be terminated with a single 18 inch butt weld connection. Each wye type connector shall be all stainless steel with suitable end connections for connecting to the exhaust connections on the engine and shall include bellows type expansion joints in each leg of the wye assembly, designed for 4-1/2 inch axial compression.

Each expansion joint shall be three ply, bellows type, fabricated of all stainless steel, and shall be designed for 4-1/2 inch axial compression. The expansion joints shall be Hyspan "Series 2500 Laminated Bellows" or equal. Insulation shall not be applied over the expansion joints.

Removable insulation covers shall be provided for the exhaust silencer. The covers shall be of sewn construction with end closures and securing ties. The covers shall be constructed of fiberglass-base fabric fill with asbestos free material and of suitable thickness to provide a cold face temperature of 150 °F. Covers shall be easily removed and replaced. Covers shall allow removing the access cover. Minimum attenuation for the silencer for the following mid band frequencies shall be as follows:

63 Hz	35	dB
125 Hz	40	dB
250 Hz	40	dB
500 Hz	40	dB
250 Hz 500 Hz	40 40	dE dE

1,000 Hz	35	dB
2,000 Hz	35	dB
4,000 Hz	35	dB
8,000 Hz	35	dB

**15910.2.4.6 Starting System and Control Power.** Each engine-generator unit shall be furnished with a complete electric motor start system including starting motors, cables and if required a battery pack with rack and battery charger. The starting system and control power shall originate from either the 125Vdc centralized battery system (furnished by the Installation Contractor) or as determined by the Seller.

The batteries shall be of the high rate, nickel-cadmium type and have a 24 volt output. The batteries shall be electrically sized for the engine furnished using electric strip heaters to maintain minimum cell voltages of 0.65 volt per cell during initial starting, and 0.85 volt per cell throughout the cranking time for five consecutive starting attempts of 10 seconds each. Battery voltages shall be maintained under the conditions specified herein.

The battery charger shall be suitable for the nickel-cadmium battery pack. The charger shall have a DC output suitable to supply power for all continuous loads and to recharge the batteries from a fully discharged state to normal operating voltage within 8 hours. The battery charger shall be provided with a NEMA 2 corrosion resistant enclosure. The battery charger shall be provided with the following: on/off switch, DC ammeter, DC voltmeter, AC input and DC output circuit breakers or fuses, floating voltage equalization, equalizing timer, and relays with form c contacts for remote annunciation of loss of AC power, low battery voltage, and high battery voltage.

The batteries, battery rack, and battery charger shall be located on the engine-generator skid. The battery rack frame shall be constructed of corrosion resistant material.

The engine-generator shall automatically supply power to the remote bus that powers the battery charger when it is operating and when utility power is not available.

The battery charger shall be powered from a customer facility power source.

The engine-generator shall automatically supply power to the remote bus that powers the battery charger when it is operating and when utility power is not available.

**15910.2.4.7 Cooling System.** Each engine-generator shall be supplied with a remote-mounted radiator cooling system complete with radiator, expansion tanks, cooling water pumps, electric motor-driven fan(s), fan guard(s), thermostatic temperature control, booster pumps (if required by equipment supplied), all stainless steel expansion joints, high-water temperature cut out, electric jacket water heater, structural supports, and all accessories as required for proper operation. The cooling system for each engine-generator shall consist of two cooling loops, one for the jacket water and one for after cooler all to be piped to a single forced-draft radiator containing two separate (dual) cooling cores. Each loop shall include an engine driven cooling water pump, temperature and pressure indicators, flexible connections, and all other accessories required for a fully operational system, all mounted on the engine-generator skid.

Each engine and each associated radiator shall be furnished with flexible intake and discharge water connections. Connections shall be all stainless steel corrugated hose with braid, and shall be Flexonics "Series 401M" or equal.

The remote radiator shall be protected against thermal shock or damage from the engine-generator cooling system while operating in cold weather.

The cooling system shall be filled with a permanent antifreeze mixture of the ethylene glycol type with rust inhibitor suitable for the minimum outdoor temperature conditions specified herein.


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**15910.2.4.7.1 Remote-Mounted Radiator.** Each radiator shall be a dual-core horizontal-core unit with vertical air discharge with motorized fan(s) and structural steel support frame, and shall be suitable for operating in all types of weather conditions which may be encountered throughout the life of the equipment. Each radiator shall be sized with sufficient capacity for cooling its associated engine-generator running at full load and all other accessories required for proper operation during outdoor ambient temperature as specified in the service conditions section. Each radiator shall produce a maximum of 85 dBA at 3 feet from the equipment. Each radiator shall be no more than 16'-0" long by 8'-0" wide.

Each radiator shall be provided with support legs suitable for bolting to the concrete pad. The length of the radiator support legs shall not be less than the required height for the expansion tank to be located at the highest point in the piping system.

Contractor to coordinate number and location of support legs supplied.

Each core tube bank manifold shall be removable for tube cleaning and access. The cores shall be pitched to a drain connection with a shutoff valve. The cores shall be capable of withstanding the pressure and flow required by the engine-generator during full load operation. Water flow through either core shall have a maximum pressure drop of 6 psi at full load operation.

Each core shall be furnished with an expansion tank for each cooling loop, to be located at the highest elevation in each piping system. Each expansion tank shall include a pressure relief valve, low level switch, inspection port with cap, piping to the radiator cores, mounting brackets, all stainless steel flexible connections, and all other accessories required for safe operation with the radiator. Each expansion tank shall be capable of being separated from the radiator and mounted at a higher elevation on a vertical surface, and shall include mounting brackets for such. Level switches shall alarm for low water level in the expansion tanks to the plant control system.

The radiator fan shall be belt-driven, forced-draft, fixed-center, air foil section with aluminum blades. Each motor shall be 460 V, 60 Hz, 3-phase motor with TEFC enclosure and operate at a maximum speed of 1,800 rpm. Motors shall be NEMA Premium Efficient type and shall include a motor space heater. The fan shall not operate above 11,200 fpm tip speed and shall avoid vibration sensitive speed ranges.

Each radiator shall include a hot-dip galvanized steel frame, fan ring, lifting lugs, core guard, fan, fan drive guards and including radiator support legs. Each support leg shall include bolt holes for fastening to a concrete equipment pad.

All valves supplied with each remote radiator shall be individually labeled and numbered by the manufacturer as specified in the Identifying Devices section and shall be provided with a corresponding valve schedule.

Radiator manufacturer shall be IEA, or equal.

**15910.2.4.7.2 Cooling Water Pumps.** The jacket water and aftercooler cooling water pumps shall be sized to provide sufficient cooling flow to the radiator. The pumps shall be either integral to the engine-generator or mounted on the engine-generator skid. The capacity of the water pumps shall be coordinated with the cooling water requirements of the engine-generator being supplied and with the radiator being supplied. The jacket water pump shall be engine-driven through a belt drive. Required pipe sizes for the installation shall be indicated on the jacket water and aftercooler cooling water pump submittal.

**15910.2.4.7.3 Gauges.** Pressure and temperature gauges shall be provided on both cooling water circuits at the inlet and outlet of the engine. The gauges shall be the analog dial-type with stainless steel case, bezel, fittings, and stem. The gauges shall be hermetically sealed with acrylic plastic or shatter-proof glass window and shall have a 4-1/2 inch minimum dial size. Gauge shall have contrasting markings against background and shall be sized such that the normal operating point will be at the

midpoint of its range. Temperature gauges shall be provided with thermowells and pressure gauges with ball type shutoff valves.

**15910.2.4.7.4 Radiator Local Control Panel.** A motor starter with overload protection and field terminals shall be mounted within the control panel for operation and control of its associated remote radiator electric motor-driven fan(s), and all accessories as required for proper operation. The radiator motor starter shall be housed in a NEMA 12 enclosure and shall include an external disconnect switch, motor starter with overload protection, circuit protection, control relays, if necessary, and field connection terminals. Control panels shall be equipped with control power transformers. Each control panel shall automatically start and stop the radiator equipment in coordination with the engine-generator and shall include the accessories necessary to accept a remote run contact from its associated engine generator.

The control panel shall, at a minimum, include the following instruments and control devices:

Control Power ON Indication.

Dry contact that closes for remote common alarm.

Three-position selector switch with "RUN-OFF-AUTO" positions.

Dry contact that closes and indicating light when the Jacket Water expansion tank water level is low.

Dry contact that closes and indicating light when the Aftercooler water level is low.

Dry contacts for Radiator selector switch in Running and In-Auto position.

The control panel shall be provided with a three-position selector switch with the following positions: "RUN-OFF-AUTO". In the "RUN" position, individual water pumps and radiator fan(s) shall have local control for maintenance. In the "AUTO" position, the radiator control panel shall be remotely started and stopped with the operation of its associated engine-generator. Isolated contacts for when the unit is in the "AUTO" position shall be provided for remote indication.

The control panel furnished shall conform to the requirements of Section 17053.

**15910.2.4.7.5** Jacket Water Heater. An electric jacket water heater shall be furnished with each engine to maintain jacket water at 90°F with a winter ambient temperature of 20°F. The jacket water heater shall be thermostatically controlled. The power supply for the heater shall be 480 VAC and shall be wired by the Contractor.

**15910.2.4.8 Speed Increaser.** If required, each engine-generator unit shall be provided with a speed increaser to match speeds of the engine driver and the generator. The speed increaser shall be oil-lubricated, conform to AGMA requirements and has AGMA service factor of at least 1.5, and shall have an efficiency of at least 98.5% at 1:1.2 ratio. The speed increaser shall be parallel-shaft, helical or herring-bone gear type. The speed increaser bearing shall be radial bearing of the sleeve type and thrust bearing of the tilting-pad or anti-friction type. The ABMA L10 bearing life should be a minimum of 100,000 hours.

Flexible couplings shall be provided to suite driver and driven units and to prevent torsional vibration.

**15910.2.4.9 Couplings and Guards.** Each engine-generator shall be provided with all coupling as part of the complete assembly.

Guards shall be supplied to protect personnel from hot and moving parts. Guards shall be located so that normal daily maintenance inspections can be undertaken without their removal.

**15910.2.4.10 Control Panel.** Each engine-generator unit shall have a control panel mounted on the engine-generator package. The panel shall be provided with vibration isolators to prevent damage to the instruments from engine-generator vibration.

The control panel shall be PLC based automatic control with safety features in accordance with Section 17053. Adequate clearance shall be provided between the panel and the engine to allow engine maintenance without moving the control panel. The control panel shall be provided at minimum with the following HMI based indications and controls:

## Analog Indications

AC voltage (V) Power (kW) Volt-Amps (kVA) Power Factor Frequency (Hz) Coolant temperature (F) Oil pressure (PSI) Speed (RPM)

## Status Indications

Equipment running status (all driven equipment) Control mode (droop, isochronous, load share, etc.) Control selection (local, off, remote) Startup sequence steps All alarm conditions Ready to start (all system start permits met)

## Trip Indications (with First Out Functionality)

Low oil pressure Overspeed Overcrank Emergency stop Fault shutdown Spare

## **Functions**

Start command Stop command Voltage control Control mode selection (droop, isochronous, load share, etc.)

The control panel shall be provided with the following minimum hardwired devices:

Non-resettable hour meter. Two normally open dry contacts that close when the engine is running and open when it is stopped. Dry contact that opens for remote common alarm. Three-position selector switch with "LOCAL-OFF-REMOTE" positions. Dry contact that closes when the selector switch is in "REMOTE" mode. Spare relay. Emergency stop pushbutton. Start pushbutton (with starting indication). Stop pushbutton (with stopping indication). Ready to start indicating light.



Over/under voltage programmable relay. Reverse power programmable relay. Over/under frequency programmable relay. Overcurrent programmable relay.

The PLC shall have a Modbus TCP/IP (Ethernet) fiber optic communications link that includes all data required to replicate the local panel functionality on the remote control room DCS operator workstations. Critical controls shall be hardwired.

**15910.2.4.11 Emergency Stop Pushbutton.** A remotely located emergency stop pushbutton (one per generator) shall be furnished under this section and connected into the respective engine-generator control panel. The pushbutton, when pressed, shall shut down the engine-generator regardless of the position of the RUN-OFF-REMOTE selector switch. Control wiring between the pushbutton and the engine-generator control panel shall be furnished by the Installation Contractor.

**15910.2.4.12 Electric Governor Control.** The governor control shall be electronic and shall have the capability for speed control and load sharing (kW & kvar). The equipment shall consist of, but not be limited to, the following:

Governor actuator. Magnetic pickup for speed sensing. Monitoring of voltage and current for the generator 3 phase output. Load sensor. Speed sensor. Ramp generator for control of ramp time and idle speed. Speed control rheostat. Control power voltage regulation. Switch for selecting either isochronous or droop control mode. Controls for the following: Rated speed. Stability. Gain. Ramp time. Low idle speed. Load gain. Droop. De-droop. Rheostat for control of speed for synchronizing.

The electronic governor control shall be furnished as a complete governor and control package, Device 65. All items except the governor actuator and magnetic pickup for speed sensing shall be furnished to the switchgear manufacturer for mounting in the generator switchgear as specified in Medium-Voltage, Metal-Clad Switchgear section. The electronic package for speed control shall be Woodward 2301A load sharing and speed controls or equal.

**15910.2.4.13 Neutral Grounding Resistor.** A neutral grounding resistor shall be furnished for connection to the generator. Neutral grounding resistor and all components shall be designed, manufactured and tested in accordance with the latest applicable standards from NEMA, ANSI and IEEE.

Resistor units shall be edge-wound type, constructed of stainless steel, with welded connections between units. The edge-wound helix strap shall be wound around a refractory core reinforced by longitudinal steel supports. Each resistor element shall be individually supported at each end by ceramic insulators and shell be designed to accommodate thermal expansion.

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The frame assembly for edge-wound resistor units shall be constructed of corrosion-resistant, hot-dipped galvanized angle. All members shall be assembled using stainless steel hardware and shall be of sufficient strength to withstand severe mechanical stress.

The grounding resistor shall be provided with a screened safety enclosure and shall be suitable for being pad mounted outdoors. A current transformer shall be provided within the resistor enclosure.

Seller shall provide the following information pertaining to the Neutral Grounding Resistor:

- Line-to-ground voltage rating
- Time rating
- Temperature rise
- Current transformer rating

**15910.2.5 Factory Tests.** The manufacturer shall factory test each engine-generator set with its unit mounted control panel to demonstrate that the equipment conforms to specified requirements for load capacity. Witnessing of the factory test by the Buyer will be required.

All items included on the control panel shall be assembled, wired, and tested in the manufacturer's factory.

The tests shall consist of repeated starts and stops, operation under a load bank at specified capacity frequency, voltage, phase, and power factor for a minimum of 1 continuous hour, and tests to demonstrate that each safety shutdown device is working properly. Fuel consumption tests shall be performed at rated speed and power factor for full load, three quarters load, and half load to verify unit meets the specified maximum fuel consumption at the specified loads. Units not meeting the specified maximum fuel consumption for the specified loads will not be acceptable. Submit certified copies of the factory test results prior to shipping the unit.

# 15910.3 Field Quality Control

**15910.3.1** Installation Supervision. The equipment manufacturer shall furnish a qualified field installation supervisor during the equipment installation.

Manufacturers' installation supervisor shall observe, instruct, guide, and direct the installing contractor's erection or installation procedures. The equipment manufacturer will be provided with written notification 10 days prior to the need for such services.

The manufacturer's representative shall furnish a written report certifying that the equipment has been properly installed and lubricated; is in accurate alignment; is free from any undue stress imposed by connecting piping or anchor bolts.

**15910.3.2 Field Testing.** Each unit shall be mechanically checked for proper operation. Prior to the Field System Operation Test, each alarm and safety shutdown shall be checked by artificially simulating an alarm condition. Defective equipment and controls disclosed by the tests shall be replaced or corrected, and the packages placed in satisfactory operating condition.

Each engine-generator set shall be tested to demonstrate that the equipment conforms to specified requirements for load capacity, and starting duty. Demonstration shall include paralleling, automatic synchronizing, and load sharing.

The complete system (engine, generator, fuel system, exhaust system, remote radiators and control panel) shall be field tested together by the manufacturer as a complete system to assure compatibility.

Each unit shall be individually tested, consisting of repeated starts and stops, operation under load bank at the specified power rating and power factor for the duration listed below. After each unit has been individually tested, they shall all operate synchronously in parallel under load bank, for the time durations listed below. Before each test, each engine shall be running at steady state conditions as determined by the instrument reading.

- Individually load bank test for four (4) continuous hours at the specified power rating and power factor within normal operating conditions of the unit without any alarm conditions.
- Demonstration of four (4) starts.
- After each unit has been individually tested, they shall start, and automatically synchronously operate in parallel operation. This shall consist of four (4) starts followed by 30 minutes of continuous operation at the specified power rating and power factor within normal operating conditions of the units without any alarm conditions. Tests shall include de-energizing normal power.

After each engine-generator has been individually load bank tested, each unit shall be performance tested that shall include demonstration of four (4) starts of the specified loads listed in Paragraph 2-2.01 in the order listed followed by 30 minutes of continuous operation per start, all within normal operating conditions of the unit without any alarm conditions or use of a load bank.

Seller shall furnish the lubricants, load bank(s), as well as all personnel necessary to perform the tests.

At the option of the buyers, an independent laboratory will be provided by the Buyer for the exhaust gas sampling and analysis during the individual 4 hour load test of the engine. The laboratory analysis will be used for verification that the units meet the guaranteed emissions and NSPF regulations.

Any retesting or modifications to the equipment to meet the above requirements and emission guarantees shall be approved by the Engineer. All costs of modifications and retesting, including the independent laboratory for air emission testing, shall be at no cost to the Buyer.

The following items shall be measured, recorded at 15 minute intervals, and submitted in a field test report:

- Outdoor ambient temperature.
- Indoor ambient temperature.
- Barometric pressure.
- kW output.
- Engine speed, rpm.
- Engine jacket water temperature.
- Engine oil pressure.
- Start time.
- Completion time.

Test reports shall be submitted and verify that the specified tests have been performed and shall state results.



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# **16031 - Cylindrical Rotor Generators**

## 16031.1 General

## 16031.1.1 Scope of Supply

The scope of supply shall include the furnishing of a 3-phase alternating current cylindrical rotor synchronous machine as specified in Section 01100, herein, and on attached Cylindrical Rotor Generators Specification Sheets. Salient pole or 4-pole type generators will be considered acceptable by Engineer given that generator type is Seller's standard and that Seller provides sufficient information, as determined by the Buyer, for the Engineer's review.

#### 16031.1.2 Items Furnished by Others and Interfaces

Section 01100 contains a listing of items furnished by others and not in this scope of supply.

#### 16031.1.3 Performance and Design Requirements

Performance and design requirements for the equipment to be furnished under this article of these specifications are indicated on attached Cylindrical Rotor Generators Specification Sheets.

#### 16031.1.4 Codes and Standards

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

Work	In Accordance With
Rotating electrical machinery	ANSI C50, NEMA MG1 and all referenced documents

## 16031.1.5 Not Used

#### 16031.1.6 Not Used

#### 16031.1.7 Test Requirements

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

Tests	In Accordance With	Conducted By
Nondestructive testing on each rotor forging	Seller's standards	Seller
Dynamic balancing of completed rotor	Seller's standards	Seller
Overspeed testing of completed rotor	Seller's standards	Seller
High potential testing on completed stator and rotor coils	Seller's standards	Seller



Tests	In Accordance With	Conducted By
Shop tests in accordance with Article 16031.2.11 of these specifications	Seller's standards	Seller

## **16031.1.8 Technical Attachments**

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

## 16031.1.9 Supplemental Specifications

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

## 16031.2 Products

## 16031.2.1 General Requirements and Construction

The generator shall be a 3-phase alternating current cylindrical rotor synchronous machine. The generator (and collector rings if used) shall be totally enclosed in a housing. All generator windings shall be copper. Unless otherwise specified, the generator shall be rated for continuous use.

The generator efficiency shall be at least 98.5 percent at unit rating, including bearing, windage, and seal losses.

The rated generator terminal voltage shall be as specified in the Cylindrical Rotor Generators Specification Sheets included at the end of this section.

**16031.2.1.1 Stator Core**. The stator core iron shall be made of high quality laminated, nonaging, siliconalloyed steel sheets with high permeability, and with each side insulated. The clamping system shall be of the through-bolt design to ensure constant and uniform pressure upon the core iron laminations by means of press plates and press fingers. The generator shall be designed so that the through-bolts can be retightened after the stator coil installation is complete.

Variations to the above described core lamination clamping system to suit the manufacturer's standard design will be allowed as long as the intent of the specifications is met and subject to approval by the Buyer.

**16031.2.1.2 Stator Winding and Terminals**. The stator winding shall be star connected. All six terminals shall be brought out of the machine and shall be available for external connections. Either end of the winding shall be designed for use as a neutral bus or for use as the main generator power leads. The generator neutral connection rating in amperes shall be the same as the generator line terminal rating and shall be based on the maximum MVA rating of the generator operating at minimum allowable generator terminal voltage. The generated stator voltages shall reach a positive maximum in the order required by the Buyer.

Variations to the above design philosophy regarding main and neutral bus connection points to accommodate the manufacturer's standard design may be allowed subject to approval by the Buyer.

The main power lead terminal bushings shall be spaced to permit connection to the Buyer's generator terminal conductor system. The main power lead terminal bushings shall be furnished with spade type terminals drilled for connection to the specified Buyer's generator terminal conductor system. Flanges or provisions for attaching the Buyer's generator terminal conductor system to the generator high voltage line bushings shall be furnished. The main power lead terminal bushings shall be located such that the Buyer's interface point is near the termination cabinet entrance point.

The Seller shall provide drawings and information required to assist the Buyer and the generator terminal conductor system contractor with the design and installation of the Buyer's generator terminal conductor system.

**16031.2.1.3 Insulation and Maximum Temperatures**. The insulation of the armature windings, field windings, and collectors shall be Class F. The temperature rises and total temperatures shall not exceed those permitted for Class B.

The stator coil insulation shall be a vacuum pressure, resin impregnated, mica type system. Windings shall be insulated for the full rated voltage to ground with no grading of insulation.

**16031.2.1.4 Stator Winding Support Structure**. The stator winding support structure shall be designed to resist all forces resulting from a maximum possible short-circuit torque which could occur and other forces imposed during normal and abnormal operation. The support structure shall also be designed to absorb thermal expansion of the stator winding bars without undue stress to any part.

**16031.2.1.5 Short-Circuit Requirements**. The machine shall be designed to withstand without failure a short circuit of any kind at its terminals while operating at any load or voltage within the generator's permissible operating range. Maximum phase current will be limited by external means to a value which does not exceed the maximum phase current obtained from a 3-phase short circuit.

**16031.2.1.6 Short-Circuit Ratio**. The measured value of short-circuit ratio at rated voltage and rated stator current shall not be less than the value specified on the Cylindrical Rotor Generators Specification Sheets.

**16031.2.1.7 Mechanical Strength of Rotor**. The rotor shall be designed, mechanically, to withstand the startup and operational requirements required by the prime mover.

**16031.2.1.8 Lubricating Supply System**. The generator shall share the common bearing lubrication system provided by the turbine manufacturer. The generator, when purchased separate from the turbine, shall be provided with all generator and collector bearing lubricating oil piping as required to meet up with and match up with the piping that is provided with the turbine bearing lubrication system.

**16031.2.1.9 Cooling of the Machine**. The generator cooling system shall be as specified on the Cylindrical Rotor Generators Specification Sheets. Alternatives to generator cooling will be evaluated provided all data sheets, guarantee points, and performance curves are provided with Seller's proposal.

**16031.2.1.10 Power Factor**. The rated power factor at the machine terminals shall be as specified on the Cylindrical Rotor Generators Specification Sheets for lagging (overexcited) power factor. The generator shall be capable of continuous operation at both the lagging and the leading power factors specified on the Cylindrical Rotor Generators Specification Sheets.

## 16031.2.1.11 Not Used.

#### 16031.2.1.12 Not Used.

**16031.2.1.13 Temperature Detectors**. Embedded resistance temperature detectors (RTDs) shall be furnished as specified in Cylindrical Rotor Generators Specification Sheets for determining the generator stator winding operating temperatures.

In addition, for machines with direct cooling of the stator winding, the temperature of the cooling medium at the outlet of the winding shall be measured with at least three temperature detectors.

Detectors for indicating the inlet and outlet air temperatures to the collector ring or exciter housing shall be provided for all machines.

Detectors shall be provided in the generator and exciter journal bearings.

All temperature element leads shall be brought out and terminated in Seller-supplied terminal boxes.



**16031.2.1.14 Generator Grounding**. The generator stator frame shall be provided with a minimum of two grounding pads located diametrically opposite at the corners of the structure, each with two or four threaded holes and associated bolts for attachment of the station grounding conductors. The hole spacings and size will be determined by the Buyer during detailed design.

## 16031.2.1.15 Not Used.

**16031.2.1.16 Generator Drying**. The generator shall be shipped in weatherproof crates or under protective covers. The Seller shall carefully examine the equipment at site to see if electrical windings have become wet and whether and how the machine should be dried before subjecting it to full voltage. The responsibility of placing the full voltage on the machine shall rest entirely with the Seller.

**16031.2.1.17 Subtransient Reactance**. The direct axis subtransient reactance at the saturation level corresponding to rated voltage shall be as specified in the Cylindrical Rotor Generators Specification Sheets.

**16031.2.1.18 Space Heaters**. The generator and exciter shall be equipped with space heaters. Space heaters shall be suitable for operation at the voltage specified in the Cylindrical Rotor Generators Specification Sheets. Seller shall provide all equipment, controls, and accessories to ensure that space heaters will be energized when the generator is off-line and will be de-energized when the generator is on line.

#### 16031.2.2 Terminal Accessories

The generator shall be equipped with the following accessories.

**16031.2.2.1 Terminal Enclosure**. The generator terminal enclosure shall be suitable for the installation location and shall preserve the integrity of the specified line terminal conductor system.

**16031.2.2.2 Bushings and Current Transformers**. The generator shall be equipped with six dry type generator bushings. Current transformers, suitable for relaying and metering service, shall be furnished as specified on the Cylindrical Rotor Generators Specification Sheets. Unless otherwise specified by the Buyer, the current transformer ratio shall be chosen so that, at rated generator current, the secondary current output is approximately 75 to 80 percent of the current transformer secondary rating. A terminal box, complete with shorting type terminal blocks, shall be furnished for mounting near the bushing current transformers to which all bushing current transformers will be wired. The Seller shall provide terminal blocks, terminal box, and terminal block markings that are acceptable to the Buyer. Current transformers specified as laboratory calibrated shall have the results plotted to create secondary excitation characteristics, ratio correction factor, phase angle correction factor, and transformer correction factor curves. Laboratory test data will be used in completing the turbine generator performance tests.

**16031.2.2.3 Generator Neutral**. One complete set of materials and accessories necessary to electrically connect and close the generator neutral at the generator neutral bushings shall be furnished. The conductors between neutral bushings shall be copper and shall be rated for 122° F ambient. A metal enclosure which completely encloses the generator neutral interconnecting buswork shall be furnished. The generator neutral shall be capable of accepting and connecting to the neutral conductor system specified on the Cylindrical Rotor Generators Specification Sheets.

**16031.2.2.4 Neutral Conductor System**. Where the neutral grounding conductor system is specified to be provided by the Seller, this article applies.

If cable and raceway are specified for the neutral grounding conductor system, the Seller shall furnish all suitable clamp type cable connectors, termination kits, glands (if applicable), cable, nonmagnetic raceway, and nonmagnetic raceway fittings for connecting the generator neutral buswork and neutral enclosure to the neutral grounding assembly. The cable shall be shielded copper cable with insulation



suitable for continuous operation at 1.5 times the generator line-to-neutral voltage. The Seller shall provide the raceway required to protect the entire length of the neutral cable connection.

If bus duct is specified for the neutral grounding conductor system, the Seller shall furnish all bus duct and all associated hardware and equipment for connecting the generator neutral buswork and neutral enclosure to the neutral grounding assembly.

**16031.2.2.5 Neutral Grounding Assembly**. If specified on the Cylindrical Rotor Generators Specification Sheets, the Seller shall furnish a generator neutral grounding resistor assembly. The assembly shall include a sheet metal steel indoor cubicle, a neutral grounding resistor and neutral grounding current transformers. If specified on the Cylindrical Rotor Generators Specification Sheets, a neutral isolation switch shall be included in the neutral grounding assembly. The neutral grounding assembly shall be capable of accepting and connecting to the neutral conductor system specified on the Cylindrical Rotor Generators Specification Sheets.

The resistance shall be selected so that the resistor kW dissipation during a phase-to-ground fault is equal to or greater than the generator and generator terminal equipment system charging kVA. In general, the phase-to-ground current should be limited to 400 amperes.

The resistor rating shall be adequate to maintain the phase-to-ground current for the specified fault duration without damage.

The secondary connections of the generator neutral grounding current transformer shall be wired out to a shorting terminal block in a Seller-supplied terminal box for use by the Buyer.

## 16031.2.2.6 Surge Protection and VT Equipment

Surge protection shall be furnished in accordance with applicable IEEE standards.

#### 16031.2.3 Generator Cooling System

A cooling system of the type specified on the Cylindrical Rotor Generators Specification Sheets shall be provided for safe and reliable operation of the generator stator and rotor. The cooling system shall be complete with all equipment, materials, and accessories. A complete scope document and technical description of the system offered to meet the requirements of these specifications shall be submitted with the proposal.

An open air-cooled machine shall be as described in Article 16031.2.3.3 titled Open-Ventilated Air-Cooled System.

#### 16031.2.3.1 Not Used.

#### 16031.2.3.2 Not Used.

**16031.2.3.3 Open-Ventilated Air-Cooled System**. Open-ventilated air-cooled generators are cooled by ambient air drawn into the generator through inlet filters and exhausted through an outlet duct.

**16031.2.3.3.1 Indoor units**. Indoor units shall be designed to have an inlet filter mounted in the wall of the building, with the filtered air being ducted to the generator air inlet flanges.

The hot exhaust air will be ducted from the generator to the outside of the building.

Air silencers shall be provided for fitting into the inlet and exhaust ducts. The silencers shall be constructed from heavy gauge galvanized steel, and they shall be filled with a sound absorbing material which is nonhygroscopic, verminproof, and noncombustible.

## 16031.2.3.3.2 Not Used.

16031.2.3.3.3 Filter types. Unless specified otherwise, the filters shall be of the adhesive impregnated replaceable media type, protected on the outside by angled louvers.

Where extended filter life is specified, self-cleaning filters of the pulse clean type shall be provided. These filters shall be housed in a free-standing module which is connected to the generator air inlets.

16031.2.3.3.4 Alarms. The Seller shall provide differential pressure switches with contacts to alarm when the filters are clogged.

#### 16031.2.4 Collector

SPGF

If the generator is furnished for use with a static type excitation system, then a collector shall be furnished with the following features:

- 1. An enclosure which is suitable for location either indoors or outdoors.
- 2. It shall be air-cooled with ventilation provided by a centrifugal blower which is integral to the collector shaft assembly.
- 3. Forged steel collector rings and bushings with subsurface ventilation.
- 4. Brush holders, which are gang mounted in magazine assemblies, have constant force springs and removable insulated handles to facilitate on-line brush replacement.
- 5. Class F insulation of dc power circuit components (main leads; brush rigging; slip ring assembly; and radial, axial, and flexible leads on the shaft).
- 6. An insulating separator between polarities to reduce the risk of short circuit during brush changing operations.
- 7. Silver-plated and bolted dc power circuit joints.
- 8. Outboard, double insulated bearing, if required to provide smooth operation to contribute to stable brush performance.
- 9. Replaceable filters for the air inlet.
- 10. Exhaust duct.
- 11. Replaceable filter for the outlet of the exhaust duct to capture all dust from the brushes.

The enclosure shall include a base which supports the stationary components and a door on each side. It shall include grounding pads, air temperature resistance temperature detectors, and space heaters.

Brushes shall be made of carbon with a minimum expected life of 6 months.

A convenience outlet shall be provided adjacent to both access doors. The housing shall be provided with interior lighting. The outlets, light switch, and light fixtures shall be of the weatherproof type for durability.

All wiring shall terminate on terminal blocks located near the base.

The collector and static excitation equipment shall be capable of accepting and connecting to the collector conductor system specified on the Cylindrical Rotor Generators Specification Sheets.

#### 16031.2.5 Excitation System

The generator excitation system shall be furnished in accordance with the following articles that support the specified requirements indicated on the Cylindrical Rotor Generators Specification Sheets. The excitation system shall be complete with all equipment, materials, and accessories. A complete scope document and technical description of the system offered to meet these requirements shall be submitted with the proposal.

The equipment offered by the Seller shall have a proven record of high availability and reliability; minimal maintenance; ease of servicing; accurate, fast, and responsive control; long life; and safe operation at the service conditions.

The excitation system shall be sized to provide adequate field voltage and current to continuously produce generator rated MVA at the maximum rated generator output voltage. Sufficient redundancy shall be provided to allow for device failure and replacement without compromising the required turbine generator availability. The excitation system must withstand, without damage, any faults or abnormal operation of the synchronous machine.

Brushless excitation systems (brushless exciter, silicon power diodes, and silicon controlled rectifier (SCR) excitation system) shall be as described in the article titled Brushless Excitation System.

**16031.2.5.1 Definitions**. The following definitions are in accordance with IEEE 421.1 and define the performance requirements specified on the Cylindrical Rotor Generators Specification Sheets:

- 1. <u>Excitation System Nominal Response:</u> The rate of increase of the excitation system output voltage determined from the excitation system voltage response curve, divided by the rated field voltage. This rate, if maintained constant, would develop the same voltage-time area as obtained from the actual curve over the first half-second interval (unless a different time interval is specified).
- 2. <u>High Initial Response</u>. The excitation system shall be capable of attaining 95 percent of the difference between the available ceiling voltage and rated load field voltage in 0.1 second or less.
- 3. <u>Ceiling Voltage</u>. The maximum direct voltage that the excitation system is able to supply from its terminals under defined conditions.
- 4. <u>Station Service Electrical System</u>. The station service electrical system provides electrical power to the plant auxiliary loads. If excitation power is obtained from this source, the transient loads and the transient effects of station service transfer schemes shall be considered.

**16031.2.5.2** Brushless Excitation System (Rotating Rectifier Exciter). The brushless excitation system shall be furnished as specified on the Cylindrical Rotor Generators Specification Sheets. The brushless excitation system shall consist of a rotating exciter, exciter power supply equipment, excitation cubicle, and an operator interface. The exciter silicon power diodes and SCR control system shall be as follows.

**16031.2.5.2.1 Rotating exciter**. A rotating rectifier exciter assembly directly connected to the generator shaft shall be furnished and shall include the following:

- 1. An alternating current main exciter with a rotating armature. The output from the rotating armature shall feed along the shaft to a rotating rectifier assembly.
- 2. A rotating rectifier assembly including silicon diodes, indicating fuses, and other components shall be included. The output from the diodes shall be transmitted along the shaft to the rotating generator field. The fuses shall protect against diode failure

and shall be series connected with the diodes. Each fuse shall have an indicating device to show whether or not it has blown. Necessary instrumentation and operator access shall be furnished for viewing the fuse assembly during operation. A sufficient quantity of fuse-diode components shall be furnished so that continuous operation at maximum generator output is achieved with at least 80 percent of the diodes per phase in operation.

- 3. Variations to the above described blown fuse indication to accommodate the manufacturer's standard design (electronic ripple detection, etc.) may be allowed as long as the intent of the specifications is met and is subject to approval by the Buyer.
- 4. Necessary Internal Connections. All rotating components shall be solidly connected together. No external leads between the exciter and the generator field shall be required.

The rotating equipment shall be totally enclosed. The covers shall be easily removable for maintenance and inspection and access doors shall be provided. Adequate illumination shall be provided in the interior. Dual element thermocouples for measurement of hot and cold air temperatures and bearing metal temperatures shall be furnished. A connection shall be provided in the cold air system for insertion of the Buyer's temperature control detector and well.

A convenience outlet shall be provided on each side of the exciter housing.

**16031.2.5.2.2 Exciter power supply equipment**. If a permanent magnet pilot exciter is specified on the Cylindrical Rotor Generators Specification Sheets, it shall be sized to provide power to the voltage regulator and the main exciter for all specified operating conditions.

**16031.2.5.2.3 Excitation cubicle**. A complete static voltage regulator and associated excitation switchgear, including the exciter field breaker (if required by manufacturer's standard design), mounted in a free-standing, dustproof, metal-enclosed cubicle shall be furnished. Necessary convenience outlets and incandescent lights with switches shall provide adequate lighting and receptacles for equipment maintenance. Thermostatically controlled space heaters shall be provided to ensure proper ambient temperature and to prevent condensation. All equipment mounted inside the housing shall be completely wired with all instrument, meter, and control leads wired to terminal blocks for external connections. All major items of equipment shall be identified with engraved nameplates acceptable to the Buyer. Inside the housing, the following equipment shall be mounted and wired:

- 1. One complete set of terminal blocks for wiring and nameplates.
- 2. One static type voltage regulating unit.
- 3. One regulator voltage transducer.
- 4. One static type amplifier panel.
- 5. One static type power panel.
- 6. One static type excitation limiter panel (maximum and minimum).
- 7. One reactance cross-current compensator (line drop compensation).
- 8. One static type damping panel.
- 9. One exciter field breaker (if required).
- 10. Suitable exciter field current shunt.

- 11. Reactive droop compensator for parallel operation.
- 12. One set of pull fuses for control power.
- 13. Solid-state or motor-operated bias adjuster.
- 14. Solid-state or motor-operated voltage adjuster.
- 15. Automatic ground detector.
- 16. Space heaters and thermostat.
- 17. One volt per hertz regulator.
- 18. Volts per hertz protection system.
- 19. One generator field overexcitation protection module with inverse time delay.

**16031.2.5.2.4 Insulation**. The insulation of the exciter shall be Class F. The temperature rises shall not exceed those permitted for Class B.

16031.2.5.3 Not Used.

#### 16031.2.5.4 Not Used.

**16031.2.5.5** Additional Requirements. The following additional requirements apply to all excitation systems.

**16031.2.5.5.1 Voltage regulator**. The voltage regulator shall be supplied with a means of both automatic and manual voltage regulation.

Manual voltage regulator shall provide the operator with a means to regulate the excitation system voltage when the automatic regulator is not functional.

Automatic regulation of voltage shall be provided by means of an automatic voltage regulator of the continuously acting type.

The automatic or manual voltage regulator shall maintain the generator terminal voltage within plus or minus 0.5 percent of the voltage set point over the range from no load to full load at the rated generator frequency. Variations in generator terminal voltage shall not exceed plus or minus 1 percent with variations in frequency of plus or minus 10 percent.

An automatic tracking device shall be provided so that the manual regulator set point follows the automatic regulator set point, and transfer from automatic to manual voltage regulation is provided without change in the excitation value.

A "bumpless" transfer function shall be provided to allow transfer from the manual to automatic regulator control without an increase or decrease in excitation value. This shall be initiated manually by the operator. The operator shall be provided with a remote meter to ensure equal set point values before transfer is initiated.

The control functions are as follows:

1. <u>Automatic Voltage Regulator (AVR)</u>. The gate pulse phase of the thyristor rectifier is adjusted so that the generator terminal voltage achieves the voltage set value (90R).

- MEC. The gate pulse phase of the thyristor rectifier is adjusted so that the generator field current becomes equal to the field current set value (70R). This function is used for testing purposes only.
- 3. <u>Voltage setting (90R).</u> The AVR control target value (voltage set value).
- 4. <u>Field current setting (70R).</u> The MEC control target value (field current set value). This function is provided for testing / commissioning purposes.
- 5. <u>Overexcitation Limiter (OEL)</u>. This function limits the field over-current of the generator. This function shall have an operation delay characteristic (inverse time characteristic), to allow for overexcitation operation that supplies a current in the event of a power system fault.
- 6. <u>Underexcitation Limiter (UEL)</u>. This function shall automatically limit the reactive power absorbed by the synchronous machine under all operating conditions. It shall have adjustable limiting characteristics to coordinate with the machine's underexcited capability curve and shall smoothly control and maintain excitation in a stable manner.
- 7. <u>Voltage-per-Frequency Limiter (VPFL).</u> This function limits overvoltage per hertz of generator and main step-up generator transformer.
- 8. <u>90R Automatic Follow Up (AFU)</u>. 90R of the standby system is made to follow 90R of the operational system.
- 9. <u>Automatic System; Excitation System Starting</u>. This function performs automatic start sequential control during excitation system starting.
- 10. <u>Power System Stabilizer (PSS)</u>. A  $\Delta$ P-PSS function shall be provided. A stabilization signal shall be output to the AVR to suppress active power disturbances.

The excitation voltage regulator shall be provided with set point adjusters (with position indicating meters) to allow local and remote control of the manual and automatic regulator set points.

Compensator(s) shall be furnished, if required, to provide regulator droop for sharing reactive line current between paralleled machine and/or provide line drop compensation to regulate voltage at a remote point from the generator terminals.

If specified on the Cylindrical Rotor Generators Specification Sheets, provisions shall be made for isochronous mode control for island operation which shall include mode selection from the main control room.

An automatic field buildup circuit shall be furnished that automatically energizes the field circuit for a controlled period of time after the ac input power breaker closes. The flashing power source will be provided from a battery source or permanent magnet generator (PMG).

The voltage regulating equipment shall be provided with a rapid de-excitation circuit.

**16031.2.5.5.2 Protection**. The following protections shall be provided, as a minimum, for the generator excitation system.

Overexcitation protection shall be provided to prevent excessive, sustained ceiling excitation voltage from increasing damage to either the excitation equipment or the generator. This protection shall consist of the following as a minimum:

- 1. Overexcitation trip to trip the machine if excessive excitation remains for a predetermined time, both in automatic and manual operation.
- 2. An adjustable limiting device which will automatically prevent operation above the rated generator overexcitation capability.

A volts/hertz regulator shall be furnished to provide a continuously acting limit to the maximum volts/hertz. The volts/hertz shall act only in the automatic regulator.

Automatic and continuous ground detection equipment shall be provided to detect grounds in the generator field. Facilities shall be provided to permit in-service tests of the ground detection system at any time. Ground detection shall be relayed via a contact for remote annunciation in the main control room.

Underexcitation protection shall be provided so that the synchronous machine voltage regulator shall be limited by means of an adjustable limiting device which will automatically prevent operation below the rated generator capability for underexcitation operation.

A voltage unbalance detector circuit shall be provided. Loss of regulator sensing voltage shall transfer the regulator from automatic to manual. Remote annunciation shall be provided in the main control room for loss of metering and regulating voltage transformer signals.

**16031.2.5.5.3 Instrumentation and alarms**. A field temperature indicator/transmitter shall be provided to transmit the temperature of the main generator field to the facility control room for display purposes.

Transducers shall be provided as applicable for generator field voltage, generator field current, and null balance. Output of the transducers shall be as specified on the Cylindrical Rotor Generators Specification Sheets.

Alarm contacts shall be provided for the Buyer's use to indicate overexcitation limit, underexcitation limit, and volts/hertz limit in addition to those limits specified elsewhere and those recommended by the manufacturer.

Test switches shall be furnished to permit isolation of the voltage regulator from the generator voltage transformers. Separate shorting switches shall be provided to permit isolation of the generator current transformer.

**16031.2.5.5.4 Metering**. The following metering package, as a minimum and as applicable, shall be provided locally on the regulator or cubicle mounted on the front of the metering section:

- 1. Exciter field voltage.
- 2. Exciter field current.
- 3. Exciter field rectifier ac input voltage.
- 4. Generator terminal voltage.
- 5. Manual regulator output.
- 6. Automatic regulator output.
- 7. Ac voltage error (difference between the generator voltage signal and the automatic voltage adjusting signal).

- 8. Underexcitation limiter output.
- 9. Overexcitation limiter output.
- 10. Volts/hertz limiter output.
- 11. Transfer voltmeter.

All meters shall be located on the metering panel of the cubicle.

**16031.2.5.5 Excitation cubicle construction**. Equipment associated with the excitation system shall be mounted in a free-standing sheet metal enclosure with front and back access doors. Necessary convenience outlets and incandescent lights with switches shall provide adequate lighting and receptacles for equipment maintenance. The Buyer will provide ac power for the lights and receptacles.

Thermostatically controlled space heaters shall be provided to ensure proper ambient temperature and to prevent condensation.

Ventilation shall be provided. Where heat cannot be dissipated with natural ventilation, forced ventilation of adequate size shall be included in the panel or cabinet, with suitable screened and filtered openings.

The Seller shall securely fasten phenolic nameplates to identify the equipment and devices in the cubicles.

A copper ground busbar with terminal lugs running the full length of each panel shall be provided and installed in the cubicle.

## 16031.2.6 Unit Synchronizing

When specified on the Cylindrical Rotor Generators Specification Sheets, a packaged control system for synchronizing the generator shall be provided. The synchronizing relays/circuitry shall be capable of manual and automatic synchronizing.

The manual synchronizing scheme shall be able to be operated independent of the automatic portion so that manual synchronizing of the unit can be performed even if the automatic unit is out of service. It is not required that the manual synchronizing circuitry be independent of the automatic circuitry if all the synchronizing circuitry is integrated with the turbine controls.

The automatic synchronizing package for each unit shall be complete with all required devices to perform all functions required for safe operation of the turbine generator and electrical system. Complete compatibility between the synchronizing equipment, circuit breakers and turbine generator control package shall be furnished.

A field-selectable provision shall be provided to permit synchronization only when the generator is "fast" with respect to the grid to prevent the unit from motoring or importing MVARs upon synchronization.

A separate, independent, synchronism check relay shall be provided and integrated into the synchronizing system to provide supervision of both the automatic and the manual synchronizing systems.

#### 16031.2.7 Control Panel

When specified on the Cylindrical Rotor Generators Specification Sheets, the Seller shall provide a completely enclosed free-standing sheet metal control panel for each generator. The panel shall contain all the devices listed on the Cylindrical Rotor Generators Specification Sheets, including mounting and wiring of the devices to terminal blocks.



Control switches shall be of the rotary operated type with enclosed silver-plated to silver-plated contacts, and be provided with easily removable protective covers. Switches not arranged for spring return shall be provided with a positive means for maintaining contact position. Handles of different shapes shall be provided as an aid in switch identification. Control switches for electrically operated circuit breakers shall be of spring-return type, with pistol grip handles and separate targets to indicate the after-trip and after-close positions. Control switch slip contacts shall be provided as required.

Meters shall have enclosed cases finished in dull black and shall be of the flush or semiflush mounting type. All resistors, reactors, autotransformers, insulating current and potential transformers, and other auxiliaries required to complete the metering equipment shall be furnished.

The Seller may provide the functionality described for the generator control panel via either a hardwired control panel or a turbine-generator control system.

## 16031.2.8 Not Used.

## 16031.2.9 Bearing Vibration Monitoring System

The Seller shall provide a complete bearing vibration monitoring system for each generator and collector bearing. The system shall be fully compatible and integrated with the bearing vibration monitoring system provided with the prime mover and shall include a key phasor for diagnostics. The probes for this system shall be installed 90 degrees apart (XY) at the same longitudinal location along the shaft for each bearing.

## 16031.2.10 Power System Stabilizer

Where a power system stabilizer is specified to be provided on the Cylindrical Rotor Generators Specification Sheets, a power system stabilizer shall be provided in accordance with the requirements of the Buyer and any governing authorities. The Seller shall be responsible for initial setup (including any and all calculations necessary to support proposed settings to the Buyer and any governing authorities) and all onsite commissioning and tuning activities related to the power system stabilizer.

#### 16031.2.11 Shop Tests

All equipment and components supplied by the Seller shall be factory tested in accordance with the manufacturer's standard methods and procedures as necessary to ensure high quality materials and equipment, reliable and safe operation, and long life. Notwithstanding the previous statement, the following tests, as a minimum, shall be conducted.

The generator mechanical tests shall be in accordance with the manufacturer's standard methods and applicable standards and shall include, as a minimum, the following:

- 1. Rotor overspeed at 120 percent of rated speed.
- 2. Rotor mechanical static and dynamic balancing.
- 3. Mechanical inspection.
- 4. Air leakage test. The generator frame shall be air tested at 1.25 times the operating pressure (for hydrogen cooled stators only).
- 5. Flow continuity (for water cooled stators only).

The generator electrical tests shall be in accordance with the manufacturer's standard methods and applicable standards and shall include, as a minimum, the following:

1. Stator core iron induction test at 1.0 Tesla or other stator core imperfection test subject to approval by the Buyer for verification of the absence of hot spots in the core iron stacking. This test shall be performed after completion of the stacking of the stator core.

- 2. Measurement of cold resistance of armature and field winding.
- 3. Insulation resistance measurement of armature and field winding.
- 4. Armature dielectric test.
- 5. Field dielectric test.
- 6. Calibration test for all temperature sensing elements. Manufacturer's calibration test reports are acceptable.

The power potential transformer tests shall be in accordance with the manufacturer's standard methods and applicable standards and shall include, as a minimum, the following:

- 1. DC resistance of transformer windings.
- 2. Polarity check of transformer windings.
- 3. Dielectric test of transformer windings.

The static excitation system tests shall be in accordance with the manufacturer's standard methods and applicable standards and shall include, as a minimum, the following:

- 1. Dielectric test of each inductor winding.
- 2. High potential test of all excitation circuits (excitation cubicle).
- 3. Rectifier voltage drop at reduced current.
- 4. Calibration test of all temperature sensing elements.
- 5. Operational check on all excitation system components.

The following tests shall be performed for thyristor rectifiers. It is understood that if the applied rectifier elements are not of new design, the type test will not be done:

- 1. Rectifier element:
  - i. DC block test (aging test).
  - ii. Characteristic test.
- 2. Thyristor rectifier assembly (cubicle). The following tests shall be performed as shop tests:
  - iii. Rated voltage test.
  - iv. Rated current test.
  - v. Temperature rise test (type test, only for the first unit).

The generator hydrostatic tests shall be in accordance with the manufacturer's standard methods and applicable standards and shall include, as a minimum, the following:



- 1. Components other than piping, whose operating pressure is more than 15 psig, shall be hydrostatically pressure tested at a minimum of 1.5 times the operating pressure held for a minimum of 30 minutes.
- 2. Equipment hydrostatically tested in the shop by the manufacturer shall be completely drained and blown dry prior to shipment to ensure against damage from freezing and corrosion. When such drainage requires the removal of the plugs, drain valves, water box covers, etc., the manufacturer shall assure that these parts are properly reinserted or reassembled prior to shipment.



## **Cylindrical Rotor Generators Specification Sheet**

Equipment Description						
Global unit definition			English			
Applicable standard			ANSI C50 / NEMA MG1			
Rated voltage			13.8 kV			
Prime mover				Combustion Turbine		
Connection to prime m	over			By Seller		
Rated frequency				60 Hz		
Rated speed				3600 or 1800		
Generator rated M∨A				Equal to or larger than the turbine shaft MW output, at the maximum lagging power factor under all operating conditions.		
Power factor leading				90%		
Power factor lagging				85%		
Short-circuit ratio				Mfg. standard		
Minimum subtransient	reactance (X	"dv in perc	ent)	By Sell	er	
Generator location				Indoor		
Location of auxiliary sk	ids			Indoor		
Nameplate voltage of d	lc motors (vo	lts)		120		
Generator MVA/Volta Operation	ge/Frequend	cy Relation	iship	at Gene	rator Rated Power	Factor for Continuous
Relationship at	MVA (Perc Rated)	ent of	Free (Per of R	quency cent ated)	Maximum Voltage (Percent of Rated	e Minimum Voltage ) (Percent of Rated)
Minimum frequency	98		98		103	95
Rated frequency	100		100		105	95
Maximum frequency	100 102		102		105	97
Current Transformers	;					
			Accuracy Class			
Application			ANSI C57.13 IEC 185		IEC 185	
Relaying			C400		N/A	
Metering			0.3B-1	.8	N/A	
Location Quantity		Secon Rating	dary Current	Laboratory Calibration Required		
Line side relaying CTs	Line side relaying CTs 3 sets of 3		5 Amp	ere	Yes	
Line side metering CTs 0		N/A		N/A		
Neutral side relaying C	Neutral side relaying CTs 4 sets of 3		3	5 Ampere Yes		

Neutral side metering CTs	0	N/A	N/A
Neutral grounding register	0		
assembly	2	5 Ampere	Yes
Generator Neutral Grounding		I	
Generator Neutral			
Generator Neutral Conducting Syst	em	Mfg. standard	
Generator Neutral Conducting Syst	em provided by	Seller	
Generator Neutral Grounding Assembly			
Location of neutral grounding asser	mbly	Next to Generator	
Neutral grounding assembly furnish	ied by	Seller	
Neutral isolation switch furnished by	у	Seller	
Neutral grounding transformer high voltage winding, Basic Lightning Impulse Insulation Level (BIL)		N/A	
Neutral grounding transformer low	voltage rating	N/A	
Phase-to-ground maximum fault current for sizing of the neutral grounding equipment		400A	
Phase-to-ground fault current duration for sizing of the neutral grounding equipment		10 sec	
Generator Cooling			
Generator Cooling System		Mfg. standard	
Altitude (ft.)		Less than 3300 ft (1000 m)	)
Minimum generator output with one cooler section out of service		66% of rated generator MVA	
Alternatives for generator cooling will be considered		Yes	
Heat Exchanger			
Tube material		Mfg. standard	
Tubesheet material		Mfg. standard	
Channel and cover material		Mfg. standard	
Miscellaneous Ratings/Options		•	
Generator line terminal conductor system		Cable	
Generator terminal enclosure		By Seller	
Number of stator RTDs per phase		4	
Seller to provide generator core mo	nitor?	Mfg. standard	
Vibration monitoring system		Bently Nevada 3300 or Acceptable Equal	
Scope of protective relay settings provided by Seller		All protective functions	

Out-of-step (78 function) required?	Yes
Surge protection and VT equipment provided by Seller	No
High inertia rotor required	Seller to provide option pricing for providing high inertia rotor
Excitation System	
Excitation Type	Mfg. standard
Response Ratio (p.u. minimum)	Mfg. standard
Ceiling voltage (percent minimum)	150%
Rotating ac exciter - brushless	
Normal power source to exciter field	Mfg. standard
Static excitation system	
Configuration	Potential source - rectifier exciter
Collector conductor system	Cable and raceway
Collector conductor system provided by	Seller
Power potential transformer	
Power potential transformer location	Indoor
Power potential transformer power source	Buyer's medium voltage switchgear
Connection to power potential transformer	By Buyer
Voltage Regulator	
High initial response	Yes
Capable of isochronous operation	Yes
Power system stabilizer	
Seller to provide power system stabilizer	Yes
Special requirements for power system stabilizer	None
Generator/Exciter controls and monitoring	
Operator interface local to machine	Mfg. standard
Operator interface remote from machine	Buyer DCS
Synchronizing Scheme	
Scope	Manual and automatic synchronizing capabilities and all associated equipment furnished by Seller
Operator interface local to machine	Mfg. standard
Operator interface remote from machine	Manual from Control Panel; Automatic from LCD
Features	

Automatic Synchronizing Relay with automatic matching speed and voltage features

Source: 16031, 2016, v2.2

Field-selectable provision to permit synchronization only when the generator is "fast" with respect to the grid	Yes
Synchronizing Check Relay	Yes
Manual deadbus closure	Yes
Generator breaker synchronizing and status with rotating vectors	Yes
Second line/breaker synchronizing and status with static vectors	Yes
Synchroscope	Yes
Generator and bus voltage display	Yes
Generator and bus frequency display	Yes
"OFF, MANUAL, AUTO" Switch	Yes
"Raise/Lower" Generator Voltage Switch	Yes
"Raise/Lower" Speed Switch	Yes
Breaker "Close/Trip" Switch	Yes
Automatic Speed Matching "ON/OFF" Switch	Yes
Automatic Voltage Matching "ON/OFF" Switch	Yes
Slip Rate Set Point	Yes
Adjustable circuit breaker advance closing time	Yes
Adjustable upper and lower voltage limits with indication of high or low values	Yes
Adjustable set points for difference of voltage and frequency of two sources being synchronized	Yes
Adjustable set points for difference of voltage and frequency of two sources being synchronized Generator Control Panel	Yes
Adjustable set points for difference of voltage and frequency of two sources being synchronized  Generator Control Panel Seller to provide generator control panel?	Yes Yes
Adjustable set points for difference of voltage and frequency of two sources being synchronized Generator Control Panel Seller to provide generator control panel? Transducer output	Yes Yes 4-20 mA
Adjustable set points for difference of voltage and frequency of two sources being synchronized Generator Control Panel Seller to provide generator control panel? Transducer output The following shall be included on generator control panel:	Yes Yes 4-20 mA
Adjustable set points for difference of voltage and frequency of two sources being synchronized         Generator Control Panel         Seller to provide generator control panel?         Transducer output         The following shall be included on generator control panel:         Automatic voltage regulator adjuster control switch with position indicating meter	Yes Yes 4-20 mA Yes
Adjustable set points for difference of voltage and frequency of two sources being synchronized         Generator Control Panel         Seller to provide generator control panel?         Transducer output         The following shall be included on generator control panel:         Automatic voltage regulator adjuster control switch with position indicating meter         Manual voltage regulator adjuster control switch with position indicating meter	Yes Yes 4-20 mA Yes Yes
Adjustable set points for difference of voltage and frequency of two sources being synchronized         Generator Control Panel         Seller to provide generator control panel?         Transducer output         The following shall be included on generator control panel:         Automatic voltage regulator adjuster control switch with position indicating meter         Manual voltage regulator adjuster control switch with position indicating meter         Automatic/manual voltage regulator transfer switch with indicating lights	Yes Yes 4-20 mA Yes Yes Yes
Adjustable set points for difference of voltage and frequency of two sources being synchronized         Generator Control Panel         Seller to provide generator control panel?         Transducer output         The following shall be included on generator control panel:         Automatic voltage regulator adjuster control switch with position indicating meter         Manual voltage regulator adjuster control switch with position indicating meter         Automatic/manual voltage regulator transfer switch with indicating lights         Close/trip control switch for ac excitation input power circuit breaker with red, green, and amber indicating lights	Yes Yes 4-20 mA Yes Yes Yes Yes
Adjustable set points for difference of voltage and frequency of two sources being synchronized Generator Control Panel Seller to provide generator control panel? Transducer output The following shall be included on generator control panel: Automatic voltage regulator adjuster control switch with position indicating meter Manual voltage regulator adjuster control switch with position indicating meter Automatic/manual voltage regulator transfer switch with indicating lights Close/trip control switch for ac excitation input power circuit breaker with red, green, and amber indicating lights Field flashing control switch with indicating lights	Yes Yes 4-20 mA Yes Yes Yes Yes Yes
Adjustable set points for difference of voltage and frequency of two sources being synchronized         Generator Control Panel         Seller to provide generator control panel?         Transducer output         The following shall be included on generator control panel:         Automatic voltage regulator adjuster control switch with position indicating meter         Manual voltage regulator adjuster control switch with position indicating meter         Automatic/manual voltage regulator transfer switch with indicating lights         Close/trip control switch for ac excitation input power circuit breaker with red, green, and amber indicating lights         Field flashing control switch with indicating lights         Voltmeter for generator field voltage, 1 % accuracy class, approx. 100 mm (4 in.)	Yes Yes 4-20 mA Yes Yes Yes Yes Yes Yes
Adjustable set points for difference of voltage and frequency of two sources being synchronized         Generator Control Panel         Seller to provide generator control panel?         Transducer output         The following shall be included on generator control panel:         Automatic voltage regulator adjuster control switch with position indicating meter         Manual voltage regulator adjuster control switch with position indicating meter         Automatic/manual voltage regulator transfer switch with indicating lights         Close/trip control switch for ac excitation input power circuit breaker with red, green, and amber indicating lights         Field flashing control switch with indicating lights         Voltmeter for generator field voltage, 1 % accuracy class, approx. 100 mm (4 in.)         Ammeter for generator field amperes, 1 % accuracy class, approx. 100 mm (4 in.)	Yes Yes 4-20 mA Yes Yes Yes Yes Yes Yes Yes
Adjustable set points for difference of voltage and frequency of two sources being synchronized         Generator Control Panel         Seller to provide generator control panel?         Transducer output         The following shall be included on generator control panel:         Automatic voltage regulator adjuster control switch with position indicating meter         Manual voltage regulator adjuster control switch with position indicating meter         Automatic/manual voltage regulator transfer switch with indicating lights         Close/trip control switch for ac excitation input power circuit breaker with red, green, and amber indicating lights         Field flashing control switch with indicating lights         Voltmeter for generator field voltage, 1 % accuracy class, approx. 100 mm (4 in.)         Armeter for generator field amperes, 1 % accuracy class, approx. 100 mm (4 in.)         Transfer meter (zero center) to indicate transfer between the automatic and manual voltage regulators, 1 % accuracy class, approx. 100 mm (4 in.)	Yes Yes 4-20 mA Yes Yes Yes Yes Yes Yes Yes Yes
Adjustable set points for difference of voltage and frequency of two sources being synchronized         Generator Control Panel         Seller to provide generator control panel?         Transducer output         The following shall be included on generator control panel:         Automatic voltage regulator adjuster control switch with position indicating meter         Manual voltage regulator adjuster control switch with position indicating meter         Automatic/manual voltage regulator transfer switch with indicating lights         Close/trip control switch for ac excitation input power circuit breaker with red, green, and amber indicating lights         Field flashing control switch with indicating lights         Voltmeter for generator field voltage, 1 % accuracy class, approx. 100 mm (4 in.)         Armeter for generator field amperes, 1 % accuracy class, approx. 100 mm (4 in.)         Transfer meter (zero center) to indicate transfer between the automatic and manual voltage regulators, 1 % accuracy class, approx. 100 mm (4 in.)         Two frequency meters, 1 % accuracy class, approx. 100 mm (4 in.)	Yes Yes 4-20 mA Yes Yes Yes Yes Yes Yes Yes Yes Yes
Adjustable set points for difference of voltage and frequency of two sources being synchronized         Generator Control Panel         Seller to provide generator control panel?         Transducer output         The following shall be included on generator control panel:         Automatic voltage regulator adjuster control switch with position indicating meter         Manual voltage regulator adjuster control switch with position indicating meter         Automatic/manual voltage regulator transfer switch with indicating lights         Close/trip control switch for ac excitation input power circuit breaker with red, green, and amber indicating lights         Field flashing control switch with indicating lights         Voltmeter for generator field voltage, 1 % accuracy class, approx. 100 mm (4 in.)         Transfer meter (zero center) to indicate transfer between the automatic and manual voltage regulators, 1 % accuracy class, approx. 100 mm (4 in.)         Two frequency meters, 1 % accuracy class, approx. 100 mm (4 in.)         Synchroscope, 1 % accuracy class, approx. 230 mm (9 in.)	Yes Yes 4-20 mA Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes

Two voltmeters, incoming and running, 1% accuracy class, approx. 100 mm (4 in.)	Yes
Two synchronizing lights (clear)	Yes
Generator breaker close/trip control switch with red and green indicating lights (2 sets)	Yes
Two synchronizing switches with 10 electrically separate contacts in the "ON" position	Yes
Generator line disconnect switch close/trip control switch with red and green indicating lights	Yes
Manual/automatic synchronizing selector switch, maintained two-position, with five contacts in each position	Yes
Generator control unit (Beckwith M-0194 or equal)	Yes
Generator automatic synchronizer (Beckwith M-0193B or equal)	Yes
Two push buttons for raising and lowering the speed of the turbine	Yes
Annunciator, 11 points with one push-button module	Yes
Plastic mimic bus, one lot	No
Generator wattmeter, two element, 4 to 20 mA dc input, 1 % accuracy class, approx. 100 mm (4 in.)	Yes
Generator ammeter, 4 to 20 mA dc input, 1 % accuracy class, approx. 100 mm (4 in.)	Yes
Generator varmeter, two element, 4 to 12 to 20 mA dc input, 1 % accuracy class, approx. 100 mm (4 in.)	Yes
Generator voltmeter, 4 to 20 mA dc input, 1 % accuracy class, approx. 100 mm (4 in.)	Yes
Generator frequency meter, 4 to 20 mA dc input, 1 % accuracy class, approx. 100 mm (4 in.)	Yes
Generator power factor meter, 4 to 12 to 20 mA dc input, 1 $\%$ accuracy class, approx. 100 mm (4 in.)	Yes
Engraved phenolic nameplates - one lot consisting of one nameplate for each device and the panel	Yes
Terminal blocks - one lot	Yes
Fuse blocks and fuses - one lot	Yes
Ground bus with grounding connector	Yes
Incandescent light with switch	Yes

**Additional Requirements** 

Note that the Seller may provide the functionality described for the generator control panel via either a hardwired control panel or via a turbine-generator control system.

A power management system shall be provided to allow multiple generators to operate in parallel while in island mode. The generator load management scheme shall be implemented in the combustion turbine generator control system with a master electric control and load sharing combustion turbine generator control panel provided by the Seller. The power management system shall communicate with the distributed control system (DCS) to manually and automatically control all plant electrical system components. Each microprocessor-based protective relay and power quality meter used in the electrical system will be linked to the DCS for data collection, alarms, and power flow monitoring throughout the system. The DCS communicates open and close commands to the switchgear and motor control center (MCC) main and feeder breakers via a hard-wired and/or communication link. Specific interface with the DCS, whether via a hard-wired or communication link will be determined during detailed design. In



addition, the power management system shall monitor generator load and power usage. The measured electrical system parameters will be used to determine the power, frequency, power factor, and voltage setpoints for each generator in service and will be implemented through the combustion turbine control system. The power management system shall interface with the combustion turbine generator controls to monitor the generator controllers. The combustion turbine generator control system will facilitate load sharing and maintain suitable frequency and voltage under steady-state and transient conditions. The combustion turbine control system shall then increase generation or trip equipment for load shedding, as required, to maintain plant stability during transients. A load shedding scheme will be determined during detailed design. The power management system shall also record load trends and display the current conditions through an operator workstation(s).



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# **16051 - Electrical Design and Equipment**

## 16051.1 General

## 16051.1.1 Scope of Supply

This section includes design, performance, and technical requirements for Seller-furnished electrical equipment. The scope of supply shall include the following items:

- 1. Low voltage motor control assemblies.
- 2. Low voltage power distribution equipment, including the following:
  - i. Low voltage panelboards.
  - ii. Dry type transformers.

#### 16051.1.2 Not Used

#### 16051.1.3 Performance and Design Requirements

Performance and design requirements for the Seller-furnished electrical equipment are as required by Seller's design, as indicated in Article 16051.2, on the Electrical Design and Equipment Data Sheets included at the end of this section, and as follows:

Design ambient temperature	Per D200
Site elevation	Per D100

#### 16051.1.4 Codes and Standards

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

Work	In Accordance With	
All	The latest revisions of the applicable ANSI C37, NEMA ICS2, and UL standards	

#### 16051.1.5 Not Used

#### 16051.1.6 Not Used

#### 16051.1.7 Test Requirements

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

**Production Tests**. After the equipment is completely fabricated, it shall be tested at the factory in accordance with the applicable standards and the manufacturer's standard practices. The Buyer shall be



permitted to witness these tests. The production tests shall include the following minimum items in accordance with all applicable standards:

Tests	In Accordance With	Conducted By
Mechanical operation and interlocks	Applicable Standard	Seller
Motor Starter operation tests	Applicable Standard	Seller
Current transformer and voltage transformer ratio and polarity check	Applicable Standard	Seller
Overall fit and finish	Applicable Standard	Seller

#### 16051.1.8 Not Used

#### 16051.1.9 Supplemental Specifications

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

## 16051.2 Products

## 16051.2.1 Not Used

#### 16051.2.2 Not Used

## 16051.2.3 Low Voltage Motor Control Equipment

This technical specification is intended for procurement of low voltage motor controllers. The Seller shall provide a standard design for items within the scope of this specification, but not covered in detail by these specifications. The standard design shall be in accordance with accepted industry practices and standards for electrical power generation.

#### 16051.2.3.1 Not Used.

**16051.2.3.2 Low Voltage Motor Control Assemblies**. Low voltage control assemblies shall be in accordance with the standards specified and the general articles below and shall meet the requirements of the Seller's design.

**16051.2.3.2.1 Enclosures**. The motor control assemblies shall be furnished with enclosures of the types specified in the Supplemental Specifications in Section 21000 and as follows:

Location	Description of Enclosure Type	
Indoors	Indoor dustproof, NEMA 12	
Indoor Wet or Outdoors	Nonwalk-in weatherproof with filters, NEMA 4	
Wet-Chemical Corrosive	Corrosion Resistant, Type 4X	

Each assembly shall consist of motor controllers, main and tie breakers (as required), and feeder breakers mounted in vertical sections fabricated of steel and assembled to provide rigid self-supporting structures. Controllers and feeder breakers shall be mounted as individual units separated by grounded



steel barriers for other units and, where possible, shall be withdrawable from the front. Each controller or breaker unit shall be furnished with hinged front door(s). Each vertical section shall have a removable rear panel (except in the case of back-to-back construction).

**16051.2.3.2.1.1 Space heaters**. When located outdoors, each vertical section shall be furnished with space heaters to prevent condensation of moisture within the section. The heaters shall be located and thermally insulated so that no painted surface will be damaged or discolored.

Space heater capacity shall be as required to maintain the compartment and unit internal temperature above the dew point using the voltage specified. Space heaters shall be controlled by an adjustable thermostat or fixed humidistat.

**16051.2.3.2.1.2 Motor space heaters**. When motors controlled by the lineup have space heaters, the Seller shall furnish space heater power buses throughout the motor control lineup. All space heater wiring shall be integral to the lineup and have suitable branch circuit protection. Motor space heater circuits shall also include connections to controller auxiliary contacts and connections to terminal blocks for external connections.

**16051.2.3.2.1.3 Nameplates**. Engraved nameplates shall be furnished for the front and rear of each switchgear unit and for equipment and devices within each unit. Nameplates shall be in accordance with the requirements of the Supplemental Specifications in Section 21000.

**16051.2.3.2.2 Motor controllers**. Combination motor controllers shall be of standard drawout design (when possible) with the following features. Except where required by the Seller's design, single-speed, full voltage, nonreversing starters shall be used:

- Molded case circuit protectors (MCCP) for disconnecting power and magnetic-only short-circuit protection for high magnitude faults. The drawout function shall be disabled when the MCCP is closed.
- 2. When the manufacturer's design does not permit the starter unit to be drawout type because of size limitations, a fused, load-break, disconnect device shall be provided in lieu of an MCCP. The fuses shall be disconnected from the power source when the switch is open. Single phasing protection shall be provided.
- 3. Bimetallic or solid-state, 3-phase, ambient compensated, overload devices provide suitable overload protection for the motors.
- 4. Auxiliary relays as required for the Seller's design.
- 5. Interposing relays as required by the Seller's DCS.
- 6. Control power transformers (with primary and secondary fuses, 100 VA minimum).

**16051.2.3.2.3 Main and tie breakers**. Main and tie circuit breakers, when furnished in motor control centers, shall be fixed mounted, molded case design. Means to coordinate instantaneous (and ground fault for solidly grounded systems) tripping functions of feeder breakers and MCCPs with main and tie breakers shall be provided. All current ratings shall be at least 10 percent greater than the values required by the design. Voltage ratings shall be in accordance with the indicated industry standards for the nominal system voltage utilized.

**16051.2.3.2.4 Feeder breakers**. Feeder circuit breakers, when furnished in motor control centers, shall be molded case design and shall be withdrawable when available. All current ratings shall be at least 10 percent greater than the values required by the design. Voltage ratings shall be in accordance with the indicated industry standards for the nominal system voltage utilized.



**16051.2.3.2.5 Power and control conductors**. MCC power and control conductors shall be furnished in accordance with the requirements of the articles which follow. Provisions shall be made for bus expansion, to prevent undesirable or destructive mechanical strains in the bus supports and connections, through a full ambient temperature range per D200. Expansion joints shall be furnished where required.

**16051.2.3.2.6 Main bus**. The MCC main bus shall be copper bar, designed to continuously carry the current required by the Seller's design plus a 25 percent margin without exceeding temperature rise requirements specified in the applicable standards.

The bus shall be installed with rigid, nontracking, fire-resistant, and nonhygroscopic insulating supports capable of withstanding the mechanical forces imposed by short-circuit currents equal to the close and latch and short-time current ratings as specified.

All joints shall have silver- or tin-plated contact surfaces with minimum contact resistance.

**16051.2.3.2.7 Ground (earthing) bus**. An uninsulated copper ground bus with a momentary rating at least equal to the momentary rating of the circuit breakers shall be furnished through the entire length of the switchgear. All switchgear equipment requiring grounding shall be connected to this ground bus.

**16051.2.3.2.8 External connections**. Facilities for the entrance, support, termination, and connection of power and control conductors shall be furnished in accordance with the requirements of the following articles.

**16051.2.3.2.8.1 Entrance**. Adequate openings shall be furnished for all conductors (metal-enclosed bus duct, power cables, and control cables, as required) entering the equipment.

**16051.2.3.2.8.2 Terminal connectors**. Terminal connectors for power cable and ground (earthing) cable entering the switchgear shall be long barrel, 2-hole, bolted clamp or compression type. Solder type terminals are not acceptable.

## 16051.2.3.2.8.3 Not Used. .

**16051.2.3.2.8.4 Ground (earthing)**. Connectors shall be furnished at each end of the assembly ground bus for connection of cables from the station ground grid.

Each unit designed for connection of metal-enclosed bus duct shall have provisions for connecting the bus duct ground bus to the assembly ground bus and/or bonding the bus duct enclosure to the ground system.

**16051.2.3.2.9 Instrument transformers, instruments, and associated devices**. Instrument transformers, instruments, and associated devices shall be furnished as required by the Seller's design. All instrument transformer secondary leads shall be wired out to terminal blocks.

**16051.2.3.2.9.1 Current transformers**. Current transformer mechanical and thermal limits shall be coordinated with the momentary and short-time ratings of the circuit breakers with which they are used.

**16051.2.3.2.9.2 Voltage transformers**. Voltage transformers shall be capable of withstanding a secondary short circuit for not less than 1 second and shall be mounted and have secondary voltage, capacity, accuracy, and other ratings as required by the Seller's design.

Each transformer shall be provided with current limiting primary fuses and secondary fuses.

Auxiliary relays mounted internally shall be surface mounted and front connected and shall be as specified in the Supplemental Specifications in Section 21000.



**16051.2.3.2.9.3 Control and instrument switches**. Control and instrument switches shall be in accordance with the requirements of the Supplemental Specifications in Section 21000.

**16051.2.3.2.10 Wiring and wiring diagrams**. The Seller shall furnish internal switchgear and motor control assembly wiring, connections, and diagrams in accordance with the requirements of the following articles.

**16051.2.3.2.11 Control and instrument wiring**. All low voltage control and instrument wiring shall be installed and tested at the factory.

All interior wiring shall be neatly and carefully installed in wiring gutters or conduit and shall be terminated at terminal blocks plainly lettered or marked in accordance with the Seller's connection diagrams. Extra flexible wire shall be furnished at hinge points.

Switchgear units that are split for shipment shall be furnished with all wiring required to interconnect the switchgear units.

**16051.2.3.2.12 Diagrams**. Wiring diagrams shall be in accordance with the requirements specified herein.

**16051.2.3.2.12.1 Diagrams for equipment within the Seller's scope of supply**. The complete connection diagram of each unit shall be on an individual sheet. Information on each connection diagram sheet shall include point-to-point wiring of the entire unit as it would appear to a person wiring the switchgear unit, including wiring on the breaker itself. Elementary diagrams of control and instrument circuits, contact arrangement of switches, and internal wiring of relays and instruments for each switchgear unit shall be on additional sheets as required. Interconnection diagrams shall be on separate sheets. All sheets shall be the same size.

Each item indicated on the diagrams shall be identified by item number and name.

Sufficient space shall be left on the customer's side of outgoing terminal blocks for adding cable color codes and circuit numbers.

#### 16051.2.3.2.12.2 Not Used

#### 16051.2.4 Low Voltage Power Distribution Equipment

When specified to be in the Seller's scope of supply, the Seller shall supply low voltage power distribution equipment in accordance with the articles below and as required by the Seller's design. The design shall be in accordance with accepted industry practices and standards for electrical power generation.

**16051.2.4.1** Low Voltage Panelboards. Low voltage power panelboards shall be furnished in accordance with the following articles.

**16051.2.4.1.1 Enclosures**. Panelboards shall be furnished with enclosures of the types specified in the Supplemental Specifications in Section 21000 and as follows:

Location	Description of Enclosure Type	
Indoors	Indoor dustproof enclosure, NEMA 12	
Indoor Wet or Outdoors	Washdown/dustproof, NEMA 4	
Wet-Chemical Corrosive	Corrosion Resistant, Type 4X	
Hazardous	Listed for conditions present	



**16051.2.4.1.2 Busing**. Main, neutral, and ground busing shall be copper. Voltage and current ratings shall be standard ratings defined in the applicable standards required to meet the requirements of the Seller's design. Minimum ratings defined in the Supplemental Specifications in Section 21000 shall apply.

**16051.2.4.1.3 Circuit breakers**. Main breakers shall be provided in all panelboards . Main and feeder breakers shall be molded case, bolt-in type. Voltage and current ratings shall be standard ratings defined in the applicable standards required to meet the requirements of the Seller's design. Breakers and busing shall be individually rated and labeled for the required short-circuit amperes available. Tandem or miniature circuit breakers shall not be used. Minimum ratings defined in the Supplemental Specifications in Section 21000 shall apply.

**16051.2.4.1.4 Spares**. Total expected load on each panelboard or switchboard shall not exceed 80 percent of its continuous current rating. At least one spare feeder breaker of each size and number of poles used for loads shall be provided in each panelboard. At least six poles of spare space shall be provided in each panelboard.

**16051.2.4.2 Dry Type Distribution Transformers**. Dry type distribution transformers shall be used indoors in dry areas only and shall meet the following requirements:

- 1. Shall have copper windings rated for 302° F temperature (by resistance) rise above 104° F ambient.
- 2. Shall be sized to approximately match the nominal ampacity of the panelboard or switchboard which is connected to its secondary terminals.
- 3. Sound level shall not exceed 45 dBA when measured in accordance with NEMA standards.
- 4. When installed in areas where dirt and dust are present, shall have filters installed on vent openings or shall be nonventilated.
- 5. Shall be appropriately derated when the ambient temperature exceeds 104° F.

**16051.2.4.3** Nameplates. Engraved nameplates shall be furnished for the front of each item of equipment. Nameplates shall be in accordance with the requirements of the Supplemental Specifications in Section 21000.

Low Voltage Motor Control Centers		
Single power supply to assembly provided by Buyer	120 VAC	
Motor control center enclosure type	Indoor, gasketed	
Low Voltage Panelboards and Switchboards		
Enclosure type	Indoors with gasketed cover, ventilated	

## **Electrical Design and Equipment Data Sheets**



# 16093 – Medium Voltage Variable Frequency Drives Datasheets

General					
1	Equipment Tag	Equipment Description			
2	LATER	Each Fuel Gas Compresso with a VFD. Exact equipme provided at a later date.	or listed in section 15220 shall be supplied ent tag and equipment description will be		
3	Site Conditions				
4	Per Section D100 & D200				
5	Applicable Standards				
6	Standards for MV VFD		IEEE 1566		
System Requirements					
7	System Voltage		4160 V		
8	System Voltage Tolerance		+/- 10%		
9	Rated normal power frequency withstand voltage (kV, rms)		11.36kV min		
10	Rated Basic Impulse Level (BIL)/lightning impulse withstand voltage (kV, peak)		60 kV		
11	System Frequency		60Hz		
12	System Frequency Tolerance		+/- 5%		
13	Required Input Power Factor		85%		
14	System Short Circuit Current (kA)		15kA		
15	Control Power Transformer		Yes, 120V 60Hz Secondary		
	Load Details				
16	Torque Profile		Variable		
17	Application		Compressor		
18	Area Classification		N/A		
	Motor Details				
19	Motor Type		Determined by Seller		
20	Rated kW		Determined by Seller		
21	Rated Speed		Determined by Seller		
22	Short Term Overload Duty		Determined by Seller		
23	Breakaway Torque		Determined by Seller		
24	Cable length from VFD to Motor		less than 600 ft		

VFD Details				
25	Enclosure type	NEMA 1G		
26	Enclosure paint	Manufacturer's Standard		
27	Cooling method	Air cooled		
28	Input impedance device	Isolation transformer		
29	Isolation transformer (If applicable)	Dry type		
30	Load side filter required	Yes		
---	--	--	--	
31	Converter design	18 pulse		
32	Inverter Type	Manufacturer Standard		
33	Switching device for inverter	Select		
34	Drive Bypass	No		
35	VFD system Efficiency	Manufacturer Standard		
36	Noise Level	Manufacturer Standard		
37	Stand Alone / Integrated	Stand Alone		
38	Power Cable Entry	Top and Bottom		
39	Control Cable Entry	Тор		
40	Externally Operable Disconnect Switch	Yes		
41	Grounding Switch	Yes		
42	Space Heater	Yes		
43	Minimum Digital Inputs Required	4 (actual number of inputs determined by Seller)		
44	Minimum Digital Outputs Required	8		
45	Minimum Analog Inputs Required	2		
46	Minimum Analog Outputs Required	2		
47	Speed control range (rpm)	0 -1800		
48	Control Mode	v/f control		
49	Operation Quadrant	1 Quadrant		
50	Operation Mode	Local and Remote		
51	Acceleration time (s)	As Required		
52	Deceleration time (s)	As Required		
53	Communication protocol	Remote I/O		
54	Digital Motor Protection Relay Required	Yes		
55	Ground Fault Protection	Yes		
56	Conformal Coating of Circuit Boards	Yes		
Testi	ng Requirements			
57	<b>Production Tests</b> – Shall be performed in accordance with:	IEEE 1566		
58	<b>Design Tests</b> – Seller shall submit Certified Design Test Report in accordance with relevant standard	Yes		
59	Witness Testing – any or all Production Tests (Buyer's choice)	Yes		
60	Field Testing by:	Buyer		
Addit	ional Requirements			
61 The VFD shall be factory pre-assembled, wired and tested as a complete package by the Seller. The design of each VFD shall be coordinated with the driven equipment. The Seller shall be responsible for furnishing each VFD system matching the motor and the drive and for the design effort to limit the harmonics to the specified levels. Each VFD system shall be capable of operating any standard ac motor with an equivalent rating over the specified speed range. The VFD shall be designed for a				

	minimum life expectancy of 20 years per the requirements in IEEE 1566.
62	Each VFD shall produce an adjustable ac voltage/frequency output and shall be equipped with an output voltage regulator to maintain correct output volts/hertz, regardless of incoming voltage variations. Each VFD shall be of sufficient capacity and shall produce a quality output waveform for step-less motor control from 10 to 100 percent of base speed. To facilitate checkout and maintenance, each VFD shall be capable of sustained operation at the minimum speed (10% of base speed). In addition, each VFD system shall be capable of operation while disconnected from the associated motor. Personnel shall have access to the low voltage compartment, with the VFD energized, without being exposed to any medium voltage.
63	(Line 13) The VFD shall be capable of maintaining required true power factor (Displacement P.F. X Distortion P.F.) at input side at 60-100% load.
64	Guaranteed minimum total VFD system efficiency shall include the input transformer, harmonic filter and power factor correction (if applicable), VFD converter, and output filter, and shall be calculated as follows.
	System Efficiency = Converter/Inverter Efficiency x Input Transformer Efficiency x Power Factor Correction Efficiency x Input Harmonic Filter Efficiency x Output Harmonic Filter Efficiency
	System efficiency shall be submitted as part of the Seller's proposal.
	Auxiliary controls, such as internal VFD control boards, cooling fans, or pumps shall be included in all loss calculations.
	The VFD system total efficiency shall be verified during the startup.
65	Each VFD shall comply with the latest edition of IEEE 519 for total harmonic voltage and current distortion.
	Individual or simultaneous operation of the VFDs shall not add more than 2.5 percent total harmonic voltage distortion while operating from the utility source.
	Maximum allowable total harmonic current distortion limits for each VFD shall not exceed 5 percent as calculated and measured at the point of common coupling (PCC).
	The variable frequency drive shall provide near sinusoidal voltage and current wave forms to the motor at all speeds and loads. Output current THD shall be less than 5%. Standard induction or synchronous motors shall not require de-rating or upgraded turn-to-turn insulation and shall not require additional service factor.
	Seller shall carry out a harmonic study. The Proposer shall submit the harmonic study with the proposal and it shall include all voltage and current harmonics up to the 99th.
66	If an output filter is required to mitigate reflected waves, or to meet any special requirements of the application, it must be integral to the VFD controller. The VFDs shall be suitable for two successive starts with the VFDs already at full load working temperature; with the motor coasting to rest between successive starts.
67	(Line 29) Input Isolation Transformer
	If the Seller's standard design provides a <b>dry type indoor transformer</b> , the transformer design shall be a rectifier grade isolation type. Transformer design shall be an epoxy sealed (VPE – vapor pressure impregnated and encapsulated) dry type construction, 3- phase, mounted on a ventilated enclosure suitable for mounting indoors. Each of them shall have copper windings with class H 220° C insulation. Transformer shall be rated with an average rise temperature not to exceed 80° C at full nameplate rating above 30 °C average, 40 °C maximum ambient.
68	(Line 29) Input Isolation Transformer
	If the Seller's standard design provides a <b>liquid insulated transformer</b> , the transformer shall be of sealed tank construction. The average winding temperature rise above ambient temperature shall not exceed 65 °C. Transformer shall be provided with accessories including but not limited to magnetic liquid level gauge and oil and winding temperature alarm contacts, Top oil thermometer gauge. The

	transformer shall be suitable for outdoor installation.
69	(Line 29) Input isolation transformer shall be supplied with electrostatic shield, electronic temperature monitoring with alarm and trip contracts, auxiliary terminal box, distribution class surge arrester, and vibration dampers.
	Transformers shall have a BIL rating in accordance with the requirements of ANSI/IEEE C57.12.01 OR IEC 60076 Standard.
70	(Line 31) Converter
	The maximum voltage (crest voltage plus spike) supplied by the converter to the motor shall be < 2 times the crest value of the rated motor voltage. The voltage spikes of current source converters shall not exceed the crest value of the motor voltage and for voltage source converters the nominal rms. value of the motor voltage.
71	(Line 32) Inverter
	The inverter output with filter shall provide a sine wave with less than 3% total harmonic current distortion.
72	Enclosure
	VFD enclosures for air-cooled VFDs shall be NEMA 1G (IEC IP21). Liquid cooled drives shall be NEMA 12 (IP42) with forced ventilation and filters. Door vents shall consist of louver panel assemblies that can be removed from the front in order to replace air filters. Safety screens shall be located behind each louver panel. Cabinets and doors shall be fabricated using minimum 12 gauge (2.64 mm thick) steel for sturdy construction. All doors shall be gasketed to provide environmental protection and secure fits.
	The floor system (floor plate and intermediate support members attached to the base) shall be designed to support the loads specified. The enclosure shall be provided with channel sills for securing to the floor. The enclosure shall have lifting eyes.
73	Cable Termination, Bus Bar
	Input and output power connections shall be made to isolated, supported, and plated bus strap connections. Sufficient space shall be provided for termination connections from the top or the bottom of each VFD cubicle. Space provisions shall be provided for application of standard stress cones, and provisions shall be provided for grounding of shielded cabling. All bus bars shall be copper, braced for the fault level at the particular location. They shall be
	protected against corrosion in the specified atmosphere. The bus bars shall be of sufficient size to carry the stated ampacity without exceeding a 65 °C temperature rise based on a 40 °C ambient temperature. Bus shall be appropriately sized for the VFD continuous current rating and braced to withstand the mechanical forces caused by a momentary short-circuit current as specified. All connections shall be bolted or continuously welded.
74	Grounding & Bonding
	Metallic enclosures shall have provision for permanently connected grounding. All metal parts that may become energized shall be permanently and effectively grounded. Corrosion resistant grounding pads shall be provided in each power cubicle. A copper ground bus shall be provided for grounding of control circuits. Hinged covers of doors containing electrical components shall be grounded using a separate strap or ground wire installed across the hinge to the main support frame. The earth connectors shall be suitable for termination of up to #4/0 AWG copper ground conductor.
75	(Line 27) Air cooling
	When specified Air-cooled VFD systems shall be furnished with redundant cooling. One set of fans shall be capable of supplying 100% of the needed cooling for a section. Failure of a single fan shall operate an alarm without shutting down the drive; failure of a second fan shall shut down the drive. Fans shall automatically switch from main to back-up every 30 days without causing a shutdown. Air filters shall be used and shall be easily replaceable while the drive is operating. The heat load of the drive at 100% output shall be specified by the vendor at the proposal stage.
	The VFD system shall have the ability to detect a cooling system failure. The use of temperature detectors as the only means of detecting a cooling system failure is not acceptable.
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	Refer to section D200 for design ambient temperatures and HVAC criteria.
76	Operator Interface
	The door of each power unit shall include the following minimum control devices:
	Manual speed control, a mode selector marked "Manual/Automatic," Start push button, Stop push
	button, Reset push button. Emergency stop (local and remote) pushbutton, Emergency Bypass
	pushbutton, and Local/Remote control switch
	Following minimum indications shall be available
	a "CONTROL POWER AVAILABLE" light, a VFD "FAULT" light, a VFD "RUNNING" light, 'READY To
	START, EMERGENCY BYPASS, OVERLOAD, OVER TEMPERATURER
77	The VFD display shall be capable of displaying the following monitoring functions as a minimum:
	1. Output frequency
	2. Frequency reference
	3. Motor speed
	4. Motor current
	5. Motor torque
	6 Motor power
	7 Motor voltage
	8 DC bus voltage
	0. Unit temperature
	9. Onli temperature
	10. Calculated motor temperature
	11. Voltage level of analog input
	12. Current level of analog input
	13. Digital inputs status
	14. Digital and relay outputs status
	15. Analog output
78	All trip and start commands shall be hardwired unless otherwise specified.
79	Each VFD system shall be capable of direct communication to a PC for serial link setup of
	parameters, fault diagnostics, trending, and diagnostic log downloading. An RS-485 port shall be door
	mounted for computer or printer interface. VFD parameters, fault log, and diagnostic log shall be
	downloadable for hard copy printout via the RS-465 port and a standard senai printer.
80	The AC Drives Seller shall have Windows based PC software available for monitoring and controlling
	the AC Drives, and the software shall be onered as an option. The software shall be supplied with the necessary hardware and a provision for connecting a PC with the AC Drives. It shall be possible to set
	and modify parameters, control the drive, read actual values, and display and configure the
	oscilloscope function of the AC Drive.
	Drive control software shall allow the selection of the following features:
	Starting Mode
	The variable frequency drive shall offer two starting modes.
	1. S-Curve profile shall consist of both nonlinear and linear portions.
	2. Ramp Mode shall have programmable acceleration and deceleration times.
	Stopping Mode
	The variable frequency drive shall have three stop modes.
	1. Ramp Mode
	2. Coast Mode
	3. Regenerative Breaking Mode
	Auto-Restart Capability
	The VFD shall be capable of automatically restarting in the event of a momentary loss of power, or a
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	clearing of a drive trip. An automatic restart delay parameter shall be available in the drive with an adjustment range of 0 -10 seconds. For safety reasons, the maximum number of attempts shall be within a selectable time. If the fault does not clear after the attempts, the drive shall lock out <b>Skip Speeds</b> The variable frequency drive shall have a minimum of three (3) skip speeds. The skip speeds shall be programmable between 1.0 and 75.0 Hz. The skip speeds shall have a programmable band width between 0.0 and 5.0 Hz. <b>Ride Through</b> The VFD shall be capable of riding through a loss of power of 5 cycles. The VFD system shall be capable of operating with 30% voltage sag on the input power line. The motor shall not be allowed to reach a pull out condition. <b>Load Loss Detection</b>
	The drive shall have a parameter to specify the response of the drive to a loss of load condition.
	The parameter shall have the following configuration options: disabled, warning or fault.
	Flying start
	The drive shall have a built-in Flying Start feature. This feature will allow a Motor unit which is still rotating, to be restarted without first stopping it. The AC Drive shall restart the motor from the rotating speed and then reaccelerate to the speed indicated by the speed reference signal.
81	Protection:
	Each VFD system shall include following minimum protection for the drive motor and the integral components:
	Line side: Outage (loss of phase), Line overvoltage/under-voltage, Line voltage unbalance, Over- current, Overload, voltage surge
	<b>Transformer side</b> : Buckholz relay(oil type only), over temperature, loss of cooling media, low oil level (oil type only), short circuit, earth fault
	<b>Converter side</b> : Overcurrent(commutation failure, short circuit), overvoltage, overload(thermal), ground fault, loss of cooling, over temperature, loss of auxiliary supply, loss of communication to process control, loss of speed feedback, switching fault, Gate driver power supply under/over voltage <b>DC bus</b> : bus overvoltage/under-voltage,
	Motor side: Overvoltage/under-voltage, overcurrent, overload(thermal), over-speed, winding
	over-temperature, bearing over-temperature, high vibrations, loss of cooling, loss of
	temperature detector (RTD) analog input per phase from the motors to each VFD control system is required.
	When specified Seller shall supply and install microprocessor based relays for the protection of each motor.
82	(Line 42) Motor Heater Control
	When specified VFD shall be provided with drive control circuitry to interface with a remote power source to energize the motor heater whenever the motor is not running. The heater shall be interlocked with the drive run relay and shall be energized whenever the motor is not running.
	A pilot light mounted on the drive system enclosure door for indication of Motor Heater On shall be provided.
83	Each VFD enclosure shall be provided with task lighting, convenience receptacles, enclosure space heater and associated items. Mechanical key interlocks shall be provided on all doors. Interlocking shall be fully coordinated to prevent access to all high voltage compartments, including transformer, filters, or any switchgear that is part of the supply, when line power is applied to each VFD system. Interlocks shall be mechanical to provide positive lockout prevention and safety. Electrical interlock switches alone are not acceptable due to the possibility of inadvertent shutdown and the ease with which such switches could be bypassed.
84	Certified reports of all the type tests performed on similar AC Variable Speed Drive shall be submitted along with the proposal for review.
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Prior to delivery, each Variable Speed Drive shall undergo the following minimum routine tests and checks. Tests shall comply with the requirements of all relevant IEC / IEEE standards. Insulation tests, Preliminary light load tests, Temperature rise tests, Output voltage tolerance, Output frequency tolerance, Harmonic content of input and output waveforms, Full functional test, Noise test. Engineering studies detailing the requirements for the drive equipment, the response of the electrical system to the drive, the rotational dynamics of the machine/motor system, and the required heating/cooling systems shall be in the Seller's scope of work and submitted to the Owner. (This Page Intentionally Left Blank)



# 17053 – Subsystem – Programmable Logic Control System

Gene	ral						
1	System Equi	pment					
2	Reciprocating	J Fuel Gas Con					
3	Blackstart Ge	nerators					
4	PLC Equipm	ent Manufactu	ırer	Processor Model, I/O Family Series or Family			ily
5	Rockwell Auto Buyer approv equipment	omation / Allen ed equal) – cor	Bradley (or nsistent for all	ControlLogix (Redundant) (or Buyer approved equal) By Seller (Consistent all Equipment)			er (Consistent for oment)
6	HMI Equipm	ent Manufactu	irer	Operator Interfac	ce Model	, Series,	or Family
7	Rockwell Auto Buyer approv equipment	omation / Allen ed equal) – cor	Bradley (or nsistent for all	PanelView (or Buyer approved equal)			
8	A personal computer-based programming unit and software shall be supplied by the Seller as defined in the specification.			Yes (one common unit for all equipment)			
9	System Pow	er Sources					
10	Location	Equipment Type	Primary Source	Primary Source Voltage	Secondary Source Source Vo		Secondary Source Voltage
11	All	Control Hardware	Battery	125 VDC	UPS 120 VAC		120 VAC
12	Primary and S Frequency (if	Secondary Volt AC)	age	60		Hertz (H	łz)
13	Special Requ	irements		Power supplies st	hall be re	dundant	
14	System Envi	ronmental Re	quirements				
15	Location			Temperature	Ηι	imidity	
16	Reciprocating (Outdoors)	Fuel Gas Con	npressors	Per Section D200			
17	Blackstart Ge	nerators (Indoo	ors)				
18	Special Requirements			NEMA 4 panels appropriately shaded for sunlight to allow HMI viewing			d for sunlight to
Prod	ucts						
19	HMI Based C	raphical Oper	rator Interface	and other access	ories		
20	An HMI based graphical operator interface shall be furnished by the Seller as defined in the specification			Yes			
21	Description			Location Quantity		у	
22	Reciprocating Fuel Gas Compressors			Panel-Mount Per Compressor			npressor
23	Blackstart Generators			Panel-Mount Per Compressor			npressor
24	Special Requirements			21" LCD			



25	Contact Output Module Ratings			Voltage		Switching		Continuous	
26	Control 120 VAC		120 VAC		1200 VA		180 VA		
27	Low Power	(control and alarm)		125 VAC 2			watts	40 watts	;
28	High Powe	r (switchgear/SUS co	ontrol)	125 VAC		100	0 watts	500 wat	ts
29	Contact In	put Interrogation V	oltage						
30	Interrogatio	on Voltage		48 VDC					
31	Interface t	o Distributed Contr	ol System						
32	A data interface to the DCS is required to be supplied by the Seller as defined in the specification.								
33	Protocol	Communication Standard	Redunda	nt	Ме	dia	Description	1	
34	Modbus	Ethernet	No (if per Yes (if cor	compressor) mmon)	Fibe Opt	er ic	Reciprocatir Compresso	ng Fuel Ga rs	as
35	Modbus	Ethernet	No (if per Yes (if cor	generator) mmon)	Cop	oper	Blackstart G	enerators	5
36	Special Requirements If equipment is networked together, communications hard shall be redundant				tions hard	lware			
Spare	es								
37	System Sp	oare Capacity							
38	Spare installed I/O points of each category 20%								
39	Spare available I/O card slots in I/O cabinets 20%								
40	Spare I/O terminal blocks in I/O cabinets   20%								
41	Spare component space (processors, communication) controllers, memory modules, etc.) in system cabinets					20%			
42	Spare Boolean logic (application program) capacity (available for future use without exceeding manufacturer's recommended maximum loading) in the most heavily used 50% processor				50%				
43	Spare display processing and storage capacity (available for future use without exceeding manufacturer's recommended maximum loading) in the most heavily used 50% display processor				50%				
44	Spare Parts Requirements								
45	Spare parts required for startup and commissioning shall be provided by the Seller as defined in the specification				Select				
46	Spare parts required for operation shall be provided by the Seller as defined in the specification.				1 year				
Addit	ional Requi	rements							
47	The PLC shall receive status intelligence, perform logic functions, issue control commands, and provide alarms and status information for control and monitoring of the system equipment. The PLC equipment shall be a microprocessor based system with user programmable memory for storage of instructions to implement input/output (I/O) control, Boolean logic, timing, counting, arithmetic operations, data manipulation, and data communication with other control systems and equipment.				, and The for ng, ns and				



48	The PLC shall be fully compatible with other Seller-furnished equipment, and the Seller shall be fully responsible for ensuring that the overall system operation meets the intent of these specifications. The Seller shall be responsible for any changes in PLC equipment or software that are required because of defective equipment, incorrect internal connections, incorrect programming, or incorrect selection of equipment.
49	The PLC shall be furnished with sufficient memory to implement all specified control and monitoring functions plus the spare capacity specified for future use by the Buyer. All user memory shall be nonvolatile, either by use of battery-backed RAM, EEPROM (preferred), or similar technology. Battery-backed RAM shall only be used if the model line specified does not include an EEPROM option. If batteries are used for memory retention, the batteries shall be capable of supporting the memory for a minimum of 2 months. Indication of low battery power shall be provided by the PLC.
50	The Seller shall furnish redundant power supplies required for powering analog transmitters that are not self-powered. Transmitter power supply circuits shall be individually current limited (preferred) or individually fused. Where individually fused, the fuse ratings shall be coordinated with the I/O channel destruction rating so that the fuse protects the I/O channel.
51	All input and output wiring to field equipment not located in the Seller's cabinet shall be terminated on terminal blocks. Terminal blocks shall be sized to accommodate 14 American Wire Gauge (AWG) wire and shall be located in the Seller's cabinet. Individual terminals shall be provided for each input and output.
52	I/O shall be partitioned such that redundant equipment I/O is placed on separate cards.
53	The PLC equipment shall be powered from a separately fused bus within the Seller's cabinet. The system shall provide, for the Buyer's use, Form C contact outputs, which will alarm loss of any power supply or PLC equipment fault.
54	In the event of a PLC equipment malfunction or power supply failure, control signal outputs shall be commanded to a defined status to be defined by the Seller through safeguard circuitry, thereby relegating operating equipment to a predetermined safe status. Operator initiation shall be required to restart the system.
55	The Seller shall provide the service of one or more field service engineers for commissioning, startup, and testing of the PLC equipment as specified herein.
56	The Seller shall supply documentation specified in Technical Supplemental Q500 included in Section 21000.
57	Means to protect against unauthorized changes to the application programs shall be provided. List of passwords must be provided for all controllers and applications to Buyer.
58	A laptop personal computer based programming unit with programming, documentation, and communication interface software shall be furnished. The programming unit shall include the current state-of-the-art hardware platform (drives, ports, processor/bus, RAM, etc.) available at the time of contract award, all required interface boards and cables. Programming software shall fully use a windows environment and shall be designed to run under the most recent supported version of Microsoft Windows™ operating system software. The programming software shall comply with the requirements of IEC Standard 61131-3.



59	Control and monitoring application programs for the PLC shall be developed by using the formats specified in IEC Standard 61131-3. The Seller shall develop tested software for control and monitoring of the system in accordance with the requirements of these specifications. The programs shall be fully documented with comments and cross-referenced. As a minimum, each contact, coil, and register shall be labeled with the functional description and address. Rung comments shall be used to describe complex logic and document blocks of logic. Descriptions of the intent for each rung in the ladder program shall be included in the ladder. The program shall utilize the Buyer's tag numbers (may be dual tagged with Supplier's tags).
	format. The list shall indicate the signal name, address, on/off state descriptor for digital points, engineering units and engineering unit range for analog points, electrical signal range, cabinet, rack, slot, point, I/O module type, and circuit number for each point.
	The Seller shall furnish two final copies of the control and monitoring program clearly marked with program name, function, complete file name, revision number, and last revision date. Each program copy shall be provided on a CD or DVD that is compatible with the programming software furnished with the programming unit. The Seller shall also furnish an electronic copy and a pdf copy of the final control and monitoring program. The programming software shall be licensed as directed by the Buyer.
60	Controller and HMI programming software must be approved by Buyer. All PLCs on site shall use identical software and version number unless Buyer approves otherwise.
61	The PLC shall be designed for industrial applications, suitable for operation in the environment as specified without fans or other cooling equipment.

62	The Seller system for	shall furnish a human machine interface (HMI) based graphical operator interface control of its equipment.				
	HMIs shall have data entry capabilities and shall include a password security function. The unit shall be connected to the PLC and display status, alarm, and diagnostic information.					
	HMIs (and accessories such as keyboards, mouse, trackball, printer, etc.) shall be provided in the quantity and locations specified. If located in the Seller's local control panel, equipment shall be rated for service in the environment where the panel will be located.					
	If HMI is a provided fo	flat panel type unit, an Ethernet port and a serial USB, RS-232, or RS-485 port shall be r communications and programming.				
	One license	ed copy of the HMI software shall be provided to the Buyer.				
	At a minim otherwise:	um, operator interface system shall provide functionality listed below, unless specified				
	1.	Microsoft Windows based graphic editor that requires no programming to configure graphic screens.				
	2.	User configurable alarm messages that can be displayed on any graphic screen.				
	3.	Hierarchical alarm management for up to 2,000 alarms.				
	4.	Displays of up to four trends on any graphic screen.				
	5.	Printing of standard reports on a scheduled basis, or on operator demand.				
	6.	Direct control of PLC functions through the use of a minimum of 12 user- defined function keys per graphic screen.				
	7.	A standard screen for monitoring and tuning the modulating controller proportional, integral, and derivative PID) functions provided by the PLC.				
	8.	A standard screen(s) for direct access to diagnostic information available from the PLC processor and I/O.				
	The Seller complete c	shall be responsible for providing fully tested graphic displays designed to allow ontrol and monitoring of its process and equipment.				
63	Interposing relays with a minimum of two form "C" contacts designed to provide the load capability defined on the 17053 Data Sheets shall be provided for all digital outputs. Interposing relay coils shall be powered by the PLC digital output card. Interposing relay contacts shall be wired to terminal blocks in the PLC I/O equipment or termination cabinets. The interposing relays shall be labeled to identify the relay with its associated output. Digital outputs may be used to switch inductive loads. All required transient protection shall be internal to the output module. Triac style transistor outputs are generally not acceptable and shall only be provided if required for special applications with written Buyer approval.					



64	The Seller shall select I/O modules that are compatible with the interrogation voltage used and the loads of the connected devices. I/O modules for contact inputs and outputs shall be furnished with status indicating lights for each point. Field powered I/O shall be electrically isolated from each other (no common hot, neutral, or return connections) and from all cabinet wiring.
65	PLC to Distributed Control System (DCS) data interfaces shall be provided. The interfaces will be used to allow the DCS to generate interactive graphic displays for operator control of the Seller's equipment. The DCS graphic displays will serve the same function as a traditional Seller-furnished subpanel with switches and indicating lights. All control logic for the Seller's equipment shall reside in the Seller-furnished PLC. The only logic in the DCS will be that required to emulate the control switch functions required to interface with the Seller's control logic.
	To enable efficient information exchange, the PLC data to be communicated to/from the DCS shall be organized into two contiguous blocks of memory within the PLC; one for transmitted data and one for received data. Each memory block shall have 25 percent spare capacity for addition of future data exchange points.
	The communication system used shall be based on the ISO Open Systems Interface (OSI) model to assure connectivity between different systems. The communications system shall be implemented by using Ethernet standards for the hardware layer. The communications interface shall be bidirectional, capable of receiving and originating messages over the communication network. All data conversions that are required for accessing the communications network shall be performed by the network interface (data link layer) and shall not require the data to be routed to a separate processor for this conversion.
	Ethernet based communication systems shall be implemented by using a bus topology employing Carrier Sense Multiple Access with Collision Detection (CSMA/CD). All Ethernet based communication networks shall conform to IEEE 802.2 (ISO 8802.2). In addition, CSMA/CD media access control shall conform to IEEE 802.3 (ISO 8802.3) and token passing media access control shall conform to IEEE 802.4 (ISO 8802.4). The Ethernet communications network shall communicate at a minimum of 10 megabits per second and shall use unshielded twisted pair (UTP) or fiber-optic cable. The fiber-optic cable bus shall conform to ISO 10BASE-F requirements. UTP cable shall conform to Category 5e or better and shall be suitable for outdoor installation if required. Outdoor Category 5e cable shall include an overall shield. Ethernet communication networks shall include all necessary connectors, taps, switches, repeaters, cables, and terminators required for a complete communications system. The network driver shall be selected to match the hardware configuration of the network. As a minimum, the network operating system shall support the Transmission Control Protocol/Internet Protocol (TCP/IP) communication protocol suite.
66	All necessary communication to support hardware and software shall be provided. The software shall be designed so that the Buyer can easily configure the communication between the DCS and the foreign device interface from the engineer/operator work station.
	The Seller shall be responsible for furnishing all communication interface boards, ports, software drivers, converters, and other required interface equipment and software required for the PLC to communicate with the DCS by means of the specified data interface method. Use of protocol and media converters are to be avoided if possible (for example, communicate in the native protocol and provide fiber ports in lieu of providing copper to fiber media converters).
	The Seller shall also be responsible for identifying and configuring any special PLC data file register/array configurations and unique PLC hardware arrangements required to support the PLC/DCS communications (for example, ControlLogix to Emerson DCS communication). Failure to correctly configure the PLC points to communicate with the DCS shall be corrected at the Seller's expense.



67	The interface shall permit the data generated in the foreign device to be used in any process con- troller, displayed on any operator work station, or used in any report. The interface shall also allow the configuration of push buttons and control stations on the DCS operator work station displays that can be used to start and stop motors, open or close valves, etc., that are controlled by the PLCs. The command and address attributes required for this configuration shall be straightforward and shall not require extensive mathematical calculations or programming.
	The PLC supplier shall provide a data interface I/O list that indicates all information that must be passed between the PLC and DCS to meet the specified control and monitoring functions. The list shall indicate, at a minimum, the signal name, address, on/off status for digital points, engineering units and engineering unit range for analog points, and digital data word format and range for each point. Additional I/O list fields may be required dependent on the type of data interface. The list shall provide all information necessary for decoding and engineering unit conversion of each point in the receiving system. The list shall be provided in Microsoft Access <sup>™</sup> (preferred) or Excel <sup>™</sup> file format.
	Data transmitted from the PLC to the DCS shall include all information necessary for the DCS graphic displays to monitor and control the Seller's process, equipment, and PLC. Such data may include pertinent analog and digital status information, interlocks, alarms, and maintenance conditions.
	Data transmitted from the DCS to the PLC shall include signals necessary to provide an operator's control interface for the Seller's equipment from the DCS and to initiate an emergency stop of the PLC logic from the DCS. PLC memory maps illustrating transmitted and received data block address locations, arrangement, and length shall be provided.
	The PLC supplier shall provide drawings or printouts showing recommended graphic displays indicating the required control and monitoring functions for its equipment. The graphic displays will be programmed into the DCS by the DCS supplier. Prior to plant startup, the PLC supplier will be given the opportunity to review and comment on the graphic displays.
	The PLC supplier shall provide written operating instructions or logic diagrams for its equipment designed to allow the DCS supplier to verify the operation of the graphic displays.
68	The system shall be supplied with spare I/O, rack space, and processing capacity as specified. Spare I/O points shall be wired out to terminal blocks.

69	The complete programmable controller system shall be assembled at the Seller's factory and functionally tested for circuit continuity, correct program function, and correct system response to power supply failure and equipment malfunctions. This test shall include the following:					
	1. A demonstration of the proper functioning of all hardware.					
	2. A demonstration of the proper functioning of all Seller-supplied software.					
	3. A point-by-point exercise of each input and output.					
	4. A demonstration of all man/machine functions.					
	All input simulation equipment and output monitoring equipment required for testing shall be furnished by the Seller. The Buyer shall be given an opportunity to witness this test.					
	The Seller shall furnish all programming hardware and software if it is separate from the PLC provided. Hard copies of the final programming shall be submitted as engineering information through the drawing review process.					
	Testing is to be considered part of the defined Scope of Work, and all associated costs are the responsibility of the Seller unless specifically identified as Optional or Buyer-conducted. Tests identified as an option are to be priced separately. If identified as Buyer-conducted, costs for the initial test will be the responsibility of the Buyer. However, the Seller is responsible for all costs associated with correcting deficiencies and retesting in the event of a test failure.					

# 17101 - Distributed Control System

Gene	ral Requirements
1	Scope of supply shall include furnishing a fully configured and tested distributed control system (DCS) as indicated on the 15560 – Small Combustion Turbine/Generator(s) and herein. The DCS shall be an expansion of the Seller's standard CTG control system to include the requirements defined herein.
2	In addition to the CTG controls, the DCS shall include (but not be limited to) the following controls as defined herein:
	<ol> <li>Two blackstart generators with hardwired critical supervisory controls and network interfaces (full emulation of local HMI capability)</li> </ol>
	<ol> <li>Three fuel gas compressors with hardwired critical supervisory controls network interfaces (full emulation of local HMI capability)</li> </ol>
	3. Two air compressors with hardwired supervisory control and status monitoring
	4. Protective relay monitoring for all main, tie and motor feeder breakers (2 network interfaces)
	<ol><li>Continuous Emissions Monitoring System (1 network interface for three CEMS)</li></ol>
	6. SCR / ammonia injection control and monitoring
	7. Ammonia storage and forwarding pumps (2) control and monitoring
	8. Switchgear and MCC breaker control and monitoring
	9. Miscellaneous electrical monitoring (metering, transformer status, UPS status)
	10. Compressed air system monitoring (air neader pressures) and status (dryer trouble alarms)
	11. Wastewater System status (oil water separator and sump levels)
	generators, fuel gas compressors, CTG's, electrical breakers and essential BOP equipment)
3	All activities associated with the routine operation, control and monitoring of all systems and equipment shall be performed from the control room. The DCS shall provide operator controls, alarm data, and plant coordination functions necessary to achieve safe and effective remote control of systems and equipment from the control room.
4	To meet the requirements of minimal staffing, sufficient automated sequences will be provided to allow starting/stopping of major system and equipment groups from single initiation, however the system will allow item-by-item starts if required by the operator. Facilities will be provided for informing the operator of the completion of each step in an automated sequence.
5	Upon loss of the electrical utility supply, the blackstart generators shall start to provide support for the standby generation facility. An automated sequence shall then be initiated by an operator to start the fuel gas compressors and then the combustion turbines once requisite permissives have been met.
6	The DCS shall be a functionally distributed microprocessor based system with user programmable memory for storage of instructions to implement input/output (I/O) processing, closed-loop control logic, sequence control logic protection logic, and data communication with the Buyer's data network and the utility SCADA system.
7	Processors shall be provided of fault-tolerant design so that a single failure will not cause a loss of control or protection functions. Equipment shall be of the manufacturer's standard design and shall be identical in terms of hardware and software, to the extent possible, to minimize the number of processor types.
8	All processors and operator interface devices shall be connected through a communication network designed so that no single point of failure, either physical or logical, shall cause communications to cease functioning.



9	The control system shall be fully compatible with other Seller-furnished equipment, and the Seller shall be fully responsible for assuring that overall system operation meets the intent of these specifications.					
Loca	Operator Interface Equipment					
10	<ul> <li>Operator work stations shall be provided at each CTG. The work stations shall be as follows. The Seller shall furnish a visual display unit (VDU) based graphical operator interface system for control of his equipment. Operator interface shall be provided by an industrial grade PC, panel-mounted VDU LCD screen, keyboard and mouse. In addition to soft VDU control of the following, the operator work station shall also include all switches, push buttons, indicating lights, and indicating meters required to provide single action access for frequently executed operator functions, including but not limited to, the following: <ol> <li>Selection of startup sequence mode (auto/manual).</li> <li>Selection of startup and shutdown sequences.</li> <li>Manual adjustment of load demand, target load, loading rate, and other control set points.</li> <li>Alarm acknowledge and reset.</li> </ol> </li> </ul>					
11	<ul> <li>Each operator work station shall be designed for interactive soft VDU operator capability for the following functions, including, but not limited to: <ol> <li>Provide actions required for the operator to interact with the system, such as cursor positioning, display selection, menu selection, menu item selection, etc.</li> <li>Select and execute process and equipment control functions including, but not limited to, start, stop, raise, lower, auto, manual, alarm acknowledge, etc.</li> <li>Select any display to any monitor, and select display combinations of graphic pictorials, trend displays, group displays, and bar chart displays on any monitor.</li> <li>Select points and assign parameters for trend displays, group displays, and bar charge displays.</li> <li>Assign points, collection periods, and print periods for reports and data storage and retrieval functions.</li> <li>Enter numerical values and alphabetic characters.</li> <li>Display alarm messages on any graphic screen.</li> <li>Hierarchial alarm management.</li> <li>Printing of standard reports on a scheduled basis, or on operator demand.</li> <li>Standard screen(s) for direct access to diagnostic information available from the control system processors and I/O.</li> <li>Single keystroke access to frequently used displays.</li> </ol></li></ul>					
12	The Seller shall be responsible for providing fully tested graphic displays designed to allow complete control and monitoring of the combustion turbine generator unit.					
13	All work station monitors shall be 21 inch (minimum) flat panel LCD displays with TFT active matrix, a minimum resolution of 1200 by 1600 pixels, minimum 400:1 contrast ratio, minimum dot/pixel pitch of 0.255 mm, and a minimum brightness of 250 cd/m2. Controls shall be provided on the front of each monitor for contrast, brightness, horizontal/vertical position, and horizontal size. VDU monitors located in the Seller's local control panels shall be rated for service in the environment where the panel will be located.					
14	The operator work station shall also provide the capability of entering, altering, debugging, documenting, and monitoring programs, databases, and other functions within the system. The operator work station shall be able to create, modify, debug, document, and view any operator work station graphic display in addition to operating any display in its normal manner.					
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Remo	ote Operator Interface Equipment					
15	The Seller shall provide four remote operator interface work stations consisting of all VDUs, PC's, keyboards and accessory devices required to provide complete control and monitoring of the combustion turbine generator unit from the station control room. The remote operator interface shall provide all of the functions of the local operator interface. The remote operator interface work station equipment shall meet the requirements specified under Local Operator Interface Equipment (except that workstations and their screens will be desktop instead of panel mounted). The remote operator stations shall include multi-unit capability such that they can control all Combustion Turbine (and BOP) systems. The four remote operator interface work stations shall be configured as follows:					
	1. Dual screen operator/engineer workstation					
	2. Dual screen supervisor/engineer workstation					
	3. Single screen operator workstation					
	4. Single screen operator workstation					
Printe	ers					
16	Two network printers shall be provided with the following print functionality:					
	1. Print from any operator workstation					
	2. 8/2X11 or 11X17, black & white or color printouts.					
	<ol> <li>Bradefined reports that are printed automatically, based on time of day or ecourcence of</li> </ol>					
	<ol> <li>Predefined reports that are printed automatically, based on time of day of occurrence of specific events, or on operator demand.</li> </ol>					
	5. Summary reports containing operating parameters selected by the operator.					
	6. Trip reports.					
	<ol><li>Alarm report containing alarm and trip event messages printed as they occur.</li></ol>					
	8. Historical reports.					
Cons	ole Furniture					
17	The following console furniture shall be provided:					
	<ol> <li>Operator console (rectangular) with space for two operators and four dual-screen (side-by- side) workstations</li> </ol>					
	2. Supervisor console (rectangular) with space for two dual-screen (side-by-side) workstations					
	<ol><li>Printer console (rectangular) with space for three printers</li></ol>					
	The console furniture shall be a desk type construction with approximately horizontal surfaces containing all operating controls and appropriate vertical surfaces for all displays. The general design of the consoles will minimize ledges and crevices and will be easy to maintain in a clean condition. The operator and supervisor consoles will, in addition to housing the necessary LCD displays and keyboards, provide a suitable horizontal surface for clerical types of duties. The operator console shall include an integrated panel with hard wired emergency trip pushbuttons.					
Forei	gn Device Interfaces (FDI's)					
18	ign Device Interfaces (FDI's) The communications systems used shall be based on the ISO Open Systems Interface (OSI) model to assure connectivity between different systems. The communications system shall be implemented by using Ethernet for the hardware layer. The communications interface shall be bidirectional, capable of receiving and originating messages over the communication network. All data conversions that are required for accessing the communications network shall be performed by the network interface (data link layer) and shall not require the data to be routed to a separate processor for this conversion.					
19	Ethernet based communication systems shall be implemented by using a bus topology employing Carrier Sense Multiple Access with Collision Detection (CSMA/CD). All Ethernet based					
₽⁄	Source: 17101, 2015, v2.1 Distributed Control System Page 137 of 270					

	communications networks shall conform to IEEE 802.2 (ISO 8802.2). In addition, CSMA/CD media access control shall conform to IEEE 802.3 (ISO 8802.3) and token passing media access control shall conform to IEEE 802.4 (ISO 8802.4). The Ethernet communications network shall communicate at a minimum of 100 megabits per second and shall use fiber-optic cable. The fiber-optic cable bus shall conform with ISO 100BASE-F requirements. As a minimum, the network operating system shall support the TCP/IP communications protocol suite. Network architecture shall use managed switch hardware and shall not use non-switching hubs.						
20	All necessary communications support hardware and software shall be provided. The software shall be designed so that the Buyer can easily configure the communication between the DCS and the foreign device from the DCS engineer/operator work station.						
21	The interface shall permit the data ge process controller, displayed on any c	nerated in the operator work s	foreign dev station, or u	ice to be used i sed in any repo	n the DCS in any ort.		
22	The Seller shall be responsible for fur drivers, protocol converters, and othe equipment to communicate with the D	nishing all con r required inter ICS by means	nmunicatior face equip of the spec	ns interface boa ment and softwa ified interface n	rds, ports, software are required for the nethod.		
23	The Seller shall provide a data interface I/O list that indicates all information that must be passed between the foreign device and DCS to meet the specified monitoring functions. The list shall indicate the signal name, address, on/off status for digital points, engineering units, and engineering unit range for analog points, and digital data word format and range for each point. The list shall provide all information necessary for decoding and engineering unit conversion of each point in the receiving system. The list shall be provided in MS Excel file format						
24	Data transmitted from the Seller's con for the DCS VDU graphic displays to data may include pertinent analog and conditions.	trol system to monitor and co d digital status	the DCS short of the DCS short of the control the control the control of the cont	nall include all ir ombustion turbir n, interlocks, ala	nformation necessary ne generator. Such nms, and maintenance		
25	FDI Description	Estimated	Media	Redundant	FDI Protocol		
		Point Quantity					
26	PVSC Data Network – Monitoring Only of Key Parameters and Status	Point Quantity 1000	Copper	No	Later		
26 27	PVSC Data Network – Monitoring Only of Key Parameters and Status Utility (PSE&G) SCADA – monitoring only	Point Quantity 1000 50	Copper Fiber Optic	No No	Later		
26 27 28	PVSC Data Network – Monitoring Only of Key Parameters and Status Utility (PSE&G) SCADA – monitoring only Protective relaying – Group 1 – monitoring only	Point Quantity 1000 50 200	Copper Fiber Optic Copper	No No No	Later Later Later		
26 27 28 29	PVSC Data Network – Monitoring Only of Key Parameters and Status Utility (PSE&G) SCADA – monitoring only Protective relaying – Group 1 – monitoring only Protective relaying – Group 2 – monitoring only	Point Quantity           1000           50           200           200	Copper Fiber Optic Copper Copper	No No No	Later Later Later Later		
26 27 28 29 30	PVSC Data Network – Monitoring Only of Key Parameters and Status         Utility (PSE&G) SCADA – monitoring only         Protective relaying – Group 1 – monitoring only         Protective relaying – Group 2 – monitoring only         Continuous Emissions Monitoring System (CEMS) – monitoring of all measured parameters and alarms, transmission of any required CT operating data for all 3 CEMS	Point Quantity           1000           50           200           200           120	Copper Fiber Optic Copper Copper	No No No Yes	Later Later Later Later Later Modbus over Ethernet		
26 27 28 29 30 31	PVSC Data Network – Monitoring Only of Key Parameters and StatusUtility (PSE&G) SCADA – monitoring onlyProtective relaying – Group 1 – monitoring onlyProtective relaying – Group 2 – monitoring onlyContinuous Emissions Monitoring System (CEMS) – monitoring of all measured parameters and alarms, transmission of any required CT operating data for all 3 CEMSBlackstart generator 1 – full replication of local HMI functionality	Point Quantity           1000           50           200           200           120           200           200	Copper Fiber Optic Copper Copper Copper	No No No Yes No*	Later Later Later Later Later Modbus over Ethernet Modbus over Ethernet		
26 27 28 29 30 31 32	PVSC Data Network – Monitoring Only of Key Parameters and StatusUtility (PSE&G) SCADA – monitoring onlyProtective relaying – Group 1 – monitoring onlyProtective relaying – Group 2 – monitoring onlyContinuous Emissions Monitoring System (CEMS) – monitoring of all measured parameters and alarms, transmission of any required CT operating data for all 3 CEMSBlackstart generator 1 – full replication of local HMI functionalityBlackstart generator 2 – full replication of local HMI functionality	Point Quantity           1000           50           200           200           200           200           200           200           200           200           200           200           200           200           200           200	Copper Fiber Optic Copper Copper Copper Copper	No No No Yes No*	Later Later Later Later Modbus over Ethernet Modbus over Ethernet Modbus over Ethernet		



34	Gas compressor 2 – full replication of local HMI functionality	200	Fiber Optic	No**	Modbus over Ethernet				
35	Gas compressor 3 – full replication of local HMI functionality	200	Fiber Optic	No**	Modbus over Ethernet				
36	<ul> <li>* If the blackstart generator controls are networked together, then a single redundant interface may be used for both generators. Interlocks and critical supervisory control signals shall be hardwired.</li> <li>** If the gas compressor controls are networked together, then a single redundant interface may be used for all three compressors. Interlocks and critical supervisory control signals shall be hardwired.</li> </ul>								
Syste	stem Cabinetry								
37	The local system cabinets (at the CTG's) will be mounted with the CTG in an enclosed, ventilated room. The remote system cabinets (BOP I/O, network equipment) will be mounted in a conditioned room. The design ambients for these areas are specified in Technical Supplemental Specification D200 - Design Ambients and HVAC Criteria in Section 21000.								
38	The local system cabinets shall be we equipment furnished under these spe provided as specified herein.	eatherproof ca cifications. In	binets with s addition, sp	sufficient space pare component	to accommodate the space shall be				
39	The local system cabinets shall be provided with suitable filter-blower equipment, including an internally mounted switch, to pressurize the control cabinet to prevent entrance of environmental contaminants. The blower shall be sized to develop a differential pressure of 1/2 inch water gauge across its inlet and outlet at maximum atmospheric pressure and shall be designed for continuous operation. The remote system cabinets shall be provided with blowers as required by the Seller's design for the stated ambient conditions. Noise level for blowers and cooling devices shall be less than 80 dBA								
40	If required, the cabinets shall be provided with anti-condensation space heater(s) designed to provide heated air to prevent condensation inside the cabinet enclosure. The heater(s) shall be designed for continuous operation.								
41	The cabinets shall be painted in accordance with the requirements specified in Technical Supplemental Specification Q301 - Manufacturer's Standard Coatings in Section 21000.								
42	Internal cabinet wiring shall conform to the requirements of Technical Supplemental Specification E100 - Wiring Methods, Cable, and Raceway in Section 21000 and shall be installed and tested at the Seller's factory. Seller shall provide all internal cabinet cables (including fiber optic and Ethernet patch cables) between field terminations and the internal components. Seller shall also provide any special connectorized cables required for regular operation or maintenance.								
43	Terminal blocks and fuse blocks shall meet the requirements of Technical Supplemental Specification E100 – Wiring Methods, Cable, and Raceway in Section 21000.								
44	All input and output wiring to field equipment not located in the Seller's cabinet shall be terminated on terminal blocks. Terminal blocks shall be sized to accommodate 12 AWG wire and shall be located in the Seller's cabinet. Individual terminals shall be provided for each input and output. Card mounted terminal strips are not acceptable.								
45	Terminal blocks for power and utility of for prefabricated interconnecting cable space for cable spreading and facilitie	ricuits shall be es shall be gro s for cable su	e grouped ir ouped in one pport shall t	n one section of e section of the be provided.	the cabinet. All plugs cabinet. Adequate				
46	Cabinets shall be designed to accept interior lighting, convenience recepted supply terminal blocks adequately siz The Seller shall provide all necessary circuit protection.	the Buyer's po cles, and blow ed to terminat internal cabin	ower supply ers as requi e the Buyer et power su	feeds for contro red. The Seller s copper power pply distribution	ol power, cabinet shall provide power supply conductors. wiring and branch				



47	Cabinets shall be designed to be front access with bottom or top cable entry. Network equipment cabinets may be front and rear access.					
Powe	er Sources					
48	Power for the cabinet's internal components shall be internally wired by the Seller from redundant power sources. The Seller may provide power from redundant internal power supplies, or from redundant surge-suppressing power strips, each fed from a separate source. If power strips are used, the strips shall be wired by the Seller to terminal blocks for customer furnished power feeds, and to the cabinet's internal components. Redundant network components shall be connected to separate, or redundant, power sources.					
49	The primary control system power supply shall be as specified herein and shall be from the Seller- furnished batteries (local cabinets) and Buyer-furnished batteries (remote cabinets). Uninterruptible (UPS) power will be provided by the Buyer for the secondary control system power supply and for control system equipment (e.g., workstations) requiring AC power.					
Grou	nding					
50	The Seller shall state in his proposal any special system ground requirements.					
GPS	Time Synchronization					
51	A GPS time synchronization system shall be provided by the Seller and shall include 4 IRIG-B signal outputs for external non-DCS users. All hardware, software, and cables shall be provided to support a fully functional time synchronization system. The system shall be fully configured at the factory by the Seller.					
52	The DCS shall include provisions to receive a single IRIG-B time synchronization signal. This signal shall be internally distributed throughout the DCS and used to synchronize all signal time stamps.					
Histo	rical Data Functions					
53	The Seller's system shall provide short-term and long-term data storage to allow data retrieval for archived, recent and active trend displays. Any system variable (I/O point, calculated variable, etc.) shall be available for storage. This stored data shall be available for display in any trend display, any process control display, or any report.					
54	<ul> <li>Parameters to be recorded shall as a minimum include the following: <ol> <li>All hardwired I/O points</li> <li>All utilized interface I/O points</li> <li>Controller process variables/setpoints/outputs</li> <li>Calculated analog values</li> <li>Operational hours and number of starts of the CTGs, gas compressors and blackstart generators</li> <li>Speed, vibration, eccentricity, and linear displacement of the CTGs</li> <li>Operational hours and running status of all motor driven equipment.</li> <li>Fuel supply conditions</li> <li>Fuel consumption</li> <li>The measured power output</li> <li>Environmental emissions</li> <li>First cause of trip</li> <li>Commands from the operator workstations</li> </ol> </li> </ul>					
55	Data shall be stored on redundant hard drives (minimum RAID 1) and shall strive to achieve sufficient storage to keep all Station data for a minimum of two years. The system shall include provisions for back-up and storage of data files to optical media. Equipment shall be provided to effectively search					



	for, select, display, and print the data.					
56	Short-term data points at a collection rate of 1 per 1 second (or state change)	2000				
57	Long-term data points at a collection rate of 1 per 15 seconds (or state change)	2000				
Spare	Spare Parts					
58	A complete stock of spare parts shall be furnished for each control system supplied. This include all components subject to replacement during the installation, startup, checkout, of operation of the combustion turbine generator unit. The stock shall include, but shall necessarily be limited to, I/O modules, fuses, lamps, and paper supplies.	s stock shall and first year not				
Spare	e Capacity					
59	Processing capacity and communication network capacity will be sufficient such that use does not impact system performance.	e of spare I/O				
60	Spare installed I/O points of each type (at time of shipment)	20%				
61	Spare available I/O card slots in I/O cabinets (at time of shipment)	20%				
62	Spare I/O terminal blocks in I/O cabinets (at time of shipment)	20%				
63	Spare component space (control processors, communication controllers, memory modules, power supply modules, etc.) in system electronic cabinets (at time of shipment)	20%				
64	Spare logic block, database, and execution capacity (available for future use without exceeding manufacturer's recommended maximum loading) in each control processor	20%				
65	Spare display and database processing and storage capacity (available for future use without exceeding manufacturer's recommended maximum loading) in each operator interface processor	20%				
Processors						
Proce	essors					
<b>Proce</b> 66	As a minimum, the Seller's design shall include the following separate processor groups processors may be kept separate, if required by Seller's design): 1. Train 1 = CTG1, SCR1 2. Train 2 = CTG2, SCR2 3. Train 3 = CTG3, SCR3 4. Common = Gas Compressors, Blackstart Generators, Switchgear, BOP The Seller shall provide additional processors as required by the I/O quantities and spare	(CTG				
<b>Proce</b> 66	As a minimum, the Seller's design shall include the following separate processor groups processors may be kept separate, if required by Seller's design): 1. Train 1 = CTG1, SCR1 2. Train 2 = CTG2, SCR2 3. Train 3 = CTG3, SCR3 4. Common = Gas Compressors, Blackstart Generators, Switchgear, BOP The Seller shall provide additional processors as required by the I/O quantities and spararequirements.	(CTG e processing				
<b>Proce</b> 66 67	As a minimum, the Seller's design shall include the following separate processor groups processors may be kept separate, if required by Seller's design): 1. Train 1 = CTG1, SCR1 2. Train 2 = CTG2, SCR2 3. Train 3 = CTG3, SCR3 4. Common = Gas Compressors, Blackstart Generators, Switchgear, BOP The Seller shall provide additional processors as required by the I/O quantities and spare requirements. All user memory shall be nonvolatile.	(CTG e processing				
Proce 66 67 Input	As a minimum, the Seller's design shall include the following separate processor groups processors may be kept separate, if required by Seller's design): 1. Train 1 = CTG1, SCR1 2. Train 2 = CTG2, SCR2 3. Train 3 = CTG3, SCR3 4. Common = Gas Compressors, Blackstart Generators, Switchgear, BOP The Seller shall provide additional processors as required by the I/O quantities and spare requirements. All user memory shall be nonvolatile. <b>/Output (I/O) Requirements</b>	(CTG e processing				
Proce           66           67           Input           68	As a minimum, the Seller's design shall include the following separate processor groups processors may be kept separate, if required by Seller's design): <ol> <li>Train 1 = CTG1, SCR1</li> <li>Train 2 = CTG2, SCR2</li> <li>Train 3 = CTG3, SCR3</li> <li>Common = Gas Compressors, Blackstart Generators, Switchgear, BOP</li> </ol> <li>The Seller shall provide additional processors as required by the I/O quantities and spare requirements.</li> <li>All user memory shall be nonvolatile.</li> <li><b>/Output (I/O) Requirements</b></li> <li>The Seller shall select I/O modules that are compatible with the interrogation voltage use loads of the connected devices. The system shall be supplied with the amount of spare type, and spare rack space specified herein. Spare I/O points shall be wired out to term</li>	e processing ed and the I/O of each inal blocks.				
Proce           66           67           Input           68           69	As a minimum, the Seller's design shall include the following separate processor groups processors may be kept separate, if required by Seller's design): <ol> <li>Train 1 = CTG1, SCR1</li> <li>Train 2 = CTG2, SCR2</li> <li>Train 3 = CTG3, SCR3</li> <li>Common = Gas Compressors, Blackstart Generators, Switchgear, BOP</li> </ol> <li>The Seller shall provide additional processors as required by the I/O quantities and spare requirements.</li> <li>All user memory shall be nonvolatile.</li> <li><b>/Output (I/O) Requirements</b></li> <li>The Seller shall select I/O modules that are compatible with the interrogation voltage used loads of the connected devices. The system shall be supplied with the amount of spare type, and spare rack space specified herein. Spare I/O points shall be wired out to term Each DCS input and output circuit shall be fused. Fused circuits shall utilize LED blown f terminal blocks.</li>	e processing ed and the I/O of each inal blocks. fuse indicator				
Proce           66           67           Input           68           69           70	As a minimum, the Seller's design shall include the following separate processor groups processors may be kept separate, if required by Seller's design): <ol> <li>Train 1 = CTG1, SCR1</li> <li>Train 2 = CTG2, SCR2</li> <li>Train 3 = CTG3, SCR3</li> <li>Common = Gas Compressors, Blackstart Generators, Switchgear, BOP</li> </ol> <li>The Seller shall provide additional processors as required by the I/O quantities and spar- requirements.</li> <li>All user memory shall be nonvolatile.</li> <b>/Output (I/O) Requirements</b> The Seller shall select I/O modules that are compatible with the interrogation voltage use loads of the connected devices. The system shall be supplied with the amount of spare type, and spare rack space specified herein. Spare I/O points shall be wired out to term Each DCS input and output circuit shall be fused. Fused circuits shall utilize LED blown f terminal blocks. Digital sequence-of-events (SOE) inputs shall be scanned at least every 0.001 second. resolution of SOE points in different control processors shall be time tagged to a resolution be millisecond and 1 second (or as specified in the I/O database).	e processing e processing ed and the I/O of each inal blocks. fuse indicator The time residing in tween 100				
Proce 66 67 Input 68 69 70 71	As a minimum, the Seller's design shall include the following separate processor groups processors may be kept separate, if required by Seller's design):  1. Train 1 = CTG1, SCR1  2. Train 2 = CTG2, SCR2  3. Train 3 = CTG3, SCR3  4. Common = Gas Compressors, Blackstart Generators, Switchgear, BOP  The Seller shall provide additional processors as required by the I/O quantities and spar- requirements.  All user memory shall be nonvolatile.  //Output (I/O) Requirements  The Seller shall select I/O modules that are compatible with the interrogation voltage use loads of the connected devices. The system shall be supplied with the amount of spare type, and spare rack space specified herein. Spare I/O points shall be wired out to term Each DCS input and output circuit shall be fused. Fused circuits shall utilize LED blown f terminal blocks.  Digital sequence-of-events (SOE) inputs shall be scanned at least every 0.001 second. resolution of SOE points in different control processors shall be the same as SOE points the same control processor. All non-SOE alarms shall be time tagged to a resolution be millisecond and 1 second (or as specified in the I/O database).  All cables from external equipment connected to the DCS (excluding FDI interface cable	e processing ed and the I/O of each inal blocks. fuse indicator The time residing in tween 100 s) shall be				

	terminated on term relays, optical iso DCS supplied cat at the factory and	erminated on terminal blocks (not wired directly to DCS I/O modules/cards). Relays, interposing elays, optical isolators and other isolation equipment shall, as far as is practicable, be housed in the DCS supplied cabinets. Wiring from the terminal blocks to the DCS I/O modules/cards shall be done it the factory and checked during the FAT.								
72	Relays shall include Form C contacts rated for 10A at 120 VAC and 125 VDC.									
73 74	<ul> <li>The interrogation power source provided by the DCS for each digital input card shall be monitor and alarmed. If an I/O card has two fuses that direct interrogation power, alarming shall be profor each fuse. Alarming shall be accomplished by wiring a single input for each fuse into an I/O on the associated card.</li> <li>I/O quantities shall be as follows (quantities listed below include the required spares):</li> </ul>							nonitored be provided an I/O point		
	Processor	DI DCS	DI SOE	DO DCS	DO Field	Al 4-20mA	AI T/C	AI RTD	AO 4-20 mA	]
	Train 1									
	CTG 1				E	By Seller				
	SCR 1				E	By Seller	•			
	Train 1 BOP	18	6	0	4	10	0	0	4	
	Train 2									
	CTG 2				I	By Seller				
	SCR 2					By Seller				
	Train 2 BOP	18	6	0	4	10	0	0	4	-
	Train 3									-
	CTG 3				E	By Seller				-
	SCR 3	_		1	E	By Seller	1	1	г	-
	Train 3 BOP	18	6	0	4	10	0	0	4	-
	Common	- <u>r</u>								-
	Blackstart 1				E	By Seller				-
	Blackstart 2				E	By Seller				
	Gas Comp 1					By Seller				-
	Gas Comp 2					By Seller				-
	Gas Comp 3	150			L	By Seller				
	BOP	156	84	2	54	36	0	16	0	
	Notes: 1. I/O totals 2. "DI DCS" preferred 3. "DI SOE" power so 4. "DO DCS 5. "DO Field	represent = digital ir ) = Sequen urce (48 V " = digital " = digital	hardwir put inte ce of Ev DC pref (relay) c (relay) c	ed I/O c rrogate vents dig erred) output p	only. d by the gital inpu owered owered	DCS I/O r ut interroga by the DC by the field	module ated by S (120 d devic	onboard the DCS VAC sol e (MCC,	d power sour S I/O module lenoid valves switchgear,	rce (48 VDC e onboard s) etc.)



	<ol><li>"AI 4-20mA" = 4-20 mA analog input powered by DCS or field (selectable)</li></ol>
	<ol><li>"AI T/C" = thermocouple (Type E or Type K) analog input</li></ol>
	8. "AI RTD" = 100 ohm platinum RTD analog input
	<ol><li>"AO 4-20mA" = 4-20 mA analog output powered by the DCS</li></ol>
	10. I/O totals do not include cabinet power supply or temperature monitoring (by Seller).
I/O Pa	artitioning
75	The Seller shall be responsible for partitioning of the I/O to meet the requirements for process and equipment separation and redundancy.
76	Redundant analog inputs for a single process measurement shall be wired to separate analog input cards as well as separate racks (branches) within the DCS. The remaining channels on each of these cards can be used for other process measurement inputs. I/O cards containing redundant analog inputs for a common control loop shall be addressed to the same processor.
77	Redundant digital inputs shall be wired to separate digital input cards as well as separate racks within the DCS. The remaining channels on each of these cards can be used for other process measurement inputs. I/O cards containing redundant digital inputs for a common control loop shall be addressed to the same processor.
78	Redundant digital (relay) outputs shall be wired to separate digital output cards as well as separate racks within the DCS. The remaining channels on each of these cards can be used for other process controls. I/O cards containing redundant digital (relay) outputs for a common control loop shall be addressed to the same processor.
79	Redundant I/O partitioned to separate cards on separate racks (branches) shall either be fed from separate power supplies or the power supplies feeding the I/O cards shall be redundant. The arrangement shall be such that no single source of failure (point, card, power supply, processor, etc.) can simultaneously fault the redundant points.
80	Redundant trains of equipment (pumps, valves, electrical gear, etc.) shall have their respective I/O separated such that the I/O for the redundant equipment shall reside on separate I/O cards as well as separate racks (branches) within the DCS. I/O for redundant equipment shall be addressed to the same processor.
81	Non-redundant I/O common to a particular device or piece of equipment shall be wired to the same I/O card. If non-isolated I/O cards are used, the individual signals shall be wired to the same fused group of that I/O card (to the greatest extent possible).
82	Input and output cards associated with one particular device or piece of equipment shall be addressed to the same processor.
83	Non-redundant I/O common to a particular control loop shall be common to the same processor (to the greatest extent possible).
84	The inputs and outputs associated with a particular device or piece of equipment shall be located in the same cabinet (bay) side to avoid running conductors of one cable to different cabinets, bays, or sides (to the greatest extent practical).
Softw	vare Configuration
85	Buyer will provide control narratives for Buyer supplied BOP equipment for implementation by the Seller. Seller shall configure and furnish logic diagrams and control program printouts documenting the system control logic.
86	Means to protect against unauthorized changes to the application programs shall be provided.
87	The Seller shall provide engineering to define and produce system configuration diagram, cabinet arrangement drawings, cabinet internal wiring diagrams, external connection diagrams for power,



	grounding, communications, and detailed job specific I/O termination drawings, logic configuration drawings, and application logic configuration files. The Seller shall furnish standard product literature including, but not limited to, hardware and software instruction manuals, and certified equipment outline and wiring drawings. After startup of the unit(s), the Seller shall update and reissue all hardware, wiring, and logic drawings to reflect the changes made during installation and commissioning of the DCS.
88	The DCS shall record and be able to subsequently display system and equipment data and produce logs of statutory and management information which will include environmental emissions, the results of performance calculations, and electrical data. The Seller shall develop and configure two periodic reports that incorporate specified plant data (content to be defined by Buyer later).
89	The DCS shall be configured to handle bad quality inputs and to take alternative action (or to indicate the doubt inherent in any calculated results or data display using that particular signal).
90	The DCS shall include a comprehensive fault diagnostic system. Equipment to interrogate the fault diagnostic system shall be independent of the operator interface used to control and monitor the operation of the Plant. The diagnostic facility shall have the ability to display the DCS system schematically and highlight faulty elements pictorially down to individual I/O card level. The system shall also have the ability to report faults on additional equipment or controllers (i.e. PLCs) connected to the DCS. Diagnostics of the DCS communication system (e.g. network connections, switches, routers, port status, etc.) is also required.
Opera	ator Graphic Displays
91	The Seller shall develop and configure all control and information displays including process control displays, faceplate displays, text displays, system (network equipment status) displays, trend displays, and group displays. The Seller shall submit one color hardcopy print of each display and a copy of the associated display configuration file for the Buyer's review. The final displays, as configured in the system, shall reflect the Buyer's comments. The display configuration files shall be compatible with the PC based display builder software provided to the Buyer.
92	Operator workstations graphics will show overview and group or detailed information to assist the operator in any type of control action required. Overview displays will provide an at a glance view of plant and major subsystem status, and provide the operator with a graphical view of the process to help with training and visual understanding of control action. These displays must remain uncluttered when designed for control operations.
93	Graphics and symbols shall be designed per the DCS Seller's standard. All graphic displays shall be approved by the Buyer. All operator graphics shall have consistent graphic symbols and navigation. Graphics shall be based on the final P&IDs.
94	In general, graphics and operator interactions will be designed to use the standard DCS pop-up faceplates.
95	Operators will be able to easily access specific displays and graphics by pressing dedicated function keys or screen targets, selecting from a list of displays in directories or menus, or by typing display or graphic names.
96	All DCS graphic displays will be globally available to all operator workstations.
97	It shall be possible to move between related displays and graphics of different detail levels or of the same detail level with a maximum of two operator actions.
98	It shall be possible to cycle through a predefined series of displays with a maximum of one operator action.
99	Special indication shall be used to indicate that a value is invalid or in an alarm condition. Alarm conditions shall be displayed consistent with color coding used on the alarm displays.
100	Faceplates shall show dynamic process (and/or status) information about a single control loop (or device) and shall permit an operator to change control parameter values or mode for the loop (or
₽	Source: 17101, 2015, v2.1Distributed Control SystemPage 144 of 270

101 System		device). Faceplates shall be defined to pop up when the appropriate location on a process graphic is selected with the pointing device.					
line, fail	System displays shall show the operational status of the communication system. The communications parameters of each module connected to the communication system (on- line, off-line, failed, primary failed, back-up failed, channel/port status, etc.) will be shown.						
102 Each co all interl conditio displays	Each controllable device shall have an accessible permissive (text style) display dynamically showing all interlocks, trips and conditions that would prevent operator control or automatic actions. All conditions, including those that are not monitored by the system, shall be included in the permissive displays.						
103 Each m the cau displays	ajor component shall have first out logic that identifies (and holds until res se of a trip. The first out information shall be operator accessible via the s.	set by the operator) permissive/trip					
104 Trend a tabular Trend d data as	nd tabular data displays are related to overview displays and shall be pro displays shall organize key data to match the plant mode while eliminatin ata displays shall be available from overview and detail displays to allow well as historical data.	ovided. Common g unrelated data. viewing of real time					
Remote Diagr	ostics						
105 The DC internet	S shall have the capability for remote diagnostics to be carried out via a s connection.	secure landline					
Meetings							
106 The Sel telecont	ler shall participate in four one-day design meetings at the Buyer's facility ferences throughout the design process.	/ and regular weekly					
Factory Acce	otance Testing (FAT)						
107 Hardwa	re FAT minimum duration (witnessed by Buyer)	2 days					
108 Softwar	e FAT minimum duration (witnessed by Buyer)	2 weeks					
109 The har 1. 2. 3. 4. 5. 6. 7. 8. 9.	dware FAT shall, as a minimum, demonstrate the following: Point-by-point verification and exercising of all inputs and outputs. Buye to witness these test separately from and prior to the factory acceptance Point-by-point continuity check of the terminal cabinets (if not checked as verification). Repeated powering up and powering down of all system components. Demonstration of the proper functioning of all hardware. Demonstration of single failure responses to detectable failures including operation during failover from primary to backup control processor and b primary, failure of one channel of each redundant communication system supply failures. Demonstration of the timing and accuracy of the sequence-of-events (SC both in the same control processor and between control processors. Demonstration of required spare system capacity. All prefabricated cables supplied under this Contract. The prefabricated be connected for the tests in exactly the same configuration as they will a at the plant site. The Seller may use temporary test cables during the te cable being supplied in bulk lots without factory installed connectors. Demonstration of processor, network and memory utilization during wors traffic/loading conditions (this shall also be demonstrated during testing a	r may elect test. s part of I/O g proper back again to n, and power DE) system cables shall be installed st for all st-case and					

110	The software FAT shall, as a minimum, demonstrate the following:					
	<ol> <li>A closed loop checkout of all modulating control logic using a simple tie-back simulation of the process</li> </ol>					
	<ol> <li>A closed loop checkout of all discrete control logic using simple tie-back simulation of the field devices.</li> </ol>					
	<ol> <li>Demonstration of all operator interface functions.</li> </ol>					
	4. Functional review of all Seller-configured control and information disp	lays.				
	<ol> <li>Demonstration of the proper functioning of the Seller-supplied softwar the software tests shall be procedures to verify the proper operation of system software functions: all on-line editing functions; all analog sca and limit checking routines; all digital scan routines; all operator comm routines; all editors, configurators, compilers, and assemblers; all soft programs; all software diagnostic routines; all display and printing rou output routines; and all programming support routines. Included in the shall be procedures to verify the proper operation of the applications p simulated I/O, all real-time variable calculations, and all performance</li> <li>Demonstration of the proper functioning of all FDIs using Buyer-furnis PCs, or Seller-furnished emulators. Depending on foreign device sys requirements and hardware availability testing may involve a compute simulation and manipulation of processor data tables to do point-to-point</li> </ol>	re. Included in of the following on conversion munication ware debug tines; all alarm e software tests programs using calculations. hed PLCs or tem er based point verification.				
	7. Trending, reporting, logs, etc.					
Code	s and Standards					
111	Work performed under these specifications shall be done in accordance with the codes and standards referenced herein. Unless otherwise specified, the applicable governing edition and addenda to be used for all references to codes or standards specified herein shall be interpreted to be the jurisdictionally approved edition and addenda. If a code or standard is not jurisdictionally mandated, then the current edition and addenda in effect at the date of this document shall apply. These references shall govern the work except where they conflict with the Buyer's specifications. In case of conflict, the latter shall govern to the extent of such difference.					
112	ASME PTC 22 or mutually agreed upon standard					
113	Interface Between Data Terminal Equipment and Data Circuit-Terminating EIA 232-D Equipment Employing Serial Binary Data Interchange					
114	Racks, Panels, and Associated Equipment EIA RS-310-D					
115	Electrical Characteristics of Balanced Voltage Digital Interface Circuits EIA RS-422-A					
116	Standard for Electrical Characteristics of Generators and Receivers for Use in Balanced Digital Multipoint Systems EIA RS-485					
117	Standard Digital Interface for Programmable Instrumentation IEEE 488.1					
118	Standard Codes, Formats, Protocols and Common Commands IEEE 488.2					
119	Guide for Protection, Interlocking, and Control of Fossil-Fueled Unit- Connected Steam Stations IEEE 502					
120	Guide for Installation of Electrical Equipment to Minimize Electrical Noise IEEE 518 Inputs to Controllers from External Equipment					
121	Standards for Local and Metropolitan Area Networks IEC 8802 (IEEE 802)					
122	Classification of Degrees of Protection Provided by Enclosures IEC 529					



123	Programmable Controllers IEC 61131			
124	Binary Logic Diagrams for Process Operations	ISA S5.2		
125	Graphic Symbols for Process Displays	ISA S5.5		
126	Environmental Conditions for Process Control Systems ISA S71.02			
127	Functional Diagramming of Instrument and Control Systems PMC22.1 equivalent			
128	Information Technology-Open System Interconnection-Basic Reference Model ISO OSI 7498-1			
129	Enclosures for Electrical Equipment NEMA 250			
130	Enclosures for Industrial Controls and Systems NEMA ICS6			
131	National Electrical Code NFPA 70			
132	Cabinets and Boxes UL 50			
122	Industrial Control Equipment	111 508		

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# **19000 - Quality System Requirements**

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

## 19000.1 General Quality System Requirements

#### 19000.1.1 Quality System

The Seller's quality management system shall ensure that all equipment, assemblies, services, and commodities supplied are in conformance with the contract drawings and specifications.

The Seller's quality management system shall provide assurance that design, procurement, materials, manufacturing processes, inspection and testing, packaging, shipping, storage, and related services comply with the requirements of the contract documents. The Seller's quality management system shall have a defined process for reporting, segregation, evaluation, disposition, and closure of nonconforming product. This quality management system shall be available to the Buyer for review and/or audit at all of Seller's locations where work is being performed subject to these contract documents.

#### 19000.1.2 Quality System Manual

The quality management system shall be documented in the Seller's quality system manual. One quality system manual shall be submitted to the Buyer as defined in the Schedule of Submittals if a current version is not already on file with the Buyer. If the Seller's program has been certified by a registered certification agency, a copy of the Certification Letter or Certification of Authorization shall be submitted along with the quality system manual.

**19000.1.2.1 Revisions**. Revisions to the Seller's quality system manual shall be submitted to the Buyer throughout the life of these contract documents. If the Seller has previously submitted a quality system manual to the Buyer, the Seller shall submit (in writing) the following information:

- 1. Title and number designation of the document, e.g., QP 500 Quality Assurance Manual.
- 2. Applicable Seller location(s) covered by the document.
- 3. Revision level and date of the manual that is currently being used.

#### 19000.1.3 Subtier Sellers

The Seller shall obtain the Buyer's approval in writing prior to using subtier Sellers for manufacturing or engineering activities. Material/commodity subtier Sellers are exempted from these requirements.

All applicable requirements of the contract documents (i.e., technical, quality, and administrative) shall be passed on to the applicable organizations within the Seller and subtier Seller's companies. The Seller shall ensure that subtier Sellers have the capabilities to fulfill contract document requirements. Sellers shall monitor subtier Sellers' quality of work and shall indicate their strategy on their inspection and test plan. Sellers shall submit required procedures, drawings, quality manuals, and/or other submittals when required for approval and/or information of subtier Seller's capabilities, processes, or in-process work involving the engineering, fabricating, and manufacturing of equipment and commodities for the Buyer.

Subtier Seller qualification and monitoring are the responsibility of the Seller. Buyer has the authority to perform quality audits and inspections, and monitor and/or review subtier Seller processes and facilities, at all locations where work is being performed subject to these contract documents.

#### 19000.1.4 Inspection and Test Plan

In accordance with the Schedule of Submittals, a detailed inspection and test plan (i.e., a Quality Assurance/Quality Control Plan) for the work/equipment shall be submitted to the Buyer as specified in

the contract documents prior to starting fabrication. Minimum surveillance activities to be included in the Seller's inspection and test plan are specified in Section 20000 – Buyer's Shop Quality Surveillance Requirements. The Buyer will designate any test witness points or other inspection points required during review of the Seller's submitted detailed inspection and test plan.

The inspection and test plan shall identify the inspection and testing points including the acceptance criteria for major components of the work, the facility location for each inspection or test, and inspection target dates for each inspection or test. The inspection and test plan shall be complete when first submitted, and shall be maintained current throughout the life of the contract documents. A monthly update shall be provided to the Buyer. The plan shall also include the Seller's strategy for inspecting subtier Seller's work, including inspection by the Seller at his subtier Seller's facilities. The Seller shall inspect the work of subtier Sellers to the extent necessary to ensure that proper materials and equipment are furnished and that fabrication, assembly and erection are accomplished in accordance with the contract documents. Commercial off-the-shelf items are exempted from these requirements.

The Seller shall keep the Buyer informed of the progress of the work. When inspection and test points have been designated by the Buyer as witness and/or hold points, the Seller shall notify the Buyer at least 14 calendar days in advance of the appropriate times for inspections and testing. The work shall not progress past the Buyer's designated hold point until the Buyer has verified the work or witnessed the designated test.

A witness point is a step in manufacturing where the Seller is obligated to notify the Buyer in advance of the performed operation so that it may be witnessed. If the Buyer is not present at the time and date specified by the Seller, the Seller may proceed.

A hold point is a designated stopping place during or following a specific activity at which the Buyer's inspection or witness is required before further work can be performed. The Seller may not proceed beyond the hold point without inspection or witness by the Buyer unless prior written authorization is obtained from the Buyer.

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

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

### 19000.1.5 Inspections by Buyer

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

The following requirements shall apply for Buyer's inspection at the Seller's mill, factory, yard, warehouse, or subtier Seller's facilities.

**19000.1.5.1 Access**. The Buyer's representative shall have the right to access the Seller's and subtier Seller's work and related documents during the manufacturing process without delaying the schedule. The Seller shall provide, without cost, reasonable facilities including tools, personnel, and instruments for demonstrating acceptability of the work.

**19000.1.5.2 Surveillance Activities**. In accordance with the contract documents, designated hold points for witnessing, mill and/or factory tests shall be performed in the presence of the Buyer's



representative unless waived in writing by the Buyer's representative. The Seller shall bear all costs for such tests, except the compensation and expense of the Buyer's representative.

**19000.1.5.3 Control of Special Processes**. It is Seller's responsibility to ensure that qualified personnel are employed to perform special processes such as welding, nondestructive examination (NDE), coating, painting, etc. If special processes are conducted by unqualified employees, the Buyer has the right to validate and test the product at Seller's expense and/or reject the product. The Seller shall be able to demonstrate the qualifications of personnel in writing.

**19000.1.5.4 Corrective Action**. Upon identification of a noncompliance with the requirements of the contract documents, the Seller shall document the noncompliance issue. For noncompliance issues where the nonconforming characteristic can be restored to a condition such that the capability of an item to function reliably and safely is unimpaired, even though that item still does not conform to the original requirement, the Seller shall submit the noncompliance to the Buyer for approval. During witness and hold point activities, if the Buyer's representative identifies a noncompliance issue, the Seller shall document the noncompliance issue and provide a copy of the documentation to the Buyer's representative. If the Seller disagrees and does not document the noncompliance, the Buyer's representative shall issue a corrective action report to the Seller for disposition and action. The Seller shall correct, in a timely manner, all deficiencies identified in the corrective action report.

**19000.1.5.5 Rejection**. If any items or articles are identified that do not meet the requirements of the contract documents, the lot, or any faulty portion thereof, may be rejected. Before offering specified materials or equipment for shipment, the Seller shall inspect the material and equipment and eliminate any items that are defective or do not meet the requirements of the contract documents. The fact that equipment or materials have been previously inspected, tested, and accepted does not relieve the Seller of responsibility in the case of later discovery of flaws or defects.

### 19000.1.5.6 Receipt Inspection

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



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# 20000 - Buyer's Shop Quality Surveillance Requirements for Power Generation System (Furnish Only)

The following table lists the minimum surveillance activities that the Buyer will perform. The Buyer may make additions and deletions of surveillance activities based on, but not limited to, the following:

- 1. Seller ITP.
- 2. Seller performance.
- 3. Client requests.
- 4. Equipment assessment.
- 5. Design reviews.

Post award communication between the Buyer and Seller regarding Inspections and Tests shall be done with the ITP (Inspection and Test Plan).

Surveillance Type	Task		
In-Process	Review QC/Code Documentation		
Witness Point	Combustion Turbine Generator Testing (Winding & Insulation Resistance/Hi Pot etc.)		
Witness Point	FAT Distributed Control System (Hardware and Software)		
Hold Point	Pre-shipment Inspection (Turbine/Generator)		
Hold Point	Pre-shipment Inspection (SCR Exhaust System)		
Hold Point	Pre-shipment Inspection (Fuel Gas Compressor)		
Hold Point	Pre-shipment Inspection (Gas Fueled Generator)		

### Surveillance Type Definitions

**Hold Point** requires the Seller to provide the Buyer's Inspector with a minimum of fourteen (14) calendar days advanced notice with verbal confirmation the day before the Hold Point is scheduled to occur. The Seller cannot proceed past a Hold Point without the Buyer's written approval unless specified otherwise elsewhere within the contract.

**Witness Point** requires the Seller to provide the Buyer's Inspector with a minimum of fourteen (14) calendar days advanced notice prior to when the Witness Point is scheduled to occur unless specified otherwise elsewhere within the contract.

**In-Process Inspection Point** is an inspection point that occurs during the manufacture of Seller equipment. Notification by Seller is required to provide a minimum of fourteen (14) calendar days advanced notice prior to when the In-Process Inspection Point is scheduled to occur unless specified otherwise elsewhere within the contract.

**Review** - Inspection point is Reviewed during the manufacture of Seller equipment. This is typically a review of documentation such as CMTRs.

**Verify** - Inspection point is Verified that it occurred during the manufacture of Seller equipment.



**Seller Inspection Notification** Buyer will provide an Inspection Notification form to the Seller. Seller is to complete and return the Inspection Notification form as the advance notice required in the Surveillance Type Definitions above.



# 21000 - Technical Supplemental Specifications

This section contains technical supplemental specifications that provide additional requirements applicable to the work covered under the technical sections which follow this Section 21000.

## 21000.1 Summary of Applicable Supplementals

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

	Technical Section Number	Technical Section Name	Applicable Technical Supplementals
1	05135	Steel Stack	D100, D200, Q300, Q301, Q302, Q500, Q520, S100, S201, V100
2	11506	SCR System	D100, D200, E100, E220, E635, E640, K100, K101, K102, K103, K105, K120, M200, M710, Q300, Q301, Q302, Q400, Q500, Q501, Q502, Q520, S100, V100
3	11507	Catalyst for SCR System	Q500
4	11508	Ammonia System	D200, E100, E220, E640, K100, K101, K102, K103, K105, K106, K120, M200, M710, Q300, Q301, Q302, Q400, Q500, Q501, Q502, Q520, V100
5	11509	Oxidation Catalyst System	Q500
6	15220	Reciprocating Fuel Gas Compressor	D200, E100, E220, E635, E640, K100, K101, K102, K103, K105, K106, K120, M200, M710, Q300, Q301, Q302, Q400, Q500, Q501, Q502, Q520, V100
7	15560	Small CTG	D100, D200, E100, E220, E640, K100, K101, K102, K103, K105, K120, M200, M710, Q300, Q301, Q302, Q400, Q500, Q501, Q502, Q520, S100, V100
8	15910	Gas Fueled Blackstart Engine Generator	D100, D200, E100, E220, E640, K100, K101, K102, K103, K105, K120, M200, M710, Q300, Q301, Q302, Q400, Q500, Q501, Q502, Q520, S100, V100
9	16031	Cylindrical Rotor Generator	D100, E100, E220, E300, E400, E510, E530, Q301, Q400, Q500, Q501, Q520, S100, V100
10	16093	MV Variable Frequency Drives	D100, D200, E100, E220, E530, Q300, Q301, Q302, Q400, Q500, Q501, Q502, V100
11	17053	Programmable Logic Controllers	D200, E100, E300, E220, E510, E530, Q301, Q400, Q500, Q501, Q502
12	17101	Distributed Control System	D200, D300, E100, E220, E300, E510, E530, Q301, Q400, Q500, Q501, Q502

## 21000.2 Technical Supplemental Specifications

The technical supplemental specifications follow.




# D100 Site Meteorological and Seismic Data

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

General Design Data:			
Building Code	2015 New Jersey International Building Code		
Risk Category	111		
Site Elevation (Mean Sea Level), ft	10-12 (final value TBD)		
Wind Design Data:			
Ultimate Design Wind Speed, V <sub>ult</sub> , Nominal 3 second gust wind speed at 33 ft (10 m) above ground for Exposure C category, mph	120		
Exposure Category	В		
Topographic Factor, Kzt	1.0		
Snow Design Data:			
Ground Snow Load, Pg, lb/ft <sup>2</sup>	20		
Importance Factor (Snow Loads), I	1.1		
Ice Design Data:			
Nominal Ice Thickness, t, Due to freezing rain at a height of 33 ft (10 m), inches	0.75		
Concurrent Wind Speed, Vc, mph	50		
Importance Factor (Ice Loads – Ice Thickness), $I_i$	1.25		
Importance Factor (Ice Loads – Concurrent Wind), I <sub>w</sub>	1		
Seismic Design Data:			
Short Period Mapped Spectral Acceleration, $S_s$	0.249g		
One Second Period Mapped Spectral Acceleration, S <sub>1</sub>	0.060g		
Site Class	С		
Importance Factor (Seismic Loads), I	1.25		

# D200 Design Ambients and HVAC Criteria

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

	Temperature, °F		Relative Humidity,		
Area	Minimum	Maximum	Minimum	Maximum	
General Outdoor Area	-5	108	25	100	
*Nominal outdoor minimum ambient design temperature for determining commodity material properties (pipe, valves, etc.) will be $-5^{\circ}$ F. Outdoor minimum ambient design conditions for determining freeze protection for piping and accessories shall be based on the all time recorded ambient low temperature of $-5^{\circ}$ F with coincident wind speed of 10 mph.					

PVSC Standby Power Plant Project HVAC Design Criteria: Space conditioning consisting of heating, ventilating, and air conditioning (HVAC) shall be provided as determined by Engineer to ensure design basis environmental conditions for equipment and personnel. HVAC systems shall be designed to maintain the indoor conditions listed above. Design shall be based on the following ambient temperatures:

Winter ambient design basis: ASHRAE 99% for Newark, NJ	16.6° F	
Summer ambient design basis: ASHRAE 2% for Newark, NJ	88.4° F DB	72° F WB

Values of ambient dry-bulb, dew point, and wet-bulb temperatures correspond to the annual percentiles the value is exceeded on average by the percentage of the total hours in a year (8760). The 2% (warm) value is exceeded on average 175 hours per year. The 99% (cold) value for which the weather is less than the design condition for 88 hours per year on average. Buildings requiring heat will be provided with adequate heat capacity to prevent indoor temperatures below freezing on record low recorded temperatures.

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

The filtration levels are as defined in the International Society of Automation Standard ISA-71.04, Environmental Conditions for Process Measurement and Control Systems: Airborne Contaminants. This may involve the use of gas filtration, if required by the outdoor air quality as determined by Engineer. The air conditioning for control and electrical equipment shall be designed to meet the filtration levels indicated in the PVSC Standby Power Plant Project HVAC design criteria table above. Tabulated filtration efficiency and MERV levels are indicated in accordance with ASHRAE Standard 52.1, Method of Testing Air-Cleaning Devices Used in General Ventilation for Removing Particulate Matter and ASHRAE Standard 52.2, Method for Testing General Ventilation Air Cleaning Devices for Removal Efficiency by Particulate Size:

Filtration Level Dust Spot Efficiency, %		Minimum MERV
High	80 to 90	13

Medium	20 to 60	7 to 11
Low	Less than 20	N/A

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

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

PVSC Standby Power Plant Project HVAC Criteria Table								
Building Area	Indoor Ter	nperature	Humidity Minimum	Im Minimum Pressurization		Redundancy	Noise	
	Maximum °F based on Summer ambient design basis	Minimum °F based on Winter ambient design basis	(%RH)	Ventilation Rate Based on a 10° F Rise or (ac/h) which ever is greater.	Particle Filtration Efficiency (% MERV)			Criteria
Combustion Tu	Combustion Turbine / General Equipment Area							
Combustion Turbine Area	104	45 (7)	None	(TBD) Minimum 6 ac/hr	None	None	Multiplicity	Background
Turbine Electrical Rooms	78	72	0-65	As required for pressurization	80, (13) 30, (7) ISA Class <3	Positive	100%	NC 45
Control Building Areas								
Control rooms and Control equipment rooms; for instruments and electronics	78	72	30-65	As required for pressurization	80, (13) 30, (7) ISA Class <3	Positive	100%	NC 45

# D300 Property Tables

Gas Fuel Characteristics Table for Natural Gas (Monthly Grab Samples Jan. 2015 to Dec. 2016)					
Parameter, Units	High	Low	Average		
Methane, percent by volume	96.51	88.87	93.88		
Ethane, percent by volume 5.25 2.61 3.89					
Methane, percent by volume 96.51 88.87 93.88   Ethane, percent by volume 5.25 2.61 3.89					



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Propane, percent by volume	0.29	0.07	0.18
Butane+ (C4+), percent by volume	0.16	0.02	0.05
Ethylene, percent by volume	1.87	0.00	0.53
Propylene, percent by volume	0.38	0.00	0.09
Carbon Dioxide, percent by volume	0.20	0.05	0.10
Carbon Monoxide, percent by volume	0.06	0.00	0.02
Hydrogen, percent by volume	2.45	0.00	0.73
Nitrogen, percent by volume	0.98	0.29	0.54
Specific gravity	0.588	0.570	0.579
Higher Heating Value (HHV), Btu/ft <sup>3</sup>	1052	1030	1040
Wobbe No.	1374	1362	1368
Tar	riff Guarantees		
Total Sulphur, gr/100scf	20	-	-
Hydrogen Sulfide, gr/100scf	0.5	-	-
Butane+ (C4+), percent by volume	1.5	-	-
Water Vapor, lbs/MM cu. Ft.	7	-	-
Temperature, °F	120	40	-

# E100 Wiring Methods, Cable, and Raceway

# E100.1 General Requirements

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

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

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

Materials containing asbestos shall not be used.

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

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

# E100.2 Equipment Safety Grounding (Earthing)

An integral shipping unit or assembly shall be furnished with a grounding pad suitable for field connection to the station ground grid by others. All equipment on an integral shipping unit or assembly shall be grounded to a common point on the shipping unit or assembly. Control devices such as solenoids, or pressure and limit switches (unless such devices require grounding for proper operation) are not required to be grounded.

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

The raceway and tray system shall not be considered to be a ground conductor except for itself. All metal conduits containing power circuits shall be provided with grounding type bushings and be wired together inside enclosures and connected internally to the enclosure ground pad bus. Ground conductor shall be sized in accordance with NEC or IEC 60364 but shall not be less than 8 AWG bare copper conductor.

Ground conductors shall be soft drawn, stranded copper Class B (per NEMA WC 3) or Class II (per IEC 60228).

#### E100.3 Wiring Methods

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

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

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

All raceway and cable entries into equipment that will be installed outdoors or in wet environments shall be from the bottom or side and be raintight.

All cable tray and raceway for Seller's wiring shall not interfere with raceway or cable entry by the Buyer. Seller shall submit raceway plan drawings for review and approval by the Buyer and shall modify the raceway design as required to eliminate interferences for no additional cost.

Conduit shall be rigid galvanized steel rated for heavy resistance to impact and compression in accordance with the NEC.

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

Moisture pockets shall be eliminated from the conduit raceway system.

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

Cable tray systems furnished and installed by the Seller shall include cable tray, fittings, supports, accessories, and hardware required for a complete system.

Cable tray shall be aluminum, hot dipped galvanized steel or fiberglass. Cable trays and associated component materials shall conform to the requirements of NEMA.

Hardware for aluminum cable tray shall be case hardened galvanized steel suitable for indoor and outdoor use. Hardware for aluminum cable tray in corrosive areas shall be Type 316 stainless steel. Cable tray and all fittings shall be supported in accordance with NEMA VE-2 for metal tray or cable tray manufacturer's recommendation.

Cable tray covers shall be of the same manufacturer and material as the cable tray. All covers shall be securely fastened to withstand the wind loads specified.

Cable tray covers shall be installed on all cable trays containing insulated (non-armored) cables for all premanufactured skids.

Tray covers in pre-manufactured enclosures shall be installed on the first six feet of any cable tray extending vertically from floor penetrations.

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

#### E100.4 Cable

Splices in cable are not allowed.

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

All single-conductor or multi-conductor cables external to control panels or cabinets, and all multi-conductor cables internal to control panels or cabinets provided and/or installed by the Seller shall pass the IEEE 1202 flame test, or the CSA FT4 flame test.

All cable shall meet the following requirements:

All cable except thermocouple cable shall be stranded copper conductors.

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

Control cable shall have flame retardant cross-linked polyethylene (FR-XLPE) or ethylene propylene rubber (FR-EPR) insulation with a minimum 600V rating, a CPE, or CSPE jacket, and a minimum size of 16 AWG.

Cable for current and potential transformers shall have a minimum size of 10 AWG.

Instrument cable shall be twisted pairs or triads with individual shields, XLPE insulation with a minimum 300V rating, a CPE jacket, and a minimum size of 20 AWG. Multi-pair or triad cables shall also have an overall shield.

Thermocouple cable shall be solid conductor, twisted pairs with individual shields, XLPE insulation with a minimum 300V rating, a CPE jacket, and a minimum size of 20 AWG. Insulation shall be color coded in accordance with ASTM E-230/E230M. Multi-pair cables shall also have an overall shield.

Shielding of thermocouple and instrument cables shall consist of aluminum-polyester tape and copper drain wire.

#### E100.5 Cable Glands

All cable glands shall comply with the requirements of IEC 62444.



Source: 21000, 2015

Cable glands for outdoor use shall be UV resistant.

All cable glands shall be rated for the same service environment as the enclosure on which they are installed. The IP rating of the cable gland shall meet or exceed that of the enclosure on which they are installed.

#### E100.6 Terminations

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

Conductors for current transformer circuits shall be terminated with preinsulated ring type terminal connectors.

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

#### E100.7 Electrical Enclosures

Junction boxes and pull boxes shall be provided without knockouts.

All junction boxes or pull boxes 4 inch trade size or smaller in any dimension shall be galvanized malleable iron or acceptable equal.

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

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

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

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

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

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

#### E100.7.1 Electrical Enclosure Heating

When electrical enclosure heating is provided by the Seller, the space heaters, adjustable thermostat, and fuse/fuse block or circuit breaker or other means of disconnect shall be pre-wired in the enclosure. Use of space heaters shall not change or discolor any painted surface.

Space heater capacity shall be as required to maintain the enclosure internal temperature above the dew point under the specified site conditions. Space heaters shall be rated and operated at the voltages shown below.

Rated Voltage	240 VAC	
Operating Voltage	120 VAC	2-wire



Source: 21000, 2015

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#### E100.7.2 Electrical Panel Lighting

When electrical panel lighting is provided by the Seller, the lights, light switch and fuse/fuse block or circuit breaker or other means of disconnect shall be pre-wired in the enclosure.

Lights shall meet the requirements in the table below.

Fixture	Ballast	Rated Voltage	Frequency	Illumination
Fluorescent	Electronic	120 VAC, 2- wire	60 Hz	30-fc

#### E100.8 Terminal Blocks

Terminal blocks shall be furnished for all wiring leaving an enclosure, for internal circuits crossing shipping splits, and where equipment parts replacement and maintenance will be facilitated.

Terminal blocks for external connections shall be grouped in the instrument and control compartment for easy accessibility, without interference from structural members or instruments. Space shall be provided on each side of each terminal block to allow an orderly arrangement of all leads to be terminated on the block. For terminal blocks interfacing with the Buyer's field cabling, one side of the terminal block shall be used by the equipment manufacturer for factory wiring and the other side of the terminal block shall be reserved for the Buyer's field cabling terminations.

Terminal blocks shall not be mounted in compartments containing uninsulated conductors operating at voltages above 1000 volts.

The arrangement of connections on terminal blocks shall be acceptable to the Buyer.

Self-stripping terminal blocks are not acceptable. Angled terminal blocks and multiple deck terminal blocks shall only be used where approved by the Buyer. Multiple deck blocks shall not exceed three decks/layers in construction.

Each terminal block shall be provided with a unique identifier. All terminal points shall be uniquely identified on the terminal block and, where permitted by the safety codes and standards, shall be without covers. Spare points shall be provided with blank strips that can be permanently marked in the field.

Twenty percent (20%) spare (unused) terminals shall be furnished evenly distributed on the terminal blocks.

Terminal blocks shall be manufactured from materials rated Inflammability Class V0 in accordance with UL 94.

Terminal blocks not used for internal, factory prewired electronic systems or for thermocouple extension wire, shall be rated for 600 volts or greater unless approved by the Buyer.

No more than two conductors shall be terminated at one connection point.

For installations requiring "Increased Safety" terminal blocks, the terminal blocks shall have a CENELEC Certification Code marked on the terminal block.

For installations requiring voltage interface of 50V and greater, the terminal block shall be designed so that incidental contact with bare metal screws, straps, jumpers, or conductors is not possible (finger safe design). If this is not practical, clear plexiglass or polycarbonate barriers shall be installed so that incidental contact with energized materials is not possible.



Rails for modular terminal blocks not used as a grounding conductor shall be corrosion-resistant steel. Rails used as a grounding conductor shall be copper. Modular terminal blocks shall be designed to be removed from the mounting rails independent of adjacent terminal blocks.

When knife disconnect terminal blocks are provided, they shall be have test ports on both sides of the knife disconnect. The knife disconnect shall be permanently attached to the block.

Terminal blocks for field terminations shall accept solid or stranded copper conductors with any wire preparation method, such as crimps, ferrules, tinning, or no preparation. Clamping shall ensure mechanical and electrical integrity without damage to the conductors. Current carrying terminal parts shall be coated or plated to prevent corrosion.

The current carrying parts of thermocouple terminal block shall be of the same materials as the thermocouple extension wire. Termination points for extending the shield wire of the thermocouple extension cable shall be provided adjacent to the block or shall be integral to the block.

Terminal blocks shall meet the requirements in the following table.

Terminal Block Type	Applications	Acceptable Termination Methods	Acceptable Construction	Acceptable Manufacturers
Feed- Through	Thermocouple Extension Wire	Strap Screw Compression	Manufacturer's Standard	Strap Screw - Manufacturer's Standard Compression - Allen-Bradley, Phoenix Contact, Wago, or Weidmuller,
Feed- Through	DCS and PLC I/O,	Compression Strap Screw Cage/Spring/ Tension Clamp	Modular Rail Grouped Block Bolted	Strap Screw - Manufacturer's Standard Cage/Spring/Tension Clamp – Allen Bradley 1492 Series, Phoenix Contact ST 4 Series, Wago 282 Series, or Weidmuller Z Series
Feed- Through	General Purpose Control	Strap Screw, Cage/Spring/ Tension Clamp	Grouped Block, Bolted, Modular, Rail	Strap Screw - Marathon 1500 Series or Buyer-Approved Equal Cage/Spring/Tension Clamp – Allen Bradley 1492-L Series, Phoenix Contact ST 4 Series, Wago 282 Series, or Weidmuller Z Series
Shorting	Current Transformer	Strap Screw	Grouped Block Bolted	Marathon 1500 Series
Power	600 Volt Power (8 AWG through 4/0 AWG [10 mm <sup>2</sup> through 95 mm <sup>2</sup> ])	Screw, Compression, Stud	Grouped Block Bolted	Manufacturer's Standard

Terminal Block Type	Applications	Acceptable Termination Methods	Acceptable Construction	Acceptable Manufacturers
Power	600 Volt Power (6 AWG [16 mm²] and smaller)	Cage/Spring/ Tension Clamp	Bolted, Modular, Rail	Allen Bradley 1492-L Series, Phoenix Contact ST Series, Wago 283 Series, or Weidmuller Z Series

#### E100.9 Hazard Warning Labels

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

<b>A</b> WARNING	<b>A</b> DANGER
	Arc Flash and
Arc Flash and Shock Hazard	Shock Hazard
Appropriate PPE Required	Appropriate
Test 16100 as instantional	PPE Required

# E220 Electrical Equipment in Hazardous Areas

All electrical equipment and devices located in areas subject to hazardous area classifications shall be suitable for use in hazardous areas. All such equipment and devices shall be furnished with a nameplate in accordance with NEC 500.8 (C) requirements. Nameplates and attachment pins shall be corrosion-resistant metal.

# E300 Electronic Systems and Components

Internal wiring of factory prewired electronic systems in cabinets may be installed according to the Seller's standard as to wire size, insulation, and method of termination on internal equipment except that insulation for all wiring shall meet the UL 1581 VW-1 flame test. Conductor identification may be accomplished by insulation color coding noted on the drawings or by printed wiring lists.

The electronic systems shall be tested and verified capable of providing surge withstand capability in accordance with the requirements of IEEE C37.90.1.

All electrical equipment containing electronic logic systems shall be tested in accordance with the manufacturer's standard tests for a minimum of 48 hours under power prior to shipment from the factory. The system shall be tested as a complete assembly. Testing of individual components or modules will not be acceptable as system tests. The system test shall include a means of confirming the logic or mathematical design response of the system by simulating changes in system input. The test shall verify correct operation of the system at both high and low power source voltage limits.

# E400 Motor Control

The ac and dc motor starters specified to be furnished with the equipment shall conform to the requirements herein and shall be manufactured to the standards identified herein. The general requirements apply to all standards.

#### E400.1 General Requirements

Each starter that interfaces with the Buyer's control system shall be provided with terminal blocks for termination of the Buyer's cable.

The interrupting capacity of each combination starter (direct on-line starter, unless otherwise specified) shall be sufficient for the available fault current without damage to the breaker or to the starter.

Each 3-phase, ac single-speed starter shall be furnished with one 3-phase, manually reset, solid state overload relay. Each 3-phase, ac two-speed starter shall be furnished with two 3-phase, manually reset, solid state overload relays. Each overload relay shall have a trip class suitable for proper operation and protection of the equipment served by the starter.

Auxiliary contacts shall be mechanically operated by the starter contactor. Unless otherwise specified, the quantity of auxiliary contacts for starters that interface with the Buyer's control system shall be as required by the Seller's design. A minimum of one normally open and two normally closed contacts shall be wired to terminal blocks for Buyer's use.

For each ac starter, a dry type control power transformer shall be furnished complete with each primary lead fused and one secondary lead fused with the other secondary lead grounded (earthed). The primary leads shall be connected to two phases of the power conducting circuits.

Large ac size starters which require line voltage to energize the operating starter coils shall be equipped with auxiliary interposing relays for use in the operating coil circuit. These interposing relays shall be operated from the low voltage circuit of the control transformers.

Two-speed starters and reversing starters, where required, shall be mechanically and electrically interlocked so that only one set of contacts can be closed at any one time.

Unless otherwise specified, any starter that uses remote control from the Buyer's control system shall be provided with an interposing relay to interface with the contactor coil if the contactor coil inrush exceeds 600 volt-amperes.

Any dc starter that uses remote control from the Buyer's control system shall have arc suppression devices installed across the contactor coil (or interposing relay coil) to protect the remote signal source.

Single-phase ac starters shall be similar to 3-phase starters, except that a single-phase set of manually reset thermal overload relays shall be provided, and control power transformers will not be required if the line voltage is the same value as the specified control voltage.

Ac contactors shall be similar to ac starters, except that no overload protection shall be required.

#### E400.2 NEMA - Combination AC Motor Starters

Combination ac motor starters shall be in accordance with NEMA ICS 2 and shall consist of the following:

An isolating device consisting of a 3-phase molded (moulded) case adjustable magnetic trip only circuit breaker.

Contactors with manually reset thermal overload relays.

Ac operating coils at specified control voltage.

#### E400.3 Not Used



Source: 21000, 2015

#### E400.4 DC Motor Starters

Magnetic starters for dc motors shall include, but not be limited to, the following:

Dc operating coils.

Contactors at specified control voltage.

Starting resistors as required to limit the inrush current to approximately 350-500 percent of motor full load current (to be finalized during detailed design).

A shunt field slide wire resistor.

For non-reversing contactors, six electrically separate contactor auxiliary contacts (three normally open and three normally closed); For reversing contactors, the same quantity of contacts per contactor.

One overload relay. The overload relay shall provide an alarm (Form C contact) and shall not trip the dc motor.

For non-reversing contactors, a means to monitor the integrity of the shunt field and main contactor coil (to warn operator that the dc starter and its timing scheme are not armed) shall be provided and shall be the Seller's standard design. A normally open and normally closed contact of the coil monitor relay shall be wired out to terminal block for external use. For reversing contactors, the monitoring scheme shall be as for non-reversing contactors for the contactor considered critical by Buyer.

A space heater wired out to terminal block points.

All auxiliary and overload contacts shall be wired to terminal blocks for external use.

The dc motor starters design shall be coordinated with the characteristics of the motors that the starters are intended to operate.

Unless otherwise specified, the following criteria apply to the starters specified to be furnished:

Standard to Which Motor Starters Shall Be Manufactured	NEMA
AC Motor Starter Control Voltage	120 volts, 60 hertz
DC Motor Starter Control Voltage	125 volts dc
Spare Terminal Points	20 percent

# E510 Branch Circuit Protective Devices

Branch circuit protective devices may be molded case circuit breakers or fuses.

All molded case circuit breakers shall be in accordance with UL 489 and have a minimum AC and DC interrupting capacity greater than the fault availability shown on the equipment technical datasheet. If the fault availability is not shown on the equipment technical datasheets, the AC and DC interrupting capacity shall be greater than 10kA for 120/208 volt circuits and 65 kA for 480 volt circuits

Fuses shall be properly sized for the application and in accordance with UL 248.



Fuses may be mounted on terminal blocks using fused terminals with swing open access to the fuse cartridge.

Fuses or holders shall be provided with visual blown fuse indication.

Fuse Holders shall meet the requirements of UL 4248.

The bases shall be a plastic that has a Flammability Rating of V-0 when tested in accordance with UL 94.

# E530 Electrical Accessories

#### E530.1 General Requirements

One spare normally open and one spare normally closed contact on each control switch and lockout relay shall be wired out to terminal blocks.

All devices shall be heavy-duty and oil-tight.

#### E530.2 Electrical Indicating Instruments

Metering devices shall be flush mounted. Displays shall be analog with black markings on a white background or a digital LCD.

Instrumentation with current elements shall be capable of 10 times the rated end scale overload values for a period of 1/2 second duration for a minimum of nine successive overloads with 1 minute between overloads without exceeding the deviations defined in the specified standard. Switchboard meters shall not open the circuit when subjected to 30 times the rated secondary current of the associated current transformer circuit for a period of 2 seconds.

Electrical indicating instruments shall be as listed in the table below.

Input	Range				
Voltage Element	Current Element	Transducer	Manufacturer	Accuracy Class (% of Full Scale Value)	Display
0-150 V	0-5 A	4-20 mA	Yokogawa Weschler Electric Corporation Crompton Instruments	1	Analog or Digital LCD

#### E530.3 Control Relays

General service auxiliary relays shall be Allen-Bradley Bulletin 700 Type P. Where current carrying requirements exceed the capacity of the general service auxiliary relays, auxiliary relays shall be Allen-Bradley Bulletin 700 Type PK, General Electric Type HFA or HGA, Westinghouse Type MG-6.

Timing relays shall be solid-state as manufactured by Agastat.

DC relays that interface with the Buyer's control system shall have a diode surge suppressor installed across the relay coil.

#### E530.4 Electrical Switches

Control switches shall be 600 volt, 20 ampere, multistage, rotary type, with black, pistol grip type handles and engraved black plastic escutcheon plates with targets.



Electrical switches shall be as specified in the below table.

Electrical Switches			
Application	Description	Manufacturer/Style	
Control Switches	Control Panel	General Electric Type 95, SB-1, or SB-10 with large cover Electro-Switch Type 24, W, or 20K	
Push Buttons and Selector Switches	Control Panel or Local	Honeywell Micro Switch Type PT Square D Class 9001 Type K	
Toggle Switches	Control Panel	Honeywell Micro Switch Type TL	

# E530.5 Indicating Lights

Indicating lights for local control stations shall be LEDs and shall permit light changing from the front.

#### E530.6 Contacts

Contact ratings for all electrical accessory devices shall be suitable for interrogation voltages up to 250 V AC or DC and for switching currents in the milliamp range.

All contacts that interface with the Buyer's control system shall be electrically "dry." Solid-state switches or triac outputs are not acceptable. All contacts shall allow the Buyer's I/O cards to distinguish between a normally open and a normally closed contact.

Alarm contacts shall include one normally open and one normally closed contact.

# E530.7 Colors of Indicating Devices and Actuators

If words or abbreviations are required to describe the function of the indicating device or actuator, they shall be English. Indicating lights shall be energized when the condition described in the following table exists, and shall be de-energized when the condition does not exist. Colors shall be as specified in the below tables.

Colors of Indicating Devices			
Color	Explanation	Examples	
Green	Normal off condition requiring no action by the operator	Motor stopped; valve (damper) closed; breaker open, contactor de-energized	
Red	Normal running condition requiring no action by the operator	Motor running; valve (damper) open; breaker closed, contactor energized; process within normal limits; cabinet/panel power available	
White	Abnormal condition requiring monitoring and/or intervention by the operator	Motor trip; breaker trip, contactor trip; tripping by a protective device or interlock; electrical lockout relay tripped; position change from normal; pressure or temperature beyond normal limits; overload	
White Flashing	Dangerous condition requiring immediate action by the operator	Pressure or temperature beyond safe limits; loss of critical process	

Colors of Indicating Devices			
Color	Explanation	Examples	
Blue	Indication of a condition which requires action by the operator	Instruction to enter a value; paralleled electrical power sources to bus causing bus rating to be exceeded	
Amber	Equipment start permissive; equipment protective relay reset	General information; electrical lockout relay reset	

Colors of Actuators		
Color	Meaning	Examples
Red	Emergency	Emergency-stop/off
Black	Normal stop/off	Normal stop; open breaker, contactor de-energized
Black	Normal start/on	Normal start; closed breaker, energize contactor



# E635 Medium Voltage Induction Motors

#### E635.1 General

## E635.1.1 Scope of Supply

Scope of supply shall include furnishing the medium voltage induction motors as specified herein and on the E635 Medium Voltage Induction Motors Specification Sheets at the end of this section.

#### E635.1.2 Codes and Standards

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

Work	In Accordance With
NEMA/IEEE designed motors	NEMA MG1, IEEE C50.41, IEEE 112, IEEE 522

#### E635.1.3 Approved Manufacturers of Components

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

Component	Manufacturer
Medium voltage induction motors	ABB, General Electric, Hitachi, Hyundai, Reliance, Siemens, TECO - Westinghouse Motor Co., Marathon, HICO

# E635.1.4 Test Requirements

Each motor shall be tested and inspected at the manufacturer's factory to determine that it is free from electrical or mechanical defects and to provide assurance that it meets the requirements of these specifications. Test procedures shall be in accordance with IEEE or NEMA test procedures for 3-phase induction motors. The routine tests listed in NEMA shall be performed on each motor. Optional tests may be performed to determine the efficiency and power factor for each motor when specified.

This testing is to be considered part of the defined Scope of Work, and all associated costs are the responsibility of the Seller unless specifically identified as Optional or Buyer-conducted. Tests identified as an option are to be priced separately. If identified as Buyer-conducted, costs for the initial test will be the responsibility of the Buyer. However, the Seller is responsible for all costs associated with correcting deficiencies and retesting in the event of a test failure:

Copies of reports of the quality control tests and inspections for each motor shall be submitted prior to shipment of the motor from the manufacturer's factory.

Tests In Accordance With Conducted By
---------------------------------------

Tests	In Accordance With	Conducted By
ANSI designed motors	NEMA MG1, ANSI C50.41, IEEE 112, IEEE 522	Motor manufacturer
Efficiency	IEEE 112, Method F1	Motor manufacturer
Power Factor	IEEE 112	Motor manufacturer

# E635.2 Products

#### E635.2.1 Design and Construction

Motors shall be designed for direct-on-line (full voltage) starting and shall be capable of at least two (2) consecutive successful starts (one start and acceleration to full speed - when initially at stabilized ambient temperature condition ("cold"), followed immediately by a trip and second start accelerating up to full rated speed again), with both starts at 100 percent rated voltage or at minimum starting voltage as specified herein, whichever case is more stringent. Also, the motor shall be capable of one start with the motor initially at a temperature not exceeding its rated-load operation temperature. All motors shall be capable of continuous running duty in the specified ambient temperature. The motor safe stall time, for all motors, shall be greater than the motor acceleration time at the minimum starting voltage.

**E635.2.1.1 Nameplates**. All motor nameplate data shall conform to the requirements of the standards listed in Article E635.1.2. The following additional nameplate data shall be included:

Insulation system class designation.

Motor horsepower rating at the site elevation, or derating factor.

Maximum ambient temperature for which motor is designed and temperature rise by resistance.

Starting capabilities at rated volts and at minimum starting voltage (may be a separate nameplate):

Number of successive starts (coasting to a rest between starts) allowable after the following:

Motor initially at maximum specified ambient temperature.

Motor driving maximum expected operating load in the maximum specified ambient temperature and coasting to a stop.

Cooling period required after completion of the preceding maximum number of starts before making an additional start with the motor in the following conditions:

Motor running driving maximum expected operating load in the maximum specified ambient temperature.

Motor running with the driven equipment uncoupled.

Motor at rest after being de-energized on reaching rated speed.

Direction of rotation and voltage sequence.

For dual voltage rated or multispeed motors, connection diagram for the specified voltage or the specified speeds.

For motors with connections to an external lubricant recirculating system, or with an integral forced lubrication system, oil pressure and oil flow required.

Type and grade of bearing lubricant, attached adjacent to lubricant filling devices.

For motors with current transformers for differential protection, connection diagram indicating motor lead terminal connections.

For motors with air filters, recommended set point for differential pressure device, attached on or near device enclosure.

All motor nameplates and attachment pins shall be corrosion-resistant metal.

**E635.2.1.2 Enclosures**. Enclosure parts for all motors (e.g., frames, bearing brackets, terminal housings, external fan covers) shall be made of cast iron, cast steel, sheet steel, or steel plates. Aluminum enclosure parts are not acceptable. Cooling fans, when provided, shall be bidirectional to allow for continuous motor operation in either a clockwise or counterclockwise direction. Specific cases where such a fan is impractical for mechanical reasons shall be brought to the attention of the Buyer.

When air filters are specified on the E635 Specification Sheets, removable washable impingement type air filters shall be furnished.

Motors located in areas classified as hazardous shall be furnished with enclosures certified for use in the classified area.

Totally enclosed motors shall be furnished with drain holes and rotating shaft seals and bearing housing seals (Inproseal or equal approved by Buyer). Drain holes shall be provided with combination water drain-breather plugs.

When totally enclosed fan cooled enclosures (IP54, IC411) are specified on the E635 Specification Sheets, the Seller shall have the option of selecting from one of the following enclosure constructions:

Totally Enclosed Fan Cooled	IP54	IC411
Totally Enclosed Tube Cooled	IP54	IC511
Totally Enclosed Air-to-Air Cooled	IP54	IC611

External cooling fans for fan cooled motors shall be fabricated of brass, bronze, aluminum alloy containing not more than 0.2 percent copper, malleable iron, or plastic. All plastic fans shall be fabricated of a reinforced thermosetting plastic.

Totally enclosed motors shall have all exposed metal surfaces protected with a corrosion-resistant polyester or epoxy paint or coating and shall have enclosure interior surfaces and the stator and rotor air gap surfaces protected with a corrosion-resistant alkyd enamel or with polyester or epoxy paint or coating. The stator air gap surfaces may be protected with a vacuum pressure impregnation coating. Bolts, nuts, screws, and other hardware items shall be corrosion-resistant or zinc dichromate treated metal. Motors furnished with sleeve type bearings shall have a rotating labyrinth shaft seal furnished on the shaft extension end of the motor.

**E635.2.1.3** Air Filter Pressure Differential Devices. A pressure differential device shall be provided at the air inlet of all motors furnished with air filters. The device shall be furnished with a snap-action sealed switch having



one normally open contact and one normally closed contact (Form C), wired out to terminal blocks, which change state on high-pressure differential. The switch shall have an adjustable set point which is accessible for calibration while the motor is in service. The initial adjustment shall be made at the motor Seller's factory to prevent motor excessive temperature because of clogged filters.

**E635.2.1.4 Insulation and Windings**. All stator coils shall use copper conductors, shall be form-wound, and shall be insulated with mica based materials. All stator winding materials shall have a Class F [311° F] thermal classification and shall use a vacuum pressure impregnation (VPI) system.

All multiturn form-wound stator coils shall have adequate turn-to-turn insulation to enable them to pass the Figure 1 Coil Electrical Impulse Withstand Envelope, which is described in IEEE Standard 522.

**E635.2.1.5 Temperature Rise**. The temperature rise at rated output shall not exceed those for a Class B thermal insulation classification.

**E635.2.1.6 Space Heaters**. All motors shall have space heaters. Space heaters shall be sized as required to maintain the motor internal temperature above the dew point when the motor is idle and supplied at the specific voltage on the E635 Specification Sheets. Heaters shall be located and insulated so that they do not damage motor components or finish.

**E635.2.1.7 Terminal Housings**. A terminal housing for power leads and a separate accessory terminal housing for accessory leads shall be furnished on all motors. All terminal housings shall be externally mounted on the motor frame enclosure. Location and dimensions of terminal housings, including conduit opening quantity and location, shall be acceptable to the Buyer.

Terminal housings for all motors shall be cast iron or sheet steel. Minimum protection requirements shall be equivalent to NEMA 4 (IP 54).

All motor leads located in the housings shall be permanently marked for ease of identification.

A separate accessory terminal housing shall be provided for space heater leads, temperature detector leads, differential pressure switches, and other similar accessory equipment leads. It shall be complete with screw type terminal blocks for termination of such leads. Each terminal in the blocks shall be identified and marked for its respective leads. Accessory terminal housings shall be accessible from outside the motor.

When current transformers for motor differential protection are specified on the E635 Specification Sheets, the current transformers shall be mounted in the power lead terminal housing and terminated in an accessory terminal housing on shorting type terminal blocks.

Motor power lead terminal housings shall be large enough to provide working space for the field fabrication of stress relief kits for shielded cable within the housing and to contain the stress relief kits after fabrication whenever incoming power supply shielded cable is specified on the E635 Specification Sheets. In those cases, the minimum distance from the motor leads to the cable entrance plate of the motor terminal box shall be as follows:

Motors with cable leads - 24 inches.

Motors with bus bar leads - 36 inches.

**E635.2.1.8 Leads**. All leads, including motor power leads, current transformer leads, space heater leads, temperature detector leads, and alarm device leads, shall be wired into their respective terminal housings. Each lead marking shall be visible after taping of the terminals.

All motors shall have the direction of rotation marked by an arrow mounted visibly on the stator frame near the terminal housing or on the nameplate and the leads marked for phase sequence to correspond to the direction of rotation and supply voltage sequence.

Leads for dual voltage rated or for multispeed motors shall be easily connected or reconnected in the terminal housing for the operating voltage or for the specified speeds.

When current transformers for motor differential protection are specified on the E635 Specification Sheets for single-speed motors, the motor phase leads shall be wired to the motor power lead terminal housing for connection for self-balancing current type differential protection. Each current transformer shall encircle all power leads to the associated winding. The motor winding wye or delta connections shall be completed at the factory, leaving only three leads, T1, T2, T3 (U, V, W), for field connection in the power lead terminal housing. The wye or delta connection shall be completed in a manner that will allow easy access to the end of each phase for field testing.

When current transformers for motor differential protection are specified on the E635 Specification Sheets for two-speed motors, the motor phase leads shall be wired to the power lead terminal housing for connection for self-balancing current type differential protection. Each current transformer shall encircle all power leads to the associated winding. The motor winding wye or delta connections shall be completed at the factory, leaving only six leads, T1, T2, T3, T4, T5, T6 (U1, V1, W1, U2, V2, W2), for field connection in the power lead terminal housing. The wye or delta connections shall be completed in a manner that will allow easy access to each end of each phase for field testing.

Cable motor leads shall use stranded copper conductors insulated with silicone rubber covered with a glass braid or acceptable equal.

**E635.2.1.9 Bearings**. The type of bearing furnished shall be as specified on the E635 Specification Sheets or the motor Seller shall determine the type of bearing to be furnished based upon the load, speed, and thrust conditions of the driven equipment. If a bearing type deviates from the specification sheets, the Seller shall request approval for the deviation prior to proceeding with manufacturing.

Thrust bearings for vertical motors shall have a life as specified on the E635 Specification Sheets and shall be capable of operating for extended periods of time at any of the thrust loadings imposed by the specific piece of driven equipment during startup/shutdown and normal operation without damage to the bearing, the motor frame, or other motor parts.

**E635.2.1.9.1 Hydrodynamic type bearings**. Sleeve bearings for horizontal motors shall be oil ring lubricated type. The bearings, end bells, and bearing housings shall be split type when available. Except for totally enclosed motors, air gap measurement holes or other acceptable means shall be provided in each motor end housing for checking air gap of sleeve bearing motors.

Sleeve bearings on horizontal motors shall be designed and located centrally, with respect to running magnetic center, to prevent the rotor axial thrust from being continuously applied against either end of the bearing. The motors shall be capable of withstanding, without damage, the axial thrusts that are developed when the motor is initially energized.

Vertical motors provided with tilting pad or flat land type thrust bearings shall have oil lubricated split sleeve or tilting pad upper guide bearings. The Seller's design shall eliminate the possibility of the "whirl" phenomenon associated with the rotor. The lower bearing housing design shall also provide for required clearance or end-play resulting from thermal growth in the rotor shaft.

Hydrodynamic bearings shall be sized for a maximum load of 300 psi at normal or rated operating conditions, and a maximum load of 450 psi at all expected operating conditions including startup or shutdown transients.

**E635.2.1.9.2 Bearing lubrication system**. Unless specified otherwise on the E635 Specification Sheets, bearing lubrication shall be furnished by an internal lubricant recirculation system. Oil reservoir capacity and ventilation of the bearing housing and oil reservoir shall be as required to adequately maintain cooling of the oil and bearings in accordance with the bearing Seller's requirements.

**E635.2.1.9.3** Antifriction bearings. Antifriction bearings for horizontal shaft motors shall be designed and fabricated to have a life as specified on the E635 Specification Sheets. Antifriction bearings shall be grease lubricated except where the specified speed and thrust require oil lubrication for the specified life. Grease lubricated bearings shall be self-lubricating and regreaseable.

Motors furnished with spherical roller thrust bearings shall be furnished with deep groove radial guide bearings.

**E635.2.1.9.4 Miscellaneous bearing requirements.** All bearing mountings shall be designed to prevent the entrance of lubricant into the motor enclosure or dirt into the bearings and shall be provided with pipes and drain plugs. Bearings and bearing housings shall be designed to permit disassembly in the field for inspection of the bearings or removal of the rotor. Filler caps or grease fittings for lubrication shall be arranged for safe, easy addition of lubricant from the outside of the motor while the motor is in service.

All oil lubricated bearings shall be provided with oil level sight glasses marked for required oil level at motor running and standstill. Plastic sight windows or bottles shall be of a material not adversely affected by continuous exposure to sunlight.

Insulation shall be provided when required to prevent circulation of shaft current on bearings, on bearing temperature detectors, or on oil piping connections.

Bearing lubricants shall contain a corrosion inhibitor. The type and grade of lubricant shall be indicated on a nameplate attached to the motor frame or end shield adjacent to the lubricant filling device. The Seller shall furnish all lubrication information required to assure proper equipment startup and subsequent bearing maintenance.

Motors using sleeve type radial bearings shall have the housings drilled and tapped in accordance with API-670 for possible use of proximity probes.

**E635.2.1.10 Oil Lubrication Systems**. If an external lubricant recirculating system is provided, the Seller shall furnish pipe taps for oil inlet and outlet connections in addition to the internal lubricant recirculating system previously specified. Pipe taps for vertical motors shall be arranged to recirculate oil from the motor thrust bearing oil reservoir for cooling. The Seller's lubrication system shall maintain proper lubrication and cooling of the bearings over the complete performance range of the external lubricant recirculating system. The internal lubricant recirculating system shall provide proper lubrication and cooling of the bearings during startup and coast-down with no oil flow from the external lubricant recirculating system.

Where water cooling of bearing oil is required, the Seller shall furnish pipe taps for the water inlet and outlet connections. The Seller's lubrication system shall maintain proper cooling of the oil and bearings under the cooling water conditions specified.

Sufficient oil cooling (external or internal) shall be provided to maintain the oil sump temperature at or below 160° F at the specified ambient condition. The probability of reverse rotation or emergence shutdown shall be considered in the bearing design details.

**E635.2.1.11 Rotors**. All induction motors shall have squirrel-cage rotors. Rotors shall be adequately sized to avoid overheating during acceleration of the motor and driven equipment. Rotors may be die-cast aluminum construction for ratings up to 560 kW (750 hp). Above 560 kW, the rotors shall be copper or copper alloy cage material except that aluminum cage materials will be considered on 2-pole motors only.



All fabricated cage rotor bars shall be installed using swaging or wedging or other proven method acceptable to the Buyer to prevent rotor bar vibration.

All motor rotating components shall be dynamically balanced after mounting on the shaft. Motor vibration shall not exceed the peak-to-peak amplitude values as defined in NEMA MG-1 (for motors <500 hp) and ANSI/API 541 (for motors ≥500 hp).

The minimum clearance space required for removal of the rotor shall be indicated on both the E635 Specification Sheets and on the dimensional outline drawing.

**E635.2.1.12 Shafts**. All shafts shall be solid. Each shaft shall be furnished with a corrosion-resistant treatment or shall be made of a corrosion-resistant material.

The output shafts of motors furnished with sleeve bearings shall be circumscribed with permanent marks indicating the motor magnetic center and end float limits when level and running at rated speed. A permanent, identified reference point shall be indicated or attached to the bearing housing or shaft seal. The markings shall be easily identifiable for use during motor installation.

For horizontal sleeve bearing motors, the rotor end float and coupling end play shall be in accordance with NEMA requirements. The distance from the magnetic center line mark to each end float limit mark shall be not less than 37.5 percent of the total rotor end float.

**E635.2.1.13 Ground Connectors**. Each motor shall be furnished with a grounding connector attached to the motor frame inside the power lead terminal housing. The grounding connector may be a lug or terminal or other acceptable grounding connector. Ground cable size will be as indicated on the E635 Specification Sheets.

**E635.2.1.14 Grounding Pads**. External grounding pads shall be provided in at least two locations (near mounting feet at opposite corners).

**E635.2.1.15 Torque Characteristics**. Breakaway, run-up/pull-up, and pull-out/breakdown torque shall at all times be at least 10 percent higher than the load-torque of the driven machine at minimum specified starting voltage. Load-torque characteristics will be furnished by the driven equipment Seller; however, the responsibility for successful starting under the given conditions shall rest with the motor manufacturer.

**E635.2.1.16 Couplings**. For motors purchased separately from the driven equipment, coupling drawings or templates for shaft machining will be provided by the Buyer. Half couplings will be supplied to the Seller by the driven equipment Seller. The Seller shall mount and secure the half couplings to the motor shafts.

**E635.2.1.17 Tachometer/controller**. When the X seconds value listed in the motor data sheet line item requirement labeled "Motor safe stall time at minimum starting voltage shall not be less than motor acceleration time at minimum voltage plus X seconds" is not possible or cannot be decreased to a lesser integer value greater than 0 seconds (as determined by all of the Approved Manufacturers), a tachometer/controller shall be furnished for each motor. The tachometer/controller shall have two auxiliary relays, each with Form C contacts, and the relays shall be configurable as either latching or auto reset. The tachometer/controller shall be programmable to allow one auxiliary relay to energize at a motor speed slightly above zero speed (motor shaft just rotating), and the other auxiliary relay to energize at a speed near rated speed. The auxiliary relay contacts are intended to be used in conjunction with motor protective relays by others to prevent motor feeder trip during motor acceleration. Speed sensor and accessories required to support operation of the tachometer/controller shall also be provided as required. The tachometer/controller shall be Tachtrol 3 by AI-TEK, or Buyer approved equal.

**E635.2.1.18 Soleplates**. Soleplates shall be furnished when specified on the E635 Specification Sheets. Soleplate drawings shall be furnished indicating the size and location of the anchor bolts holding each soleplate to the concrete foundation and all mounting, alignment, and connection details and procedures. Motor mounting



bolts shall be furnished with each soleplate. All foundation anchor bolts, washers, and nuts will be furnished by others.

Soleplate anchor bolt cross-sectional area shall not be less than the cross-sectional area of the motor mounting bolts. Anchor bolt holes shall be shop drilled and shall be oversized 1/4 inch in diameter. The anchor bolts shall be located under the motor, and all projections, including washers and nuts, shall clear the motor and its appurtenances completely. Grout holes shall be provided in the central portion of each soleplate. Motor mounting holes shall be drilled and tapped.

Motors shall be designed to permit convenient access for drilling vertically through the motor feet for installation of tapered dowel pins after the motors are mounted with driven equipment. Where motor design requires angle drilling of dowel pin holes through the motor feet, the Seller shall start the dowel pin holes at the required angle, and shall drill each hole to a depth not less than one-half the thickness of the motor feet. The tapered dowel pins shall be furnished by the Seller.

**E635.2.1.19 Critical Speeds**. Motors shall be designed to keep torsional and rotational natural frequencies of vibration at least 25 percent (or at least 15% for well damped resonant frequencies (having amplification factors less than 5.0) subject to approval by Buyer)above or below, preferably above, the motor rated speed ranges to avoid resonant vibration over the operating speed range of the equipment-motor unit.

**E635.2.1.20 Temperature Detectors**. Thermocouple type temperature detectors shall be single-element ungrounded, of ISA type as specified on the E635 Specification Sheets. All temperature detectors shall be ungrounded with detector leads wired to terminal blocks furnished in the accessory terminal housings. A grounding terminal for each temperature detector shall be included with the detector lead terminals. The grounding terminals shall be provided with internal wiring to a common ground connection. The internal wiring shall be removable.

**E635.2.1.20.1 Bearing temperature detectors**. Bearing temperature detectors shall be provided as specified on the E635 Specification Sheets. Each detector shall be complete with a detector head and holder assembly; the detector temperature-sensitive tip shall be hermetically sealed.

Where sleeve type bearings are furnished, each detector tip shall be held in intimate contact with the outside diameter of the bearing babbitt not more than 1/8 inch from the shaft surface of the bearing.

**E635.2.1.20.2 Winding temperature detectors**. Winding temperature detectors shall be provided as specified on the E635 Specification Sheets. Temperature detector and detector lead insulation class shall be the same as the stator coil insulation class.

When resistance temperature detectors (RTDs) are specified, they shall be of the 3 wire type. All leads of a given RTD shall be electrically isolated from the leads of the next RTD. The motor Seller shall clearly indicate on the motor wiring diagrams which winding (phase) of the motor is monitored by each winding temperature detector.

**E635.2.1.21 Current Transformers**. Current transformers shall be furnished as specified on the E635 Specification Sheets. Current transformer relaying accuracy and ratio will be provided by Buyer during detailed design.

**E635.2.1.22 Vibration Transducer Mounting**. Refer to the E635 Specification Sheets for the minimum requirements for vibration transducer mounting provisions. Detailed requirements are provided with the driven equipment specification and/or Technical Supplemental K100.

**E635.2.1.23 Variations from Rated Voltage and Rated Frequency**. Unless specified otherwise on the E635 Specification Sheets, induction motors shall operate successfully under running conditions at rated load with a variation in the voltage or the frequency as follows:



Plus or minus 10 percent of rated voltage with rated frequency.

Plus or minus 5 percent of rated frequency with rated voltage.

A combined variation in voltage and frequency of 10 percent (sum of absolute values) of the rated values, provided the frequency variation does not exceed  $\pm$  5 percent of rated frequency.

#### E635.2.2 Motor Efficiency Contract Price Adjustments

Any motor which, upon test, is found to have an efficiency value less than the value stated in the proposal data shall have the contract price reduced. The price reduction will be the difference between the guaranteed efficiency obtained from the values stated on the E635 Specification Sheets and the actual efficiency as determined from test values multiplied by the appropriate dollar values given on the E635 Specification Sheets. The price reduction will be invoked for each motor of a given motor design based on the testing of one motor of that design.

## E635.2.3 Drawings and Engineering Data

Motor dimensional drawings shall be provided in accordance with Q500 Shop Drawings and Instruction Manuals and include the following information:

Complete nameplate data.

Rotor weight and motor total weight.

Special requirements, if any, for provisions by others for control of shaft end float during starting, operating, or stopping of the motor.

# E635.2.4 Superimposed Motor Driven Equipment Speed-Torque Curves and Supporting Tabulated Data

The Seller shall furnish superimposed speed-torque curves for each motor driven equipment match. Speedtorque curves shall include the motor speed-torque curves at minimum specified starting voltage at 100 percent voltage and at 110 percent rated voltage, superimposed on the driven equipment speed-torque curve during acceleration. Additionally, for high inertia loads, the tabulated data from which each curve was prepared shall be submitted. If the driven equipment configuration allows for both an open inlet condition and a closed inlet/startup condition, driven equipment speed-torque curves and associated tabulated data shall be provided for both conditions. Motors shall not be released for manufacture until the Seller's match of motor driven equipment speed-torque curves is acceptable to the Engineer.

#### E635.2.5 Superimposed Thermal Limit and Time-Current Curves and Supporting Tabulated Data

The Seller shall submit a motor thermal limit curve superimposed on time-current curves during acceleration of the driven equipment for each motor. For high inertia loads, tabulated data from which the curve was prepared shall be submitted.

The thermal limit curve for each motor shall be based on initial motor parts temperatures equal to the service factor load operating temperatures in the maximum specified ambient. Each thermal limit curve shall include the following components:

Locked-rotor thermal limit for values of current from 110 percent rated voltage to the minimum specified starting voltage.

Accelerating thermal limit for values of current from locked-rotor current to the current at breakdown torque, at minimum specified starting voltage.



Running overload thermal limit at rated voltage, for values of current from the current at service factor load torque to the current at breakdown torque.

For each motor, time-current curves during acceleration of the driven equipment shall include acceleration at minimum specified starting voltage, acceleration at 100 percent rated voltage and acceleration at 110 percent rated voltage.

## E635.2.6 Motor Current Versus Speed Curves and Supporting Tabulated Data

The Seller shall submit the motor's current versus speed curves at minimum specified starting voltage, 100 percent voltage, and at 110 percent rated voltage. Additionally, for high inertia loads, the tabulated data from which each curve was prepared shall be submitted.



## E635 Medium Voltage Induction Motors Specification Sheet

This motor data sheet is applicable for motors with n	ameplate ra	atings		
Including and below	3,000 hp (2	2,237 kW)		
Including and above	250 hp (18	6 kW)		
Manufacturing Standard	NEMA/IEEE			
Motor Sizing Criteria	The motor nameplate horsepower rating (kW) multiplied by the motor nameplate service factor shall be at least 15 percent greater than the driven equipment operating range maximum brake horsepower (kW).			
Mounting arrangement	Horizontal	shaft		
Rated voltage (volts) / frequency (hertz)	4000 volts	/ 60 hertz		
Maximum ambient temperature, (°C)	See Section	on D200		
Minimum ambient temperature, (°C)	See Section	on D200		
Altitude	Less than	3,300 ft (1,000 m) abo	ove sea level	
Efficiency, minimum (percent)	N/A			
The following features shall be provided:				
Feature	NEMA			
Enclosure / degree of protection	Explosion proof			
Method of cooling	Not Applicable			
Hazardous classification	NEC Class I, Group D			
Enclosure openings shall be covered with screens manufactured from the following materials:	Stainless Steel			
Air filters	Stainless steel air filters shall be provided.			
Heat exchangers required?	No			
	Source of Water to Heat Exchangers			
Bearing heat exchanger	Not Applicable			
Enclosure heat exchanger	Not Applicable			
No-load sound produced by the motor at 1 meter (dBA)	Per V100			
Full-load starts per year	1,000			
Surge protection to be located in motor terminal box	K Surge Capacitors and Lightning Arrestors			
Current transformers	Current transformers shall be provided for each stator winding for a self-balancing current type differential protection.			h stator ential
Stator winding temperature detectors	RTDs - 100 ohm platinum (six per motor)			
Starting voltage range:	Minimum	80 percent	Maximum	110 percent
Starting current during a full voltage across-the-line start shall not exceed percent of rated current	600			1

Motor safe stall time at minimum starting voltage shall not be less than motor acceleration time at minimum voltage plus	4 seconds (see Sections 2.1 and 2.1.17)			
Incoming power supply cable and terminations	Shielded cable with stress relief kits installed in conduit from below			
Ground connectors in motor terminal box shall accept ground cable size of	4/0 AWG			
Anticondensation space heaters	Space heaters shall be provided. Space heater circuits exceeding 1200 watts shall be configured 3-phase.			
Space heaters shall be rated	240 VAC			
Space heaters shall be energized at	120 VAC (1200 watts or less), 208 VAC (> 1200 watts)			
The following dollar value will be used to evaluate mathematical horsepower (kW) as defined on the motor proposal of	otor energy losses at driven equipment maximum brake lata sheet:			
Dollars (US) / kW	Not Applicable			
Special features and accessories:				
Vibration transducers	Refer to driven equipment sections and/or Technical Supplemental K100. Where no requirements are specified elsewhere, as a minimum, provide a machined surface at each bearing for use with a portable vibration probe.			
Half-coupling supplied by the Buyer				
Shaft end key				
Shaft end keys for both shaft ends				
Nonreverse rotation ratchet device (only required for vertical intake pumps)				
Soleplates	Soleplates for motors shall be provided for all motors not mounted on a common skid with the driven equipment.			
Bearings shall have a life when operating under the load, speed, and thrust requirements of the driven equipment of not less than	To be determined during detailed design			
Horizontal motor bearing type	Either sleeve bearings or antifriction bearings			
Antifriction bearings shall have an ABMA (American Bearing Manufacturer's Association) L10 life of not less thar the following when operating under the load, speed, and thrust requirements of the driven equipment:				
Connection to Driven Equipment	Hours			
Direct	40,000			
Bearing temperature detectors shall be furnished	On each motor bearing			
Bearing temperature detectors shall be	Type E Thermocouples			
Bearing lubrication system	Oil rings			
Bearing lubrication system cooling	Self-cooled			

# E640 Low Voltage Induction Motors

#### E640.1 General

#### E640.1.1 Scope of Supply

Scope of supply shall include furnishing the low voltage induction motors as specified herein and the E640 Low Voltage Induction Motors Specification Sheets at the end of this section.

#### E640.1.2 Codes and Standards

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

Work	In Accordance With	
NEMA/IEEE designed motors	NEMA MG1, ANSI/NEMA C50.41 (for motors larger than 440 series frame), IEEE 112	
Motor efficiency	Applicable National law regulating motor efficiency. In the U.S Energy Independence and Security Act (EISA) 2007	

#### E640.1.3 Approved Manufacturers of Components

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

Component	Manufacturer		
Low voltage induction motors	ABB, Baldor-Reliance, General Electric, Siemens, Toshiba-USA, TECO - Westinghouse Motor, U.S. Motors, WEG, Marathon		

#### E640.1.4 Test Requirements

Each motor shall be tested and inspected at the manufacturer's factory to determine that it is free from electrical or mechanical defects and to provide assurance that it meets the requirements of these specifications. Test procedures shall be in accordance with IEEE or NEMA test procedures for 3-phase induction motors. The routine tests listed in NEMA shall be performed on each motor by the motor manufacturer.

This testing is to be considered part of the defined scope of work, and all associated costs are the responsibility of the Seller unless specifically identified as Optional or Buyer-conducted. Tests identified as an option are to be priced separately. If identified as Buyer-conducted, costs for the initial test will be the responsibility of the Buyer. However, the Seller is responsible for all costs associated with correcting deficiencies and retesting in the event of a test failure:

Copies of reports of the quality control tests and inspections for each motor shall be submitted prior to shipment of the motor from the manufacturer's factory.

Tests In Accordance With Conducted By
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Tests	In Accordance With	Conducted By
NEMA/IEEE designed motors	NEMA MG1, IEEE 112, ANSI/NEMA C50.41	Motor manufacturer

#### E640.2 Products

#### E640.2.1 Design and Construction

Motors shall be designed for direct-on-line (full voltage) starting. All motors shall be capable of continuous running duty in the specified ambient. Intermittent duty motors may be furnished where recognized and defined as standard by the equipment standards and codes.

**E640.2.1.1 Nameplates**. All motor nameplate data shall conform to the requirements of the standards listed in Article E640.1.2. The following additional nameplate data shall be included:

Insulation system class designation.

Maximum ambient temperature for which motor is designed and temperature rise by resistance.

Starting limitations, if any.

Direction of rotation and voltage sequence.

Type and grade of bearing lubricant, attached adjacent to lubricant filling devices.

Complete nameplate data shall be included on the motor dimensional drawing submitted for final review. All motor nameplates and attachment pins shall be corrosion-resistant metal.

**E640.2.1.2 Enclosures**. Enclosure parts for all motors (e.g., frames, bearing brackets, terminal housings, external fan covers) shall be made of cast iron, cast steel, sheet steel, or steel plates. Aluminum enclosure parts are not acceptable.

Motors located in areas classified as hazardous shall be furnished with enclosures certified for use in the classified area.

Totally enclosed motors shall be furnished with drain holes and rotating shaft seals and bearing housing seals (Inproseal or equal approved by Buyer). Drain holes shall be provided with combination water drain-breather plugs. External cooling fans for fan cooled motors shall be fabricated of brass, bronze, or aluminum alloy containing not more than 0.2 percent copper, malleable iron, or plastic. All plastic fans shall be fabricated of a reinforced thermosetting plastic.

Totally enclosed motors shall have all exposed metal surfaces protected with a corrosion-resistant polyester or epoxy paint or coating and shall have enclosure interior surfaces and the stator and rotor air gap surfaces protected with a corrosion-resistant alkyd enamel or with polyester or epoxy paint or coating. Bolts, nuts, screws, and other hardware items shall be corrosion-resistant or zinc dichromate treated metal.

**E640.2.1.3 Insulation and Windings**. All stator winding materials shall have a Class F 311° F (155° C) or higher thermal classification. The stator insulation system shall include two dips and bakes of varnish or, alternatively (subject to approval by Buyer), may use materials and a process that has been proven to completely eliminate voids in the stator slots and between the stator conductors. All insulated stator conductors shall be copper.

**E640.2.1.4 Temperature Rise**. The temperature rises at rated output shall not exceed those for a Class B thermal insulation classification.

Source: 21000, 2015 Technical Supplemental Specific	ations Page 184 of 270
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**E640.2.1.5 Space Heaters**. Space heaters shall be furnished as specified on the E640 Specification Sheets. Heaters shall be located and insulated so they do not damage motor components or finish. Space heaters shall be sized as required to maintain the motor internal temperature above the dew point when the motor is idle.

**E640.2.1.6 Terminal Housings**. A single terminal housing for motor power leads and accessory leads shall be furnished on all motors. All terminal housings shall be externally mounted on the motor frame enclosure. Terminal housings for all motors shall be cast iron or sheet steel. Minimum protection requirements shall be equivalent to NEMA 4. All motors shall be furnished with an oversized terminal housing. Location and dimensions of terminal housings shall be acceptable to the Buyer.

**E640.2.1.7 Leads**. All leads, including motor power leads, space heater leads, and temperature sensing device leads, shall be wired into the terminal housing. All motor leads located in the housings shall be permanently marked for ease of identification.

All motors shall have the direction of rotation marked by an arrow mounted visibly on the stator frame near the terminal housing or on the nameplate and the leads marked for phase sequence to correspond to the direction of rotation and supply voltage sequence.

Cable motor leads shall be fully insulated and provided with permanent phase identification.

**E640.2.1.8 Ground Connectors**. Each motor shall be furnished with a grounding connector attached to the motor frame inside the motor terminal housing. The grounding connector may be a lug or terminal or other acceptable grounding connector. The grounding connector size shall be in accordance with NEC requirements based on the motor full load amperes unless otherwise specified on the E640 Specification Sheets.

**E640.2.1.9 Bearings**. The Seller shall determine the type of bearings to be furnished based upon the load, speed, and thrust conditions of the driven equipment. All bearing mountings shall be designed to prevent the entrance of lubricant into the motor enclosure or dirt into the bearings. Bearings and bearing housings shall be designed to permit disassembly in the field for inspection of the bearings or removal of the rotor.

Antifriction bearings shall be designed and fabricated to have a life as specified on the E640 Specification Sheets. Antifriction bearings shall be grease lubricated, self-lubricating, and regreaseable. Grease fittings for lubrication shall be arranged for safe, easy addition of lubricant from the outside of the motor while the motor is in service.

Bearing lubricants shall contain a corrosion inhibitor. The type and grade of lubricant shall be indicated on a nameplate attached to the motor frame or end shield adjacent to the lubricant filling device. The Seller shall furnish all lubrication information required to assure proper equipment startup and subsequent bearing maintenance.

**E640.2.1.10 Rotors**. All induction motors shall have squirrel-cage rotors. Rotors shall be adequately sized to avoid overheating during acceleration of the motor and driven equipment. Rotors shall be die-cast aluminum construction or shall have fabricated copper or copper alloy cage material. Fabricated aluminum cage materials will be considered on 2-pole motors only.

All fabricated cage rotor bars shall be installed using swaging or wedging or other proven method acceptable to the Buyer to prevent rotor bar vibration.

**E640.2.1.11 Shafts**. All shafts shall be solid. Each shaft shall be furnished with a corrosion-resistant treatment or shall be made of a corrosion-resistant material.

**E640.2.1.12 Torque Characteristics**. Breakaway, run-up/pull-up, and pull-out/breakdown torque shall at all times be at least 10 percent higher than the load-torque of the driven machine, even at minimum specified

starting voltage. Load-torque characteristics will be furnished by the driven equipment Seller; however, the responsibility for successful starting under the given conditions rests with the motor manufacturer.

**E640.2.1.13 Critical Speeds**. Motors shall be designed to keep torsional and rotational natural frequencies of vibration at least 25 percent (or at least 15 percent for well damped resonant frequencies (having amplification factors less than 5.0) subject to approval by Buyer) above or below, preferably above, the motor rated speed ranges to avoid resonant vibration over the operating speed range of the equipment-motor unit.

**E640.2.1.14 Variations from Rated Voltage and Rated Frequency**. Unless specified otherwise in Articles E640.1.2 through E640.1.4, induction motors shall operate successfully under running conditions at rated load with a variation in the voltage or the frequency as follows:

Plus or minus 10 percent of rated voltage with rated frequency.

Plus or minus 5 percent of rated frequency with rated voltage.

A combined variation in voltage and frequency of 10 percent (sum of absolute values) of the rated values, provided the frequency variation does not exceed plus or minus 5 percent of rated frequency.

# E640.3 Drawings and Engineering Data

Motor dimensional drawings shall be provided in accordance with Q500 Shop Drawings and Instruction Manuals and include the following information:

Complete nameplate data. Rotor weight and motor total weight.

Special requirements, if any, for provisions by others for control of shaft end float during starting, operating, or stopping of the motor.

# E640 Low Voltage Induction Motors Specification Sheet

Application	Indoor or outdoor areas, g		general purpose	
This motor data sheet is applicable for motors with nameplate ratings:				
Including and below 249 hp (186 kW)				
Including and above	3/4 hp	(560 watts)		
Rated voltage / frequency	460 vo	lts / 60 Hz		
Speed	Coordi	nated with driven	equipment	
Motors shall be manufactured to	NEMA/	IEEE Standards		
The following features shall be provided				
Feature		NEMA/IEEE		
Enclosure/degree of protection		Totally enclosed	fan-cooled	
Method of cooling		Not Applicable		
Hazardous classification		Not Applicable		
Maximum ambient temperature, °F (°C)		See Section D20	00	
Minimum ambient temperature, °F (°C)		See Section D20	00	
Motor nameplate horsepower multiplied by the motor nameplate service factor for NEMA/IEEE motors shall be at least 15 percent greater than the driven equipment operating range maximum brake horsepower. Motor nameplate kW for IEC motors shall be at least 15 percent greater than the driven equipment operating range maximum brake kW. Motors shall be sized to operate at a Service Factor equal to or less than 1.0 during normal operation.				
Starting voltage range				
Minimum (percent)			80	
Maximum (percent)			110	
Locked rotor current during a full voltage across-the-line start shall not exceed percent of rated current for motors above 50 HP (37 KW)			650	
Altitude above sea level			Less than 3,300 ft (1,000 m)	
Bearings on horizontal motors shall have a life when operating under the load, speed, and thrust requirements of the driven equipment of not less than the following:				
Direct coupled service, hours			40,000	
Belt or chain connected service, hours			20,000	
Bearings on vertical motors shall have a life (hours) of not less than			40,000	
Anticondensation space heaters shall be provided on all motors located outdoors equal to or above			30 hp (22.4 kW)	
Space heaters shall be rated			240 VAC, single-phase	
Space heaters shall be energized at			120 VAC, single-phase	
Additional Requirements NEMA Premium efficience			cy; Standard balanced rotors or better	

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# **K100** Instrumentation General Requirements

#### K100.1 General Requirements

Unless specified otherwise in other sections, all instrumentation components furnished with equipment shall be in accordance with the following.

Instrument air for pneumatic instrument and control devices will be clean, dry, and oil free.

All instrumentation shall be provided with a stainless steel tag, which shall be attached with rivets or stainless steel wire.

All instruments requiring electrical wiring shall be provided with threaded connections to either 3/4 inch (preferred), 1/2 inch conduit or gland seal as appropriate.

Electrical housings shall be dustproof and moisture-proof in accordance with NEMA 4 or NEMA 4X (IP65) requirements or, if they are installed in a hazardous area, shall be of a design suitable for the specific area classification.

Components of the instrument that contact the process media shall be stainless steel or a material suitable for service approved by the Engineer. Coatings shall not be considered adequate protection to resist process corrosion.

Pressure instruments shall be capable of withstanding sustained over-pressurization to 150 percent of the maximum service pressure, or the system design pressure, whichever is greater, with no subsequent loss of function or change in measurement accuracy.

The process connection on each pressure instrument shall be 1/2 inch MNPT for bottom connection static pressure indicators, at least 1/4 inch FNPT for draft differential pressure devices, and at least 1/4 inch FNPT for all others.

Instruments shall be calibrated in the factory. Calibration ranges shall be suitable for the process conditions. The instruments shall be calibrated so that the normal readings fall somewhere near two-thirds of the calibrated span. Certified calibration sheets shall be furnished for each instrument with a copy included with shipment of each device and in the instruction manual.

Contact ratings shall be as specified in Technical Supplemental E530, Article E530.6 Contacts.

Analog devices (transmitters, positioners, etc.) shall include HART communication capability with onboard diagnostics.

For instrumentation that is supplied skid mounted or installed on package equipment, the instrument installations shall be designed for maintenance and local display viewing accessibility without the use of ladders or scaffolds. For skids that require freeze protection of the instrumentation by the Buyer, space shall be provided to install insulation and freeze protection boxes around the instruments and tubing.

The Seller shall furnish, as a deliverable, ISA-format datasheets for all Seller-provided instruments.

The Seller shall furnish, for Buyer review, plan drawings showing instrument locations on or around the equipment.

Freeze protection insulated enclosures shall be furnished for outdoor devices that can freeze at temperatures at or below 32° F. Clam-shell enclosures shall be furnished including instrument mounting hardware to accommodate transmitters, manifolds, instrument valves, tubing, fittings, and accessories. When applicable, instrument valves and blowdown valves shall be mounted inside the enclosure.



Source: 21000, 2015 Technical Supplemental Specifications

Enclosures shall be hinged and include braces to provide easy hands-free access of internal components. Enclosures shall include suitably sized 120 VAC thermostatically controlled space heaters wired to terminal blocks. Heaters shall be wired to externally mounted junction boxes located outside the enclosure.

Transmitters and standalone area monitors/hazardous gas detectors in general shall be 2 wire loop powered wherever possible.

# K101 Local Indicators and Switches

# K101.1 Local Indicators

Each local indicator shall have the service legend engraved on the dial or have a tag, engraved with the Buyer's ID number and the service legend, attached to it. Each tag shall be engraved laminated phenolic or stainless steel. Legend and tag number will be provided by the Buyer.

The scale range of each indicator shall be selected so that the normal operating condition is approximately midscale (between one third and two thirds of full scale of the dial). Except for pressure differential gauges, rotary type indicator full scale pointer travel shall be a minimum of 270 degrees. Indicator dial size shall be at least 4-1/2 inches.

Differential pressure indicator full scale pointer travel shall be at least 80 degrees. Indicator dial size shall be at least 4 inches. Accuracy shall be 2 to 4 percent of full scale range.

# K101.1.1 Pressure Indicators (Gauges)

Each static pressure indicator shall be equipped with a pressure relief device designed to protect the operator from high pressure blowout of the indicator. Each indicator shall have a stainless steel movement, wetted parts, and socket unless the application requires other materials. The housing shall be dust- and moisture-resistant and shall be furnished with laminated safety glass. Each indicator shall be provided with overpressure stops to protect against pressure surges outside the scale range limits. Each pressure indicator indicating supply air pressure to an instrument shall be in accordance with the Manufacturer's standards. Pressure indicators shall conform with ASME B40.1, Class 2A (0.5% accuracy).

Where pressure oscillations are expected, a pulsation dampener shall be furnished on each indicator to protect against process fluid oscillations of  $\pm 3$  percent or more of the full scale range. The pulsation dampener shall be adjustable with the pressure indicator installed on the process line. If approved by the Buyer, Manufacturer may provide mechanical/anti-flutter linkage gauge dampening instead of a separate dampener. Mechanical linkage dampers shall be proven to provide the 3 percent level of dampening specified.

Preformed coil pipe siphons or straight siphons shall be furnished for gauges where hot condensable vapors or steam are present. Siphon materials shall be suitable for the process design temperature and pressure, and shall have 1/2 inch threaded connections.

Indicators for outdoor liquid processes that can freeze at 32° F (or below) shall be furnished with a silicone fill and diaphragm seal. Seals shall include 316 stainless steel welded diaphragms and bottom housings with 1/2 inch FNPT process connections. Silicone fill and seal attachment shall be done at the factory.



Pressure Indicator			
Material Wetted Parts	Acceptable Manufacturer/Model		
Suitable for process fluid (316 SS minimum or Engineer approved alternative)	Weksler AA44 Ashcroft 1279SS US Gauge 1981 3-D Instruments Accu-Drive Series 25 Perma-Cal 111TIDxxAx3LT Dwyer Series 4000		

# K101.1.2 Temperature Indicators

Each temperature indicator for local mounting shall be a bimetal or gas actuated, filled thermal system type, gauge with at least a 5 inch dial having an every-angle adjustability. Temperature indicators shall be furnished with a compression union so that the stem will bottom out when placed in the thermowell. Gas actuated systems shall only be used where a direct mounting does not allow for easy viewing.

Temperature indicators shall conform with ASME B40.3, grade A (1% accuracy).

Each gas actuated indicator shall be furnished with armored stainless steel capillary tubing of the length required for the installation. If required, thermowells with lagging extensions shall be furnished for all indicators and shall be as specified under the article entitled Thermowells, Protecting Tubes, and Test Wells, except that extension nipples shall not be furnished for temperature indicators.

Temperature Indicator				
Description	Construction	Switch Contact Ratings	Acceptable Manufacturer/Model	
Bimetallic	5-inch dial, every angle adjustable	N/A	Ashcroft US Gauge Wika	

# K101.1.3 Magnetic Level Gauges

Magnetic level indicators shall be provided with flag-style magnetically actuated colored flags. Indicator shall include a flanged bottom to allow access to the float. Float and sensor tube shall be of material suitable to the process conditions with 316SS as a minimum. Gauges shall be furnished to match the design pressures and temperatures of the application.

# K101.2 Process Actuated Switches

As a general rule, process transmitters shall be used in lieu of process switches, as transmitters provide better accuracy and reliability, and allow for process monitoring.

Process switches shall not be used without the written consent of the Buyer.

Process measurement (Pressure, differential pressure, and level) will be field adjustable, vibration resistant, and will have high repeatability with minimal temperature effect. Switches located in non-hazardous areas shall be rated NEMA 4 or NEMA 4X.

Switch contacts shall include at least one DPDT element. Where multiple pole switches are furnished for one trip (actuation) point, actuation and reset of all poles shall occur simultaneously. Switch contact shall be of the snapacting type. Mercury wetted switch contacts shall not be used without Buyer's approval. Switch set point shall be field adjustable and tamperproof. Range, repeatability, deadband, and overpressure capability shall be acceptable to the Buyer. Switch contacts shall be rated for 5 Amps at 120 VAC.



Source: 21000, 2015 Technical Supplemental Specifications

Pressure switches shall be furnished with factory installed isolation/test manifolds. Static pressure service devices shall be furnished with two-valve manifolds.

Differential pressure service devices shall be furnished with five-valve manifolds that include isolation, equalization, and test valves.

Manifolds shall be compliant with ASME B31.1 requirements, and shall include grafoil packing with stainless steel construction.

Other Buyer approved materials shall be used if stainless steel is not suitable for the process.

# K101.2.1 Pressure and Temperature Switches

Pressure switch accuracy shall be  $\pm 1$  percent of full scale range. Pressure switch sensing elements shall be bellows, diaphragm, or piston. Wetted parts shall be suitable for the application.

Temperature switch accuracy shall be  $\pm 2$  percent of full scale range. Each temperature switch shall be furnished with a thermowell (as specified under Thermowells, Protecting Tubes, and Test Wells). Each temperature switch sensing element shall be of the bimetal or filled thermal system type.

Pressure Switch						
Description	Switch Contacts	Material Wetted Parts	Manifold?	Fail- Safe?	Deadband	Acceptable Manufacturer/ Model
Pressure Switch - Gauge	SPDT	Stainless Steel or Engineer approved alternative	No	N/A	Manufacturer's Standard	Ashcroft Dwyer Instruments, Inc. – (Capsu- Photohelic) S-O-R, Inc. United Electric Buyer Approved Equal
Pressure Switch - Differential (Static Pressure < 500 psi)	DPDT	Stainless Steel or Engineer approved alternative	Yes	N/A	1%	Ashcroft Dwyer Instruments, Inc. – (Capsu- Photohelic) S-O-R, Inc. United Electric Buyer Approved Equal
Pressure Switch - Differential (Static Pressure > 500 psi)	DPDT	Stainless Steel or Engineer approved alternative	Yes	N/A	2%	Ashcroft Dwyer Instruments, Inc. – (Capsu- Photohelic) S-O-R, Inc. United Electric Buyer Approved Equal

Temperature Switch			
Description	Construction	Switch Contact Ratings	Acceptable Manufacturer/Model
Gas Filled	Filled thermal system assembly, with thermowell	5A at 120 VAC	Allen-Bradley Bulletin 837 Ashcroft Type 400B United Electric Series 400 S-O-R, Inc.

# K101.2.2 Float Type Level Switches

Cages of float type level switches shall be compliant with ASME B31.1.


Float type level switches shall be of the all-welded construction type. Each instrument shall have a float, body construction, and switch element appropriate for the application. The switch element shall be magnetically coupled to the float or displacers. Mercury contacts are not permitted. Rolling ball-style elements are not permitted.

Level switches for sumps or underground storage tanks shall be cable-mounted displacement style or cablehung float switches. Switches shall include sealed enclosed housings and hermetically sealed SPDT snapacting switch contacts. Cable shall be suitably rated for full liquid immersion and shall be furnished in appropriate length to wire to the Manufacturer's termination panel.

Switch construction shall include accessories required to insure that the customer wiring can be rated for 90° C or lower for all process design conditions. Accessories may include extensions, fins, condensing bulbs, external termination enclosures, etc.

Level Switch - Enclosed Cage					
Switch Contacts	Deadband	Switch Construction	Cage Construction	Sensing Element and Switch Material Wetted Parts	Acceptable Manufacturer/ Model
2SPDT	Manufacturer's Standard	Snap Acting	B31.1	Stainless Steel or Engineer approved alternative	Magnetrol International S-O-R, Inc.

	Level Switch - Float or Displacer Type				
Switch Contacts	Deadband	Switch Construction	Cage Construction	Material Wetted Parts	Acceptable Manufacturer/ Model
SPDT	Manufacturer's Standard	Snap Acting	N/A	Manufacturer's Standard	Warrick Series "M"(for AC interrogation only) ITT Flygt ENM 10 Series Magnetrol Highland Tank (for oil water separators only)

# K101.2.3 Conductivity type Level Switches and Level Indicator Devices

Conductivity type level devices shall include prefabricated water columns with appropriately designed ports along with plugged vent and drain connections. The probe and water column shall be factory assembled and include a wiring enclosure or junction box with pre-terminated high temperature extension wire for connection to an externally mounted signal conditioning relay junction box. Junction boxes and signal conditioning boxes shall be stainless steel and include a NEMA 4X rating.

Signal conditioning junction boxes shall be furnished suitable for field mounting near the probes and water column. Signal conditioners shall be suitable for a 120 VAC power source. Where used for redundant applications, the system shall include provisions to accept redundant power sources.

Specialized high- temperature wiring shall be furnished for field connection between the water column junction box and the signal conditioning junction box. Signal conditioning devices shall include a Form C relay contact output for system faults- including loss of external power.

Electrode sensitivity shall be user adjustable to allow for variations in water purity.

However, no adjustment shall be required over the normal operating range of pressure.

For drum applications, density compensation calculations shall be performed to determine the spacing between the level probes. The column shall be designed to minimize the error between actual drum level and indicated column level as a result of density error. Maximum observed error shall be ½ inch or less under all operating conditions

The electrodes shall be installed into the measurement column which senses the sample in the column using low voltage resistivity measurement. Electrodes shall be field replaceable and shall be installed into the column with a gasket-less leak-proof seal for applications over 1000 psig. Electrodes may include gaskets at pressures less than 1000 psig. The electrodes shall be equipped with built in lightning surge protection.

Conductivity based level indicator devices for boiler drums (including the probes, columns, valving, and indictors) shall conform with the requirements of ASME Boiler and Pressure Vessel Code.

Where conductivity type level devices are used, spare sensing elements shall be furnished with the equipment. A minimum quantity of 5% spare probes shall be furnished.

Level Switch or Indicator- Conductivity Type					
Switch Contacts	Deadband	Switch Construction	Water Column Construction	Material Wetted Parts	Acceptable Manufacturer/ Model
SPDT	Manufacturer's Standard	Relay	Steel, Per B31.1	Stainless steel probes. Water Column to match process piping	Clark Reliance FST Rosemount (Solatron) Tyco/Yarway

#### K101.2.4 Flow Switches

Flow switches shall generally be piston type with an integral indicator. Switch wetted parts shall be suitable for the process fluid.

Flow Switch				
Switch ContactsDeadbandMaterial WParts		Material Wetted Parts	Acceptable Manufacturer/Model	
SPDT		Application specific	Manufacturer's standard	

# K102 Transmitters and Temperature Instruments

#### K102.1 Temperature Element Assemblies

Each temperature element assembly shall be a thermocouple or resistance temperature detector equipped with a thermowell. Each temperature element and thermowell shall be spring-loaded and furnished as a complete assembly, including well, nipple-union-nipple, and weatherproof connecting head.

#### K102.1.1 Thermocouples

Each thermocouple shall be furnished packed in a stainless steel sheath with magnesium oxide insulation and shall have an ungrounded measuring junction. Each thermocouple shall be in accordance with the table attached at the end of this section unless otherwise specified, and shall meet the standard limits of error specified in ASTM E-230/E230M. Extension wire shall be coordinated with the thermocouple type.

#### K102.1.2 Resistance Temperature Detectors (RTDs)

Each RTD shall be in accordance with the table attached at the end of this section unless otherwise specified, with stainless steel sheath, packed in magnesium oxide. Each RTD shall meet the standard limits of error.

Temperature Element					
Description	Grounding	Construction	Switch Contact Ratings	Acceptable Manufacturer/Model	
Thermocouple	Ungrounded	ISA Type E (Chromel- Constantan) with EX Extension Wiring	N/A	Pyromation Pico STI Manufacturing JMS Southeast, Inc Statesville, NC USA Sandelius Instruments – Houston, TX TSC – Garland, TX	
Resistance Temperature Detector	N/A	Pt 100-ohm (at 0°C), 3-wire type	N/A	Pyromation Pico STI Manufacturing JMS Southeast, Inc. – Statesville, NC USA Sandelius Instruments – Houston, TX TSC – Garland, TX	
Special Requirements:	Type E thermocouples are the Buyer's standard thermocouple. If the temperature requirements exceed the Type E application, then ISA Type K thermocouples shall be supplied. RTDs shall only used only when an equipment Seller feels it is prudent for a performance reason.				

#### K102.2 Thermowells, Protecting Tubes, and Test Wells

Thermowells shall be one-piece construction from barstock, with suitable provisions for attachment to the pipe. Welded thermowell tips are not acceptable. When boss/'o-let fittings are used in alloy or non-alloy piping, the fitting material shall match the pipe material. Wells shall be stepless (except for air and flue gas applications) tapered construction.

Thermowells for thermocouples, RTDs and bi-metal thermometers shall have an inner bore of 0.260 inch. Thermowells for filled thermometers shall have an inner bore of 0.385 inch. Test wells shall have an inner bore of 0.385 inch, which will permit interchangeability of dial thermometers, test thermometers, thermocouples and RTDs. Thermowell outside diameter at the large end of the taper shall be approximately the same as the root diameter of the threads.



Thermowell accessories for thermocouples and RTDs shall include extension nipple-union-nipples and connection heads. Connection heads shall be weatherproof with screwed covers and connection blocks of appropriate design for the temperature detectors installed. Connection heads shall include grounding screws. Each thermowell shall be furnished with a 6 inch stainless steel nipple-union-nipple assembly in addition to a lagging extension if required to keep the thermocouple head away from the insulation and lagging.

Each element shall be furnished with separate positive and negative terminals for extension wire connection and with a grounding screw for termination of each extension wire shield.

For thermocouples, terminal blocks shall be brass compression style with brass blocks on a ceramic baseplate. For RTDs, terminal blocks shall be compression style with nickel-plated brass blocks on a ceramic baseplate.

Test wells without permanently installed temperature detectors shall have lagging extensions as needed to clear insulation. Test wells shall be supplied with a stainless steel plug or cap for closure. A stainless steel captive chain shall be included to connect the plug or cap to the test well.

Each duct temperature sensor shall be equipped with a protecting tube. Each protecting tube shall be 1 inch OD standard weight pipe, stainless steel unless otherwise specified, with a bushing provided to make a 2 inch NPT threaded connection to the duct wall, allowing a variable insertion length into the duct. After the protecting tube has been inserted through the bushing, it will be seal welded to the bushing. Protecting tubes shall be made of Type 316 stainless steel and shall be provided with stainless extension nipples and unions. Protection tubes shall be closed end type.

Thermowell material is dictated by the piping material, and essentially falls into one of two categories, e.g., wells installed into alloy pipe and wells installed into non-alloy pipe.

Thermowells using a threaded installation shall be constructed of ASTM A479 316 stainless steel (or alloy material, if process temperature requires). The exception to this requirement is for water-wetted boiler piping and water-wetted non-boiler external piping as defined by ASME BPVC and B31.1. For these ASME defined water-wetted applications, well material shall be in compliance with the ASME codes (i.e., match the pipe material). Wells that are to be in-line welded in non-alloy or any other pipe shall match the pipe material.

The Seller shall perform design velocity and allowable length calculations for any thermowells in high velocity hydrocarbon gas services. Calculations shall evaluate all governing design conditions including design velocities and clean out velocities. Thermowell calculations shall be in accordance with ASME PTC 19.3-TW, Thermowells. Calculations shall show that well designs pass all PTC requirements. Calculations shall be submitted for Engineer review in accordance with the Schedule of Submittals.

#### K102.3 Transmitters

Transmitters for the measurement of static pressure, differential pressure, level, or flow shall be microprocessorbased and of the 2 wire design. Transmitter sensing element shall be of the diaphragm or capsule type. All wetted parts shall be stainless steel unless the application requires another material.

Gold-plated transmitter diaphragms shall be used in hydrogen service above 300 psig.

Tamperproof zero and span adjustment shall be provided. Transmitter accuracy shall be ±0.075 percent of calibrated span or better and a minimum turndown capability of 50:1. Transmitter housing shall be dustproof and moisture-proof, aluminum, rated NEMA 4X (in non-hazardous areas) and shall include ½-inch NPT conduit connections

All transmitters shall be furnished with integral local LCD indicators that are field configurable at the transmitter to indicate the measured process range.



Transmitters shall be furnished with integral manifolds factory attached to the transmitter. Static pressure service transmitters shall be furnished with two-valve manifolds.

Transmitters shall be factory calibrated.

Differential pressure service devices shall be furnished with five-valve manifolds that include isolation, equalization, and test valves.

Manifolds shall be compliant with ASME B31.1 requirements and shall include grafoil packing with stainless steel.

Manifolds may be constructed of other Buyer-approved materials if required for process compatibility. Fugitive emissions packing is required in hydrocarbon service. Transmitters shall be furnished with universal mounting brackets.

Where static pressure transmitters are used for outdoor level service on liquids that can freeze, integral diaphragm seals shall be furnished. Seals shall be stainless steel as a minimum, direct mount flanged style and include flushing rings with plugged ports.

Pressure Transmitter (Static and Differential Types Used for Pressure, Level or Flow)					
Description	Transmitter Output	Manifold?	Material Wetted Parts	Acceptable Manufacturer/Model	
Pressure Transmitter	4-20 mA 2-wire w/HART or Foundation Fieldbus	Yes	Stainless Steel or Engineer approved alternative	Rosemount – 3051 C or T Honeywell – ST 3000 Yokogawa – EJA Series Anderson Greenwood, Swagelok, PGI, or Rosemount manifolds	
Level Transmitter	4-20 mA 2-wire w/HART or Foundation Fieldbus	Yes	Stainless Steel or Engineer approved alternative	Rosemount – 3051 C or T Honeywell – ST 3000 Yokogawa – EJA Series Anderson Greenwood, Swagelok, PGI, or Rosemount manifolds	
Flow Transmitter	4-20 mA 2-wire w/HART or Foundation Fieldbus	Yes	Stainless Steel or Engineer approved alternative	Rosemount – 3051 C or T Honeywell – ST 3000 Yokogawa – EJA Series Anderson Greenwood, Swagelok, PGI, or Rosemount manifolds	



Level Transmitter - Ultrasonic					
Transmitter Output	Energizing Power	Material Wetted Parts	Cage Material	Cage Construction	Acceptable Manufacturer/ Model
4-20 mA	24 VDC (for 2-wire) 120VAC (for 4-wire)	Stainless Steel	Not applicable	Not applicable	Magnetrol International, Endress Hauser, Siemens Milltronics, Rosemount, Ametek Drexelbrook
	Level Transmitter - Displacer				
4-20 mA	24 VDC (2 wire)	Stainless Steel	Manufacturer's standard	Per B31.1 with vent and drain connections	Fisher Controls, Magnetrol

Displacer-style level transmitters shall not be used without authorization from the Buyer.

# K102.4 Radio Frequency Probe and Radar Type Level Devices

Each radio frequency (RF) probe type level instrument system shall be constructed to withstand the service conditions of the application. Each level instrument system shall be designed to ignore material buildup or coating on the sensing element and only respond to changes in level. Where required by the manufacturer's design, each level instrument system furnished shall be complete with suitable RF interference filters to eliminate the effect of other transceivers operated in the area. Each point type system output shall use double-pole, double-throw (dpdt) output contacts.

In each application that requires the electronics unit to be mounted separately from the probe, the necessary cable shall be furnished to connect the sensing probe(s) to the separately mounted electronics enclosure. The cable shall be suitable for the environment in which it is installed and shall have the necessary mechanical strength to be pulled through conduit. A factory installed connector shall be installed on only one cable end when the cable is to be installed in conduit. A field installed cable termination kit shall be furnished for the other end.

#### K102.4.1 Radar Level Transmitters

Radar level transmitters shall be either guided wave or non-contacting technology depending on the application. Non-contacting style shall be used for solids or liquids where direct contact cannot be tolerated. Wetted parts shall be 316 stainless steel or better. Heat insulators shall be furnished between the sensor and the transmitter where required by process temperature.

Externally mounted guided wave radar probes shall be furnished with cages suitably designed for the process conditions. Cages shall include flanged upper and lower connections along with <sup>3</sup>/<sub>4</sub>" plugged drain and vent connections. Cages shall be suitable for the process design temperature and pressure.

For saturated steam services over 100 PSI, guided wave radar transmitters shall be furnished with on-board dynamic compensation for temperature based changes in steam vapor dielectric. For services below 100 PSI, static compensation shall be furnished.

Non-contacting radar transmitters shall have beam angle of 11.5 degrees from vertical or as recommended by the transmitter manufacturer for the application.



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193946.67.9120	Power Generation System	29December2017

Transmitters shall be 2-wire style with a 4-20 mA output and non-interactive zero/span adjustments. Transmitters shall include HART protocol for communication with hand-held configuration devices. Transmitters shall include integral displays.

Guided wave sensors shall be coaxial, single rod-style, or cable guided as required for the application. Cable guided style probes shall include weights, and shall only be used for non-process services such as sumps or waste water. Coaxial or single rod style probes shall be used for saturated steam or vapor services.

Radar Level Transmitter					
Transmitter Output	Energizing Power	Material Wetted Parts	Cage Material (guided wave only)	Cage Construction	Acceptable Manufacturer/ Model
4-20 mA	24 VDC (for 2-wire) 120VAC (for 4-wire)	Stainless Steel	Manufacturer's Standard	Per B31.1, match the process piping. Include vent and drain connections	Rosemount, Magnetrol, Endress Hauser, Buyer approved equal

#### K103 Valves and Accessories

#### K103.1 Solenoid Valves

Solenoid valves shall be selected to incorporate body construction, trim materials, and internal arrangements suitable to the application. Each solenoid coil shall be UL listed Class H high temperature construction and shall be suitable for continuous duty.

Solenoid valve construction and CV (orifice size) shall be suitable for the service. Where the manufacturers/models listed below do not meet the process requirements, Buyer approved alternates may be furnished.

Solenoid valves used in non-hazardous service shall include terminal blocks in NEMA 4X enclosures for customer connections.

Solenoid valves used as pilot valves on air actuators shall be pre-tubed. Arrangement shall allow venting of air from the actuator. Normally, three-way valves will be sufficient. However, four-way valves are required for all operators employing springless operation.

	Solenoid Valve			
Coil Type	Coil Rating	Manual Operator	Acceptable Manufacturer/Model	
Туре Н	120 VAC, 60 Hz	Yes	ASCO – EFHB8320G174xx (Brass ExP) ASCO – EFHB8320G200xx (Stainless Steel ExP) ASCO – JKH8320G172xx (Brass NEMA 4,<100 dp) ASCO – JKB8320G174xx (Brass NEMA 4) Buyer Approved Equal	
Туре Н	24 VDC	Yes	ASCO – EFHB8320G200 (Stainless Steel ExP) ASCO – EVHT8327G42 (Stainless Steel ExP) Buyer Approved Equal	

The manufacturer's standard solenoid valves may be furnished for the following applications: dust collector pulse air, hydraulic fluids, and gauged solenoids within an enclosure.

#### K103.2 Position Switches

Position switches shall be provided for the indication of each remotely actuated device (proximity type where possible). These devices include, but are not limited to, the following:

Valves.

Dampers.

Gates.

Electric/Pneumatic Drives with Linkages.

Position switches are not required on pilot solenoids or primary drive motors.

Position switches shall be provided in both the "Open" and "Closed" positions of these devices. For devices that modulate in severe service applications (i.e., are controlled by an external modulating signal), a proximity position switch shall be provided in the de-energized position of the device. This includes services such as steam bypass and boiler feed pump recirculation. Additional position switches shall be provided as specified herein.

Switch contacts should be designed to operate reliably with low power applications with minimal or no leakage current (i.e., 24/48 VDC interrogation with low current).

Top-mounted beacon style indicator and limit switch assemblies shall be furnished for rotary/quarter turn rack & pinion style actuators. Position switch actuation points shall be field adjustable. The limit switch compartment shall also include terminations for the solenoid valve.

Beacon indicator color shall be black and yellow where yellow-on-yellow indicates valve closed, and alternating yellow/black indicates open.

Switch - Lever (Linear Valves, Dampers, and Gates)					
Description	Switch Contacts	Deadband	Acceptable Manufacturer/Model		
Position Switch – Mechanically Actuated	DPDT	Manufacturer's Standard	NAMCO Controls EA-170 Honeywell Microswitch Type LS Allen Bradley 802T-ATP		

Switch - Proximity (Linear Valves, Severe Service Linear Valves)					
Description	Switch Contacts	Deadband	Acceptable Manufacturer/Model		
Proximity (Non- contact)	DPDT	Manufacturer's Standard	Topworx (Go Switch) 7G23528-A2, 7G2356-A2		



Switch – Beacon/Monitor (Quarter Turn Valves with Piston Actuators)					
Description	Switch Contacts	Deadband	Acceptable Manufacturer/Model		
Position Switch and Indicator - Top Mount Beacon Style	SPDT	Manufacturer's Standard	Westlock Accutrack 2004 Topworx DXP		

#### K103.3 Pneumatic Valve Positioners and Position Transmitters

Each valve positioner shall be microprocessor based electronic-to-pneumatic design. Each valve positioner shall be designed for a 4-20 mA input range unless otherwise specified and an output signal from zero to the full supply air pressure required by the actuator. Each positioner shall be capable of split-range sequencing and direct or reverse action. Other features shall include speed and gain adjustment, failure mode choice, noninteractive adjustments, easy pilot access for cleaning, characterization, automatic zero/span calibration, and "HART" or Foundation Fieldbus protocol for valve position feedback, configuration, and calibration.

Each positioner shall be equipped with a filter regulator air supply set mounted on the valve yoke. If the positioner electronics and I/P is remote mounted, then the regulator set shall be remote mounted with the positioner. If the positioner can accept the maximum air supply pressure, a regulator is not required.

Positioners shall be furnished with pressure gauges for indicating the air supply, diaphragm, and control signal pressures.

Positioner housings shall be epoxy coated or provided with a superior finish if required for the ambient operating conditions.

Positioners, positioner feedback devices, and position transmitters shall be designed and located so that they will not be damaged from packing leaks and high temperatures without the application of insulation and/or blankets.

Refer to the Technical Specification Sheets included with the equipment specification sections or the Valve List for valves required to be furnished with tri-loops for use with the "HART" protocol.

Position transmitters shall be integral to valve positioners and, if required, shall produce 4-20 mA output in direct relationship to the valve position. The output signal shall be 2 wire, isolated and ±1.0 percent linear. See the Technical Specification Sheets included with the equipment specification sections or the Valve List for valves requiring 4-20 mA position feedback.

Where microprocessor based positioners are furnished for 10 or more applications or for any positioners on severe service applications (such as steam bypass), the Seller shall include 1 day on site (including additional time for round trip travel and expenses) for a service technician to provide on-site training on setup and commissioning of the valve positioners. The service technician shall include materials for up to 5 participants, and shall bring a sample positioner (of the same make/model) for use during the training. Where more than one positioner manufacturer is furnished, separate trips from the individual manufacturer's representatives will be required.

Where service time has already been included as part of the valve scope of supply, the service technician shall be qualified with the positioner startup and commissioning, and shall provide the on-site training with materials as designated.



Positioner				
Manual Operator	Input Signal	Acceptable Manufacturer/Model	Special Requirements	
No	4-20 mA 2-wire	CCI "QuickTak" Fisher Controls – "Fieldvue" DVC 6200 Series Siemens – "Sipart PS2" Valtek - Logix 3000MD	Positioner shall be smart type with integral position feedback transmitter Positioners for bypass valve service shall be Fisher DVC 6200 series with Hardware 2 (HW2) option (for integral valve position feedback), Siemens Sipart PS2, or CCI Quicktrak only.	

Position Transmitter (where a separate transmitter is specified)				
Output Signal	Acceptable Manufacturer/Model			
4-20 mA / 2-wire	Fisher Controls – 4200 Series			
Filter Regulators				
Type Output Range Acceptable Manufacturer/Model				
Small – Volume Regulator with Filter and Outlet Pressure Gauge	3 to 80 psig	Fisher 67CFR		

# K105 Flow Elements

#### K105.1 Primary Flow Elements

Flowmeters shall be furnished as specified and shall generally consist of orifice plate type flow elements, nozzles, and pitot tubes. DP flow devices for condensing level or steam services shall be furnished with condensing reservoirs suitably rated for the process conditions.

Flow elements for general service shall be orifice plates or flow nozzles designed in accordance with ASME MFC-3M-2004. Flow elements for air/gas flow may be nozzles, venturi, or low loss pitot tubes.

Preliminary data sheets may be included for scope purposes only. The Manufacturer shall submit detailed flow calculations and data sheets for each primary flow element that establishes final beta ratios and differential pressure drops, based on the preliminary data sheets. The Manufacturer provided flow calculations shall be the basis for the calibration of the corresponding flow transmitters.

The primary flow elements shall be designed to produce a differential head necessary to produce the design flow rate indication listed on the preliminary data sheets. The Manufacturer data sheets' maximum differential head shall equal the design differential head listed on the data sheet. Primary flow element beta ratio shall be within the range stated on the data sheets. The Manufacturer shall notify the Buyer of any deviations from the recommended beta ratios.

The Manufacturer shall be responsible for verifying physical properties used in calculations, such as viscosity, density, and isentropic expansion coefficient, of the specified fluid or gas at the temperatures and pressures specified on the data sheets.

Orifice plates shall be sized to operate as follows:

For gases and vapors, differentials between 20 and 100 inches of water are preferred. The ratio of differential pressure to static pressure shall be < 1.0 to assure flow does not choke across the device. In other words, the differential pressure, expressed in inches water column, shall never be more than the inlet pressure expressed in psia.

For liquids, a differential of 100~200 inches of water is preferred.

Beta ratio shall range between 0.3 and 0.65, with 0.4 to 0.6 preferred.

In circumstances where a larger range than noted above is required, it is more desirable to increase the meter differential than to increase the meter run pipe diameter.

Orifice plates shall be thin plate square edge concentric orifice plates. Orifice plates shall be constructed of materials suitable to the process conditions.

Each orifice plate shall be furnished with a handle on which the tag number, material, orifice (bore) diameter, the word "INLET," the pipe inside diameter, and the type of orifice plate ("FLANGE TAP") are stamped and electroetched. The data shall appear on the inlet side (side installed facing upstream) and shall be located on the handle so that it can be read without removing the orifice plate from the pipeline.

Pitot tubes shall be averaging style, reverse/impact style and include any required straightening vanes, shrouds, etc. to ensure reliable/accurate flow measurement as required for the application. Pitot tubes shall include chamfered pressure ports as required for high angle of attack installations.

Flow nozzles shall be of the ASME long radius weld-in low or high beta ratio type nozzles. Flow nozzles shall be constructed of materials suitable for the process conditions. Flow nozzles shall be constructed so that they can be welded between two adjacent sections of pipe. Where the two pipe sections meet, the nozzle shall include a 1/4 inch wide raised shoulder around the perimeter of the nozzle. The shoulder shall provide the weld root gap between the two pipe sections. Flow nozzles may also be insertion-type, to be mounted between piping flanges. This allows removal for maintenance or replacement in slurry, corrosive or erosive services.

Essential data shall be stamped on a sheet metal tag suitable for tack welding to a steel band. The piping fabricator shall be responsible for permanently attaching the tag to the pipe exterior near the nozzle inlet with a steel band.

The essential data to be stamped shall include the following:

Flow element tag number.

Flow element serial number.

Actual bored pipe diameter.

Actual bored nozzle diameter.

Flow direction.



Source: 21000, 2015 Techr

Flow Element Type	Acceptable Manufacturer
Orifice plates, flow nozzles, venturis, pitot tubes	Vickery Simms/Fluidic Techniques Triad Dieterich Standard Primary Flow Signal Daniel Measurement and Control Endress Hauser

Where DP devices are not appropriate due to the service, excessive pressure drop, accuracy, or other factors, other flow measurement technologies listed below may be used as approved by the Buyer. Alternate manufacturers shall be subject to Buyer approval.

Flow Transmitter (Nondifferential Pressure Types)					
Flow Technology Type	Transmitter Output	Energizing Power	Material Wetted Parts	Acceptable Manufacturer/Model	
Magnetic	4-20 mA	24 VDC (for 2-wire) 120 VAC (for 4-wire)	Stainless Steel or Engineer approved alternative	Rosemount Yokogawa Endress Hauser ABB	
Ultrasonic	4-20 mA	120 VAC (for 4-wire)	Stainless Steel or Engineer approved alternative	Brooks/Daniel Thermo Scientific Endress Hauser	
Vortex Shedding	4-20 mA	24 VDC (for 2-wire)	Stainless Steel or Engineer approved alternative	Rosemount Yokogawa ABB	
Coriolis	4-20 mA	120 VAC (for 4-wire)	Stainless Steel or Engineer approved alternative	Rosemount Yokogawa ABB	
Turbine	4-20 mA	24 VDC (for 2-wire)	Stainless Steel or Engineer approved alternative	Badger Daniel	
Positive Displacement	4-20 mA	120 VAC (for 4-wire)	Stainless Steel or Engineer approved alternative	FMC Flow Technology Brooks	
Thermal Dispersion	4-20 mA	24 VDC (for 2-wire)	Stainless Steel or Engineer approved alternative	Kurz FCI	

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# **K106 Vibration Instruments**

#### K106.1 Vibration Monitoring Philosophy (non-turbine equipment)

The Seller shall furnish vibration monitoring provisions in accordance with the table provided below.

Where maintenance provisions only are listed, the equipment shall include machined flat areas at each bearing for use with portable vibration monitoring devices. No permanently installed vibration monitoring equipment will be required. In the absence of any requirement, maintenance provisions shall be provided as a minimum. Where the Seller is required to provide vibration transducer mounting provisions only, the Seller shall provide ½" NPT tapped and plugged connections (at the X and Y axis) for each applicable location/bearing.

This section shall not apply to turbine equipment. Requirements for vibration monitoring on combustion turbines are defined in the equipment specifications specific to those pieces of equipment.

The general philosophy for vibration monitoring shall be as follows:

Maintenance provisions only.

Equipment Vibration Monitoring Philosophy					
Equipment	Pump Bearings	Pump Casing	Fluid Drive and Casing (if applicable)	Motor	
Other medium voltage equipment	Maintenance provisions only		Maintenance provisions only		
Other low voltage equipment	Maintenance provisions only		Maintenance provisions only		

#### K106.2 Vibration Switches

Vibration switches shall be inertia sensing, snap acting style with two SPDT 120 VAC contacts. Switches shall include manual resets with a field adjustable time delay setting. Switch Seller shall be acceptable to the Buyer.

#### K106.3 Vibration Transmitters

The Seller shall select, design, and furnish vibration transmitter devices suitable for the service. Transmitters for vibration velocity or proximity shall be furnished as specified. Each device shall transmit a 4-20 mA signal that is proportional to peak velocity or proximity. Devices shall be 24 VDC loop powered. Loop power shall be furnished by the Buyer. Transmitter range shall be in English units and specified by the driven equipment and motor manufacturer. Range shall be compatible with the expected vibration conditions associated with the equipment. High pass or low pass filtering shall be provided if recommended by the Seller. Other filtering devices shall be provided as required to shield the transmitters against ambient electrical noise from sources such as medium voltage switching equipment, variable frequency drives, plant radios, and other RF interferences.

Transmitters shall be installed on equipment by the manufacturer and factory wired to terminal blocks in a skid mounted, common NEMA 4 junction box.



Vibration Transmitters				
Description	Transmitter Output	Construction	Voltage	Acceptable Manufacturer/Model
Vibration Transmitter (velocity or proximity)	4-20 mA 2-wire	NEMA 4	24 VDC (120 VAC for signal conversion modules)	Metrix Robertshaw Rockwell/Entek (requires signal conversion module) STI Bently Nevada (requires signal conversion module)

# K120 Instrument Valves and Instrument Tubing

#### K120.1 General Requirements

All instrument primary piping and tubing, instrument valve manifolds, instrument shutoff valves, instrument check valves, instrument equalizing valves, and instrument blowdown valves shall be supplied, installed and tested in accordance with ASME B31.1 - Power Piping and Technical Supplemental M200 Process Piping, in accordance with the piping material specification.

Instrument primary piping and tubing is defined as the piping or tubing from the process connection root valve to the blowdown and the instrument valves or manifold.

Changes in tubing direction shall be made only with tube fittings or tube bending. Tubing bends shall be made without reducing the internal diameter of the tubing. All tubing shall be thoroughly cleaned of burrs and blown clean with dry compressed air after installation, but prior to attachment to devices at either end. Chemical cleaning may be required, based on tubing exposure to process chemicals.

#### K120.2 Instrument Primary Piping

Instrument primary piping external to instrument enclosures or racks shall meet the requirements stated in M200.

#### K120.3 Instrument Primary Tubing

Tubing shall be supported to allow thermal expansion, minimize vibration and protect it from damage. Tubing runs shall be supported both horizontally and vertically, with never more than 5 feet between supports. Where continuous support is required, support using tubing tray is preferred. Support using connection to structural steel is allowable when it provides equivalent protection from damage and vibration.

Instrument tubing sensing lines shall be installed as short as possible, yet consistent with slope requirements:

- 1. Gas or condensable vapors 1 inch or more preferred and where this is not possible, no less than 1/2 inch per foot slope down to tap.
- 2. Liquid 1 inch or more preferred and where this is not possible, no less than 1/2 inch per foot slope down to the instrument.

Pressure connections on piping shall be as follows:

- 1. Horizontal or inclined piping (liquids) side
- 2. Horizontal or inclined piping (gas or air) top
- 3. Vertical piping (liquids, gas or air) no preference

Electric traced tubing shall be assembled using the manufacturer's splice kits. In no case shall trace tubing be field spliced using any other method. It is imperative that tracing shall cover the entire process tubing run, from and including piping block valves to and including the instrument itself.

Plastic covered copper tubing shall not be used.

### K120.4 Control and Instrument Enclosure/Rack Tubing

Instrument tubing within enclosures or racks shall be arranged to allow any device to be serviced, disconnected, or removed from the enclosure or rack without disconnecting tubing to other devices. Tubing for external connections shall be terminated on a bulkhead plate, utilizing bulkhead fittings for enclosures, or unions for open racks. Each bulkhead termination shall be identified with a nameplate.

# K120.5 Instrument Valves and Valve Manifolds

Each pressure instrument shall be installed downstream of an instrument shutoff valve or instrument valve manifold designed for instrument shutoff service. The instrument shutoff valve or instrument valve manifold shall be in addition to the process instrument isolation (root) valve for the instrument.

Each static pressure instrument shall be provided with a two-valve manifold. Alternatively, direct mounted static pressure indicators may be furnished with a plugged tee.

Each differential pressure instrument shall be provided with a five-valve manifold that includes isolation, equalization, and test valves.

Each instrument valve manifold shall be provided with 1/2" FNPT process connections and 1/4" plugged test ports.

Instrument valves and manifolds shall be compliant with ASME B31.1 and shall include grafoil packing with stainless steel construction or suitable materials in accordance with the piping specification.

Other Buyer-approved materials shall be used if stainless steel is not suitable for the service.

#### K120.6 Blowdown Valves

A blowdown valve shall be provided for each instrument primary line except oil, draft, and vacuum services. Each blowdown valve shall have a globe pattern design, stainless steel construction, a grafoil packed stem, and a minimum 0.25 inch orifice.

#### K120.7 Instrument Valves, Fittings, and Support Tray

Instrument Process Components	Acceptable Manufacturer/Model
Tubing - Grip Type Fittings	Swagelok or Buyer Approved Equal
Tubing - Socket-Weld Fittings	Swagelok or Buyer Approved Equal
Valve Manifolds	Swagelok or Buyer Approved Equal
Instrument Shutoff Valve	Stainless steel needle valves with ball stem tips, Grafoil Packing and ASME B31.1 compliant hydrostatic testing, Swagelok SS- 6DB series or Buyer Approved Equal



Instrument Process Components	Acceptable Manufacturer/Model
Instrument Equalizing Valve	Swagelok Stainless Steel, Series SS-6DBS8 with Grafoil Packing or Buyer Approved Equal
Instrument Blowdown Valve	Swagelok Stainless Steel, Series SS-6DBS8 with Grafoil Packing or Buyer Approved Equal
Instrument Tubing Support Tray	James C. White Company, Inc., Series "Tubetrack" or Buyer Approved Equal

#### K120.8 Instrument Installation Details

Instrument installation details shall be submitted for approval for each instrument supplied. The instrument installation details furnished shall show all valves, instrument manifolds, tubing, fittings, and devices from the instrument isolation (root) valves required to support installation of the instrument. The instrument installation details shall include a bill of materials in sufficient detail to support procurement of materials. The instrument installation details and associated bill of materials shall identify the Seller's scope of supply and the installation contractor's scope of supply.

Inline instruments, level gauge glasses and other bridle-mounted instrument installations shall be shown either on installation detail drawings or on dimensioned piping drawings.

Each instrument shown on the instrument installation details shall include a tag name.

Where freeze protection is required, the electrical heat-traced instrument tubing shall be indicated in the instrument installation details with the scope of work and installation indentified. Heat traced instrument tubing shall use pre-traced, pre-insulated tubing bundles. The electrical power source for heat tracing will be 120 VAC and furnished by Buyer. Each heated instrument enclosure shall have a unique tag name. All heat tracing components shall be included in the bill of materials in the instrument installation details.

# M200 Piping

All piping and pipe supports shall be in accordance with ASME B31.1 - Power Piping. Materials and wall thickness of piping and fittings will be selected based on design conditions established for the piping system. The following minimum requirements shall apply:

Table 1 - General Pipe and Tubing Selection Criteria						
			Minimum Wall Thickness			
Material	Typical Standard	Typical Temperature Range	Diameter Less Than or Equal to 2 Inches	Diameter Greater Than 2 Inches	Notes	
Carbon steel	A53, A106	-55° F to 800° F	Sch XS	Std wt		
Stainless steel	A312 A790	-20° F to 1,500° F	Sch 10S	Sch 10S		
SS tubing	A213	-20° F to 1,500° F	Refer to Table 4		"U" not allowed. Rockwell hardness less than B90 (B80 or less preferable).	

The following pipe sizes shall be used for carbon steel and low/intermediate alloy steel. Other sizes shall not be used:

Table 2 - Carbon/Low Alloy Pipe				
NPS	Service	Schedules	Connections	
1 inch	All	80, 160, XXS	SW, BW, SCRD or flanged	
1-1/2 inch	All	80, 160, XXS	SW, BW, SCRD or flanged	
2 inch	All	80, 160, XXS	SW, BW, SCRD or flanged	
2-1/2 inch and up	All	Std wt min	BW, grooved, or flanged	

The following pipe sizes shall be used for stainless steel pipe. Other sizes shall not be used:

Table 3 - Stainless Steel Pipe				
NPS Service Schedules Connections				
1 inch	All	10S, 40S, 80S	SW, BW, flanged, or crimp type	

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Table 3 - Stainless Steel Pipe			
NPS	Service	Schedules	Connections
1-1/2 inch	All	10S, 40S, 80S	SW, BW, flanged, or crimp type
2 inch	All	10S, 40S, 80S	SW, BW, flanged, or crimp type
2-1/2 inch and up	All	10S and up	BW or flanged

The following tubing specifications shall be used for chemical feed, instrumentation, compressed air, and sample line systems.

Tubing material shall be stainless steel tubing and shall be joined with automatic butt-welding fittings, grip fittings, or socket-welded fittings as described below:

Table 4 - Stainless Steel Tubing Requirements			
Tubing Design Parameter	Project Design Basis		
Tubing fittings (wall less than or equal to 0.083 inch)	316 SS butt-weld, grip type, or socket- weld fittings		
Tubing fittings (wall greater than 0.083 inch)	316 SS butt-weld or socket-weld fittings		
Tubing direction changes	Tubing fitting or bending (bending will affect pressure and temperature rating)		
Tubing supports	Per B31.1 and as required to allow thermal expansion or to protect tube from damage		
Tubing design pressure and temperature	In accordance with mechanical design criteria for process pipe and B31.1		
Tubing Sizing			
Pressure measurement tubing, sample lines, chemical lines, compressed air	1/2 inch OD with nominal wall thickness of 0.049, 0.065, or 0.083 inch, depending on process design pressures and temperatures and B31.1. Actual minimum wall thickness (accounting for tolerances allowed by the material specification) must meet or exceed the requirements of B31.1.		

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Table 4 - Stainless Steel Tubing Requirements			
Tubing Design Parameter	Project Design Basis		
Sample lines, compressed air	3/8 inch OD with nominal wall thickness of 0.049, 0.065, or 0.083 inch, depending on process design pressures and temperatures and B31.1. Actual minimum wall thickness (accounting for tolerances allowed by the material specification) must meet or exceed the requirements of B31.1.		
Flow and level measurement by differential pressure	Use pressure tubing criteria except for steam applications with condensate pots (piped)		
Using separate instrument manifolds (not direct mounted)	1/4 inch OD with minimal wall thickness of 0.049 inch as flex lines (less than 36 inch length)		

# Seam Welded Pipe

Seam welded pipe may be used in the following applications as determined by the Buyer, or where seamless pipe is not available:

Table 5 - Seam Welded Pipe		
System/Application	Limitations	
Stainless steel	No limitations when design complies with B31.1	
Carbon steel	No limitations* when design complies with B31.1, except ammonia, hydrogen, and fuel gas applications	
*Buyer may require additional UT/RT of the longitudinal weld in certain applications.		

#### Fittings, Flanges, and Valves

Fittings, flanges, and valves shall be in accordance with the requirements which follow:

Table 6 - Fittings and Flanges		
System/Application	Limitations	
Fittings 2-1/2 inches and larger	Butt-weld type, in accordance with ASME B16.9	
Fittings 2 inches and smaller	Forged steel socket-welded type, in accordance with ANSI B16.11	
Flanges, nonmetallic with metallic backing ring	Flat faced slip-on or socket-welded for thermal or solvent welding	
Flanges, cast iron or steel, to mate with nonmetallic flanges	Flat faced slip-on type or threaded, in accordance with B16.5	
Flanges, 150 class	Raised face weld neck or slip-on type, in accordance with B16.5	



Flanges, 300 class and higher	Raised face weld neck type only, in accordance with B16.5
Press-fit type joints	Victaulic Vic-Press®, Viega Pro-Press®, or approved equal
Grip/compression style	Stainless Steel Swagelok or approved equal
Threaded air fittings	Stainless Steel Swagelok or approved equal

All welded fittings shall be of the same material as the pipe. Forged steel socket-welded and threaded fittings shall have the minimum class rating described below:

Table 7 - Forged Steel Fittings Minimum Class Ratings			
Pipe Wall Thickness	Threaded Fittings	Socket-Welded Fittings	
Schedule 80 and less	3,000	3,000	
Over Schedule 80 to Schedule 160	3,000	6,000	

Integrally reinforced branch fittings shall have the minimum class rating described below. All welded fittings shall be of the same material as the header pipe. Fittings between dissimilar branch/header materials shall be considered on a case-by-case basis:

Table 8 - Integrally Reinforced Branch Fittings Minimum Class Ratings			
Pipe Wall Thickness	Threaded Fittings	Socket-Welded Fittings	
Schedule 80 and less	3,000	3,000	
Over Schedule 80 to Schedule 160	6,000	6,000	

Table 9 - Valves		
System/Application	Limitations	
2-1/2 inch and larger	Carbon steel, alloy, stainless steel, or other, corresponding to pipe material; ASME Pressure Class 150 minimum; butt-welded, flanged, or grooved ends; cast or forged steel bodies, with pressure/temperature ratings in accordance with ANSI B16.34	
2 inch and smaller	Carbon steel, ASME Pressure Class 600 minimum, socket-welded ends, forged steel bodies, with pressure/temperature ratings in accordance with ASME B16.34. Control valves and other special applications may deviate from these requirements.	

Joints shall be provided as required to facilitate assembly or disassembly of equipment. Pipe unions shall not be used.

Pipe ends for socket-welded connections shall be reamed to full inside diameter to remove all burrs and obstructions. Fittings shall be used for all changes in direction.

Butt-weld end preparations shall be in accordance with Technical Supplemental Q210, Welding of Power Piping.

#### Flange Bolting

Flange bolting shall be furnished if so indicated in the Table 10.

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

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

Bolting for bolt diameters 1-3/4 inches and larger shall consist of threaded studs and two nuts. Bolting for bolt diameters less than 1-3/4 inches may be threaded studs and nuts or bolts and nuts. Bolts and nuts shall be heavy hexagonal heads conforming to the applicable standard.

Table 10 - Studs, Nuts, Bolts		
Alloy steel bolting materials for use with piping with design temperatures less than 800° F		
Studs	ASTM A193/A193M Grade B7 ASME SA-193/SA-193M Grade B7	
Nuts	ASTM A194/A194M Grade 2H ASME SA-194/SA-194M Grade 2H	
High-strength stainless steel bolting materials		
Studs	ASTM A453/A453M, Grade 660 ASME SA-453/SA-453M, Grade 660	
Nuts	ASTM A453/A453M Grade 660 ASME SA-453/SA-453M Grade 660	
Low-strength stainless steel bolting materials		
Studs	ASTM A193/A193M Grade B8M ASME SA-193/SA-193M Grade B8M	

Source: 21000, 2015

Nuts	ASTM A194/A194M Grade 8M ASME SA-194/SA-194M Grade 8M
Carbon steel bolting materials	
Studs	ASTM A307 Grade B ASME SA-307 Grade B
Nuts	ASTM A563 Grade B ASME SA-563 Grade B
Bolt coating (applies to alloy, stainless steel, and carbon steel bolting)	
Piping design temperatures of 450° F and above	No coating
Piping design temperatures less than 450° F	PTFE coating
Bolt plating (applies to alloy and carbon steel bolting	
Piping design temperatures of 450° F and above	No plating
Piping design temperatures less than 450° F	Cadmium plating in accordance with ASTM B766 or zinc plating in accordance with ASTM A153
Nonmetallic flanges without backing ring	Follow nonmetallic flange manufacturer's recommendation

# Gaskets

Some chemical and glycol systems may require the use of different gasket materials. Gaskets shall be as follows:

Table 11 - Gaskets			
Joint	Gasket	Limitations	
All Class 150 and Class 300RF flanges	1/16 inch compressed fiber type, nonasbestos	Class 300 systems or lower within temperature limits of gasket material	
FF metallic flanges (including steel and cast iron)	1/16 inch compressed fiber type, nonasbestos	Within temperature limits of gasket material.	
	1/8 inch elastomeric type (EPDM for hot service)	For temperatures above 150° F up to 215° F, use EPDM.	
Nonmetallic flanges	1/8 inch elastomeric type (EPDM for hot service)	With backing rings as needed. For temperatures above 150° F up to 215° F, use EPDM.	

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Table 11 - Gaskets							
Joint	Gasket	Limitations					
RF flanges (except as above)	Spiral wound type, nonasbestos (Note 1)	Only low seating stress spiral wound gaskets shall be specified for Class 150 and Class 300 flanges.					
Victaulic Vic-Press® joints	Hydrogenated nitrile O-ring (HNBR) (air and water)	Cold air and water systems (less than or equal to 215° F and less than or equal to 300 psig)					
Viega Pro-Press <sup>®</sup> joints	EPDM	Cold compressed air					
Grooved pipe joints	EPDM (water) or nitrile (air) rubber	Cold air and water systems (less than or equal to 215° F and less than or equal to 300 psig)					
Bell and spigot cast iron and ductile iron	EPDM	Gravity drains less than or equal to 215° F and roof conduits					
Mechanical joints and bell and spigot cast iron and ductile iron with restrained joints	EPDM	Cold water systems (less than or equal to 215° F and less than or equal to 300 psig)					
Note 1: Spiral wound gaskets in gas piping shall have inner and outer retainer rings in accordance with ASME B16.20.							

Washers shall be suitable for the temperature, material, bolt load, and environment of the flanged joint. The use of conical spring washers is only allowed if specified by the Buyer.

Flange torque values shall be determined based upon the recommended values for equipment by the supplier, or by ASME PCC-1. Bolt pre-loads shall ensure a leak-tight joint, which is correctly seated, and does not damage the flange or bolting.

Flange fit-up shall meet the following tolerances:

Holes for bolts shall be within 1/8" (3 mm)

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

Gaps shall be within 1/16" (1.5 mm) plus space for any required gaskets.

# M710 Compressed Air

Filtered, dried, oil free compressed air (ISA 7.0.01) will be supplied for operation of pneumatic instruments and control valves. Normal service air will be supplied for operation of other pneumatic devices. The compressed air will be supplied at receiver pressure varying from 80 to 150 psi.

Pressure regulators with pressure gauges shall be provided for pneumatic devices which operate at pressure levels less than maximum receiver pressure. Where pneumatic drives operate at full receiver air supply pressure, air filters shall be furnished. Air filters shall be provided with pressure gauges.



Source: 21000, 2015 Technical Supplemental Specifications

# **Q300** General Coating Requirements

Section Q300 shall be used in conjunction with the other Coating Technical Supplemental Specification sections including Q301, Q302, Q310, and Q320. All color selections shall be reviewed and approved by Buyer prior to commencing work.

The following tables shall be used when specifying coating and lining systems where their use is indicated on the drawings or specified in the Technical Specifications.

BLACK & VEATCH Building a world of difference.	COATING SELECTION				
	Atmospheric Service Category C4 Industrial Environment	PAGE 1 OF 4 08/04/15			

Section	Description	Design Temp °F	Coating System Number	Codes <sup>(1)</sup>	
1.0	Structural Steel			1	
1.1	Outdoor columns, beams, girders, trusses, channels, and other structural members	≤200	1712	EPZ/URA	
1.2	Indoor columns, beams, girders, trusses, channels, and other structural members	≤200	1401 or 1301	IZ or EPZ	
1.3	Columns, beams, girders, trusses, channels, and other structural members receiving passive fire protection (PFP)	≤200	In accordance with PFP manufacturer recommendation		
1.4	Ladders, cages, handrail and guardrail assemblies, and grating	≤200		Galvanized	
			Refer to the Following for Touchup Only:		
			1302	EPZ	

SPGF 193946.67.9	Passaic Valle 120 Power	ey Sewerage Generation S	Issued for Permit Review 29December2017		
			Refer to th Only:	ne Following for Safety Color	
			1713	SPC/URA	
1.5	Concrete cast-in- place structural steel including anchor rods, threaded	ice ≤200 Jing ed		Galvanized	
	inserts, continuous inserts, plates, and shapes		Refer to the Following for Touchup Only		
	F		1302	EPZ	
1.6	Concrete post installed anchor rods and threaded inserts	≤200	Consult Ch Engineer	ief Civil	
2.0	Not Used	<b>i</b>			



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# COATING SELECTION

Atmospheric Service Category C4 Industrial Environment

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Section	Description	Design Temp °F	Coating System Number	Codes <sup>(1)</sup>				
3.0	Tanks, Drums, Columns, Vessels, Reactors, and Shell and Tube Heat Exchangers - Shop Fabricated $^{\!\!(3)}$							
3.1	Carbon Steels and Lo	w Alloy (≤9% Cr) S	iteels					
3.1.1	Uninsulated	≤200	1712	EPZ/URA				
3.1.2		>200 ≤1,000	1613	IZ/SLA				
3.1.3	Insulated	All	No coating					
3.2	Stainless Steels and I	ligh Nickel Alloys						
3.2.1	Uninsulated	All	No coating					
3.2.2	Insulated	All	No coating					
4.0	Pipe and Pipe Supports							
4.1	Carbon Steels and Lo	w Alloy (≤9% Cr) S	iteels					
4.1.1	Uninsulated	≤200	1112	EPX/ACW				
4.1.2		>200 ≤1,000	1613	IZ/SLA				
4.1.3	Insulated	All	No coating					
4.2	Stainless Steels and I	High Nickel Alloys	I	1				
4.2.1	Uninsulated	All	No coating					
4.2.2	Insulated	All	No coating					
5.0	Bulk Valves, Fittings, Pumps, Compressors, Rotating Equipment, and Other Mechanical Equipment Not Specified Otherwise	All	Q301 Manufacturer's Standard Coating for the intended ISO 12944 C4 environment.					



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# COATING SELECTION

Atmospheric Service Category C4 Industrial Environment

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Section	Description	Design Temp °F	Coating System Number	Codes <sup>(1)</sup>			
6.0	Civil/Structural/ Architectural Surfaces and Equipment Not Specified Otherwise	All	Q301 Manufacturer's Standard Coating for the intended ISO 12944 C4 environment.				
7.0	Electric Motors and Equipment Not Specified Otherwise	All	Q301 Manufacturer's Standard Coating for the intended ISO 12944 C4 environment.				
8.0	Instrumentation and Control Panels Not Specified Otherwise	All	Q301 Manufacturer's Standard Coating for the intended ISO 12944 C4 environment.				
9.0	Not Used						
10.0	Stacks, Breeching, Du	uct, and Boilers					
10.1	Carbon Steels and Lo	w Alloy (≤9% Cr) S	iteels				
10.1.1	Uninsulated	≤200	1712	EPZ/URA			
10.1.2		>200 ≤1,000	1613	IZ/SLA			
10.1.3	Insulated	All	No coating				
11.0	Architectural Element	S					
11.1	Pre-Coated Metal Components						
11.1.1	Pre-Painted Components (Metal Doors, etc.)						
11.1.1.1	Outdoors/Indoors	≤150	1714	SPC/URA			
11.1.1.2	Outdoors/Indoors - Chemical or Water Treatment Area	≤150	1314	SPC/EPS			

BLACK & VEATCH Building a world of difference.	COATING SELECTION				
	Atmospheric Service Category C4 Industrial Environment	PAGE 4 OF 08/04/15			

Section	Description	Design Temp °F	Coating System Number	Codes <sup>(1)</sup>			
11.1.1.3	Pre-engineered Metal Building - Structural Steel	≤150	1714	SPC/URA			
11.1.2	Galvanized Sheet Met	al					
11.1.2.1	Outdoors/Indoors	≤150	1713	SPC/URA			
11.2	Concrete and Concrete Masonry						
11.2.1	Outdoors/Indoors	≤150	1116	SPC/ACW/ACW			
11.2.2	Indoors – Bathrooms and Changing Rooms	≤150	1315	SPC/EPS			
11.3	Drywall						
11.3.1	Indoors	≤150	1117	ACW/ACW/ACW			
11.3.2	Indoors – Bathrooms and Changing Rooms	≤150	1316	SPC/EPS/EPS			

- ACW Acrylic waterborne ALK Alkyd EPF - Epoxy flake filled EPP - Epoxy phenolic EPX - Epoxy polyamide EPZ - Epoxy zinc IZ - Inorganic zinc SLA - Silicone acrylic SPC - Special URA - Polyurethane
- (2) Not used.
- (3) For chemical storage tanks in curbed or walled storage areas, select coating in accordance with the Classification of Corrosive Environments - Buried, Immersion, or Chemical Containment Service appendix.



	Lining Selection – Buried, Immersion, or Chemical Containment Service								
				Carbon St	eel Surfaces	Concrete	Surfaces		
Section	Description	Design Temp, °F	Soil Quality	Coating System Number	Codes <sup>(1)</sup>	Coating System Number	Codes <sup>(1)</sup>	Typical Structures or Applications	
1.0	Buried Service								
1.1	Soil	≤120° F	pH≥6 SO4≤2,000 ppm CI-≤400 ppm	3311	EPT/ EPT	No Coating		Buried tanks and piles Complies with AWWA C210	
1.2	Soil	≤120° F	pH≥6 SO4≤2,000 ppm CI-≤400 ppm	3301	ЕРВ	No Coating		Buried pipes (carbon steel and stainless steel) Complies with AWWA C213	
1.3	Soil	≤230° F	pH≥6 SO4≤2,000 ppm CI-≤400 ppm	3312	EPB/ EPB	No Coating		Buried pipes (carbon steel and stainless steel) Complies with AWWA C213	
1.4	Soil	≤120° F	pH≥6 SO4≤2,000 ppm CI-≤400 ppm	3011	SPC/ SPC	No Coating		Buried pipe fittings and field girth welds (carbon steel and stainless steel) Complies with AWWA C209	
1.5	Soil	≤230° F	pH≥6 SO4≤2,000 ppm CI-≤400 ppm	3012	SPC/ SPC	No Coating		Buried pipe fittings and field girth welds (carbon steel and stainless steel) Complies with AWWA C209	

				Carbon Steel Surfaces		Concrete Surfaces		
	Description	Design Temp, °F	Fluid Quality	Coating System Number	Codes <sup>(1)</sup>	Coating System Number	Codes <sup>(1)</sup>	Typical Structures or Applications
2.0	Immersion Servi	ce – Not Us	ed					

				Primary Containment Service		Secondary Containment Service				
				Carbon Steel Surfaces		Carbon Steel Surfaces <sup>(4)</sup>		Concrete Surfaces		
Section	Description	Design Temp, °F	Fluid Quality	Coating System Number	Class <sup>(1)</sup>	Coating System Number	Class <sup>(1)</sup>	Coating System Number	Class <sup>(1)</sup>	Typical Structures or Applications
3.0	Chemical Containment Service									

SPGF
193946.67.9120

				Primary Conta	inment Service	Secon	dary Cont	ainment S	ervice			
				Carbon Ste	el Surfaces	Carbon S Surfaces	teel 4)	Concrete Surfaces				
Section	Description	Design Temp, °F	Fluid Quality	Coating System Number	Class <sup>(1)</sup>	Coating System Number	Class <sup>(1)</sup>	Coating System Number	Class <sup>(1)</sup>	Typical Structures or Applications		
3.1	Air											
3.1.1	Compressed Air	≤300° F	NA	1401 <sup>(5)</sup>	IZ	NA	NA	NA		Air receiver, internal surfaces		
3.2	Chemical Treatm	ent - Not Use	ed									
3.3	Flue Gas											
3.3.1	Flue Gas, outlet	≤130° F	pH≥3	2011	SPC/ SPC	NA		NA		Ductwork, internal surfaces		

<sup>(1)</sup> Code Abbreviations:

EPA - Epoxy amine

EPB - Epoxy fusion bonded

EPN - Epoxy novolac

EPP - Epoxy phenolic

EPS - Epoxy

EPT - Epoxy coal tar

EPX - Epoxy polyamide

IZ - Inorganic zinc

- SPC Special
- URA Polyurethane

(2) Not used.

<sup>(3)</sup>Not used..

<sup>(4)</sup> Includes steel in a curbed or walled storage area, e.g., skid steel, structural members, and external surface of chemical storage tanks.

 $^{(5)}\mbox{No}$  coating is required if the air receiver is ahead of an air filter.



Coating System Data Sheets										
Drawing Number	Rev. No.	Title/Description								
81113-DM-0667_1112		Coating System Data Sheets - System 1112 – Polyamide Epoxy (EPX)/ Acrylic Waterborne (ACW)								
81113-DM-0676_1116		Coating System Data Sheets - System 1116 – Masonry Filler (SPC)/ Acrylic Waterborne (ACW)/Acrylic Waterborne (ACW)								
81113-DM-0677_1117		Coating System Data Sheets - System 1117 – Acrylic Waterborne (ACW)/Acrylic Waterborne (ACW)/Acrylic Waterborne (ACW)								
81113-DM-0692_1201		Coating System Data Sheets - System 1201 – Alkyd (ALK)								
81113-DM-0641_1301		Coating System Data Sheets - System 1301 – Epoxy Zinc (EPZ)								
81113-DM-0642_1302		Coating System Data Sheets - System 1302 – Epoxy Zinc (EPZ)								
81113-DM-0647_1313		Coating System Data Sheets - System 1313 – Epoxy Phenolic (EPP)/ Epoxy Phenolic (EPP)								
81113-DM-0678_1314		Coating System Data Sheets - System 1314 – Tie Coat (SPC)/Epoxy (EPS)								
81113-DM-0679_1315		Coating System Data Sheets - System 1315 – Masonry Filler (SPC)/ Epoxy (EPS)								
81113-DM-0648_1401		Coating System Data Sheets - System 1401 – Inorganic Zinc (IZ)								
81113-DM-0691_1613		Coating System Data Sheets - System 1613 – Inorganic Zinc (IZ)/ Silicone Acrylic (SLA)								
81113-DM-0654_1712		Coating System Data Sheets - System 1712 – Epoxy Zinc (EPZ)/ Polyurethane (URA)								
81113-DM-0668_1713		Coating System Data Sheets - System 1713 – Tie Coat (SPC)/ Polyurethane (URA)								
81113-DM-0669_1714		Coating System Data Sheets - System 1714 – Tie Coat (SPC)/ Polyurethane (URA)								
81113-DM-0655_2011		Coating System Data Sheets - System 2011 – Vinyl Ester (SPC)/Vinyl Ester Flake Filled (SPC)								
81113-DM-0662_3011		Coating System Data Sheets - System 3011 – Adhesive Primer (SPC)/ Cold Applied Tape (SPC)								
81113-DM-0663_3012		Coating System Data Sheets - System 3012 – Adhesive Primer (SPC)/ Cold Applied Tape (SPC)								
81113-DM-0664_3301		Coating System Data Sheets - System 3301 – Epoxy, Fusion Bonded (EPB)								
81113-DM-0665_3311		Coating System Data Sheets - System 3311 – Epoxy Coal Tar (EPT)/ Epoxy Coal Tar (EPT)								
81113-DM-0666_3312		Coating System Data Sheets - System 3312 – Epoxy, Fusion Bonded (EPB)/Epoxy, Fusion Bonded (EPB)								

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Color Schedule Table								
	Color							
Structural Steel (Other Than Galvanized)	(LATER)							
Stack	(LATER)							
Equipment Enclosures	(LATER)							

Ę	BL/ Buildi	ACK & V	Polyaı	mide E	роху	(EPX)/Ac (ACW)	orne	Coating System 1112						
Proj	ect		Energy-Std-2-(	)3880-014	<b>120</b>									
Desc	ription		Polyamide epo	Polyamide epoxy with acrylic finish										
Surfa	aces		Carbon steel	Carbon steel										
			First Coat			Touc	hup			Seco	nd Coat			
voc	Limits		2.83 lb/gal (34	0 g/L)		2.83 ll	b/gal (34	0 g	;/L)	2.83	lb/gal (34	0 g/L)		
Арри	roved Pr	oducts	Coating manufa review/approv	acturers ar 7al.	nd pro	ducts o	other thar	n th	nose listed h	ierein ai	re subject	to Engin	ieer's	
Manu	ıfacturer		First Coat			Touc	hup			Seco	nd Coat			
Carbo	oline		Carboguard 88	0		Carbo	guard 88	0		Carbo	ocrylic 335	59 DTM		
Hemp	pel		Hempadur 458	80		Hemp	adur 458	80		Hem	ucryl 5803	0		
Intern	national		Intergard 345			Interg	gard 345			Inter	cryl 530			
Jotun	1		Jotacote Unive	rsal		Jotaco	ote Univer	rsal	1	Wate	rfine Topo	oat		
PPG A	Amercoat		385			385		_		220				
Sherv	vin-Willia	ms	Recoatable Epo	r	Recoa	Recoatable Epoxy Primer				Cryl HPA				
Tnem	iec		Series N69 Series N69 Ser							Serie	s 1028			
Surfa Prep	ace paration		SSPC-SP6/NAC Profile depth 1	SSPC-SP6/NACE No. 3 Commercial Blast Cleaning Profile depth 1 to 2 mils (25 μm to 50 μm)										
Rem	arks		Profile to be ve Welds to be pr	Profile to be verified by Contractor using ASTM D4417 Method C. Welds to be prepared in accordance with NACE SP0178, Appendix C, Designation "E."										
Dry	Film Thi	ckness (DI	T)					_						
		Generic Coating Type	Minimum DFT May			imum	DFT	Sh Fi Aj	iop (S) or eld (F) pplied	Ren	narks			
First	Coat	EPX	4 mils (1	100 µm)	6 mi	ls (150	) μm)	S						
Touc	hup	EPX	4 mils (1	LOO μm)	6 mil	ls (150	) µm)	<b>S</b> , 1	F	SSPC-SP3 Power Tool Cleaning (Nonrusted Areas Only).				
										SSP( Clea Met	C-SP11 Po ining to Ba al or Ruste	wer Too Ire Meta ed Areas	l l (Bare ).	
Seco	nd Coat	ACW	2 mils (!	50 µm)	3 mil	ls (75	μm)	<b>S</b> , 1	F					
Comp Syste	pleted m		6 mils (1	150 μm)	9 mil	ls (225	,μm)			Dry veri SSP	film thicki fied in acc C-PA2.	ness to b ordance	e with	
	 			$\overline{+}$	<b>—</b>	2	12/29/1/	4	General Revi	ision Aerger		JTD GMA	RHW	
	·	<u> </u>				0	06/01/0	8	Initial Issue	leigei		BPL	RHW	
REV	DATE	REVISIONS AND	RECORD OF ISSUE	BY	APP	REV	DATE		REVISIONS AND	RECORD OF	ISSUE	BY	АРР	
BLAC	K & VEATO	СН	COATING	i SYSTEM	DATA S	SHEET	S - SYSTE	M 1	1112	81113	ng No. -DM-0667		Rev 2	

Ę	BL	ACK & V	EATCH	Masor (A	nry Fill CW)/A	Coa	nting Sys 1116	stem						
Pro	ject		Energy-Std-2-0	3880-014	¥20									
Des	cription		Masonry filler v	with acryl	ic finisł	ı								
Sur	faces		Concrete and co	oncrete and concrete masonry										
			First Coat	:	Seco	nd Coat		Thir	Third Coat					
voo	Limits		1.66 lb/gal (20	0 g/L)		1.25 ll	b/gal (150 g	g/L)	1.25 l	b/gal (15	50 g/L)			
Арр	proved Pr	oducts	Coating manufacturers and products other than those listed herein are subject to Engineer's review/approval.											
Man	ufacturer		First Coat		:	Secon	nd Coat		Thi	rd Coat				
Carb	oline		Sanitile 500			Carbo	crylic 3350		Carl	ocrylic 3	350			
Hem	pel		Epoxy Filler 35	250	I	Hemu	cryl 18032		Hen	ucryl 58	030			
Inter	rnational		Tru-Glaze-WB	4015	1	Devcr	yl 1440		Dev	cryl 1448	/1449			
Jotu	n		Block Filler		I	Pilot V	WF		Pilo	t WF				
PPG			Amerlock 400 I	l	Pitt-T	ech Plus 90	-1310/1210	Pitt-Tech Plus 90-1310/1210						
Sher	win-Willia	ms	General Polyme	ers 3462G	i I	Pro Industrial Multi-Surface Acrylic				Pro Industrial Multi-Surface Acrylic				
Surf Pre	face paration		In accordance with SSPC-SP 13/NACE No. 6 and as recommended by coating manufacturer.											
Ren	narks													
Dry	Film Thi	ckness (DF	T)											
Generi Coating Type			Minimum D	Maxi	imum	DFT	Shop (S) o Field (F) Applied	r	Remar	ks				
First	t Coat	SPC	In accordanc manufacture	e with r	In ac manu	corda ufactu	nce with rer	F						
Seco	ond Coat	ACW	2 mils (50 µr 1-1/2 mils (3	n) 57 μm)	3 mil 2 mil	s (75 s (50	μm) μm)	F		All exce Jotun o	ept Jotun nly.			
Thir	d Coat	ACW	2 mils (50 µn 1-1/2 mils (3	n) 37 μm)	3 mil 2 mil	s (75 s (50	μm) μm)	F		All exce Jotun o	ept Jotun nly.			
Completed System (Second and Third Coats Only)			4 mils (100 μ 3 mils (75 μn	6 mil 4 mil	s (15) s (10)	0 μm) 0 μm)		All except Jotun. Jotun only. Dry film thickness doe not include first coat.			ess does coat.			
4	03/31/16	Epoxy Maso	nrv Filler	GMA	BPL	2	12/27/13 Added Jotun 08/31/11 General Revi		ision		GMA GMA	RHW		
3	12/28/15	Biennial Rev	iew	GMA	BPL	0	02/28/11	Initial Issue	DECOSE C	100115	GMA	RHW		
BLA	CK & VEA		COATING S	YSTEM I		M 1116	Drawing No. Rev   81113-DM-0676 Rev							

Ę	BL/Buildi	ACK & V	Ac Wate	rylic W rborn	Vater e (AC	Coating System 1117							
Pro	ject		Energy-Std-2-(	)3880-01 <sup>2</sup>	420								
Des	cription		Acrylic primer	Acrylic primer/sealer with acrylic finish									
Surf	faces		Dry wall										
			First Coat			Seco	nd Coat		Thir	d Coat			
voc	Limits		1.66 lb/gal (20	00 g/L)		1.25 l)	b/gal (150	g/L)	1.25	lb/gal (1	50 g/L)		
Арр	roved Pr	oducts	Coating manuf review/approv	acturers a val.	ind proc	ducts (	other than	those listed h	ierein a	re subjec	t to Engii	neer's	
Man	ufacturer		First Coat			Secon	ıd Coat		Thi	rd Coat			
Carb	oline		Sanitile 120			Carbo	crylic 335	0	Carl	oocrylic 3	350		
Hem	pel		Hemucryl 180	32		Hemu	cryl 5803	0	Hen	nucryl 58	030		
Inter	mational		Devcryl 1440			Devcryl 1448/1449				Devcryl 1448/1449			
Jotur	n		WaterFine Acr	er	WaterFine Acrylic Primer				WaterFine Topcoat				
PPG			Seal Grip 17-92		Pitt-T	ech Plus 9	0-1310/1210	Pitt	Tech Plu	s 90-131	0/1210		
Sher	win-Willia	ms	Pro Mar 200 Zo Interior Latex		ProClassic Waterborne P Interior Acrylic Enamel In				Classic W rior Acry	aterborn lic Enam	e el		
Surf Pre	face paration		Clean, dry, and	Clean, dry, and free of contamination and as recommended by coating manufacturer.									
Ren	narks												
Dry	Film Thi	ckness (DI	FT)										
		Generic Coating Type	Minimu	Shop (S) or Field (F) Minimum DFT Maximum DFT Applied					Ren	narks			
First	t Coat	ACW	1 mils (	25 µm)	2 mil	s (50	μm)	F					
Seco	nd Coat	ACW	2 mils (!	50 µm)	3 mil	ls (75 j	μm)	F					
Thir	d Coat	ACW	2 mils (!	50 µm)	3 mil	ils (75 μm) F							
Com Syst	pleted em		5 mils (2	125 µm)	8 mil	s (200	)µm)						
						2	03/31/16	Biennial Rev	view		GMA	BPL	
┢──	+	+		+	+	0	02/28/11	Initial Issue	ision		GMA	RHW	
REV	DATE	REVISIONS AND	RECORD OF ISSUE	BY	APP	REV	DATE	REVISIONS AND	RECORD OF	ISSUE	BY	APP	
BLA	CK & VEA	АТСН	COATING S	SYSTEM I	DATA	EM 1117	Draw 8111	Rev 2					

	ACK & V	<b>EATCH</b> of difference.		Alkyd (ALK)							Coating System 1201			
Project		Energy-Std-2-(	J3880-01 <sup>2</sup>	420										
Description		Alkyd with zin	c phospha	ite corr	osion i	inhibitor	۲							
Surfaces		Carbon steel												
		First Coat			Touc	hup			Seco	nd Coat				
<b>VOC Limits</b>		3.75 lb/gal (45	0 g/L)1		3.75 lł	b/gal (45	50 g	3/L)1						
Approved Pr	oducts	Coating manuf review/appro	acturers a val.	nd pro	ducts o	other tha	an th	hose listed h	ierein ai	re subject	to Engin	ieer's		
Manufacturer		First Coat			Touc	nup			Secor	nd Coat				
Carboline		Carbocoat 153			Carbo	coat 153	3							
Hempel		13201			13201	1	_							
International		Interlac 789			Interla	ac 789	_							
Jotun		Pilot QD Primer			Pilot (	<b>⊋D Prim</b> €	er							
Tnemec		Series 10	eries 10 Series 10											
Surface Preparation		SSPC-SP6 Com Profile depth (	SSPC-SP6 Commercial BlastCleaning Profile depth 0.5 to 1.5 mils (15 μm to 40 μm)											
Remarks		Anchor profile Weld profile to	Anchor profile to be verified by Contractor using ASTM D4417 Method C. Weld profile to be prepared in accordance with NACE RP0178, Replica "E" profile.											
Dry Film Thi	ickness (DI	FT)												
	Generic Coating Type	Minim	ım DFT	Maxi	imum	DFT	She Fie Ap	op (S) or eld (F) pplied	Rema	rks				
First Coat	ALK	2 mils (	50 µm)	3 mil	s (75 j	μm)	S							
Touchup	ALK	2 mils (!	50 µm)	3 mil	ils (75 μm) S, F				SSPC-SP3 Power Tool Cleaning. (Nonrusted Areas Only)					
									SSPC-SP11 Power Tool Cleaning to Bare Metal (Bare Metal or Rusted Areas)					
Completed System		2 mils (!	50 µm)	3 mil	s (75 j	μm)			Dry film thickness to be verified in accordance with SSPC-PA2.					
<sup>1</sup> EPA co	mpliant, no	t OTC compli	ant											
	+		+	+	1	12/28/	15	Biennial Rev	view		GMA	BPL		
		·			0	03/01/1	13	Initial Issue			GMA	RHW		
REV DATE	REVISIONS AND	RECORD OF ISSUE	BY	APP	REV	DATE		REVISIONS AND	RECORD OF		BY	APP		
BLACK & VEAT	СН	COATING	SYSTEM	DATA	SHEET	S - SYSTI	EM (	1201	Drawing No.			Rev 1		

81113-DM-0692
SPGF 193946.67.9120

Building a world of	EATCH difference.			Еро	ky Zinc (E	PZ)		Coi	ating Sys 1301	stem
Project	Coating Syste	em and Bl	ast Med	ia Sel	ection Pro	ocedure				
Description	Organic zinc									
Surfaces	Carbon steel									
Regulatory Compliance	Volatile orga regulations f	nic compo or the poi	ound (V nt of ap	OC) co plicat	ontent of ion and, a	all materials n s required, the	nust cor e site loo	nply with cation.	applicab	ole
Approved Products	Coating man review/appr	ufacturers oval.	s and pr	oduct	ts other th	an those liste	d hereir	n are subj	ect to En	gineer's
Manufacturer	First Coat			То	ouchup					
Carboline	Carbozinc 85	59		Ca	rbozinc 8	59				
Hempel	Zinc Rich Ep	oxy 178US	5	Zir	nc Rich Ep	oxy 178US				
International	Interzinc 31	5		Int	terzinc 31	5				
PPG	Amercoat 68	HS		An	nercoat 6	BHS				
Sherwin-Williams	Zinc Clad III	HS		Zir	nc Clad III	HS				
Surface Preparation	SSPC-SP 6/N Profile depth	ACE No. 3 1 to 3 mi	Comme ls (25 µ	ercial m to 7	Blast Clea 75 µm)	ning				
Remarks	Profile to be Welds to be p	verified by prepared i	y Contra n accor	actor i dance	using AST with NA(	M D4417 Met E SP0178, Ap	hod C. pendix	C, Designa	ation "E."	
Dry Film Thickness (DFT	)									
Generic Coating Type	Minimu	m DFT	Maxi	mum	DFT	Shop (S) or Field (F) Applied	Ren	narks		
First Coat EPZ	3 mils (7	75 μm)	4 mils	s <mark>(</mark> 100	) µm)	S	0.50 surf	) slip facto faces.	or for fay	ing
Touchup EPZ	3 mils (7	75 μm)	4 mils	s (100	) µm)	S, F	SSP( Clea Only	C-SP 3 Po ining (Noi y).	wer Tool nrusted A	Areas
							SSP Pow Met	C-SP 15 C ver Tool C al or Rust	ommerci leaning ( ed Areas	ial Grade [Bare ).
Completed System	4 mils	s (100	) μm)		Dry veri SSP	film thick fied in acc C-PA 2.	mess to h cordance	e with		
		6 10/28/16 Slip-Critical J						lates	RJT	BPL
		RV	ДРР	0 REV	06/01/08	REVISIONS AND	RECORD OF	ISSUE	BPL	
BLACK & VEATCH	COATING	SYSTEM	DATA S	HEET	S - SYSTEI	M 1301	Drawi 81113	ng No. -DM-0641		Rev 6



Ш	Buildi	ACK & V ng a world	<b>/EATCH</b> of difference.			Еро	xy Zinc (I	EPZ)		Coat	ting Sys 1302	tem
Pro	ject		Energy-Std-2-03	880-014	¥20							
Des	cription		Organic zinc col the dry film above	d galvani ve 92 pei	izing c rcent a	ompo nd co	und in aer mplies wit	osol contain h ASTM A78	er. Coating 80-09 <mark>(</mark> 201	g contains 5).	zinc con	tent in
Surf	faces		Carbon steel wit	h galvan	izing							
			First Coat		Т	ouch	up					
voo	Limits		Galvanizing exis	ts	4	.17 lb,	/gal (500 g	g/L)				
Арр	proved Pr	oducts	Coating manufactors and the contract of the co	cturers a l.	nd pro	oducts	other tha	n those liste	d herein ai	re subject	to Engin	eer's
Man	ufacturer		First Coat		Т	ouch	սթ					
Alviı	ı				G	alvax	Cold Galva	nizer 5010	1			
Clear	rco				Z	inc Sp	ray					
Rust	-Oleum				С	old Ga	alvanizing	V2185838				
Seyn	ymour Cold Galvanizing Primer 16-1445											
ZRC			ZRC Cold Galvanizing Compound									
Sur	face		SSPC-SP 3, Powe	er Tool Cl	leanin	g (Non	nrusted Ar	eas Only)				
Pre	paration		SSPC-SP 11, Pow	ver Tool (	Cleani	ng to E	Bare Metal	(Bare Meta	l or Rusted	Areas)		
Ren	iarks		Complies with A	SIMA/8	so or M	III-P-2	21035A					
Dry	Film Thi	ckness (Dl	FT)									
		Generio Coating Type	c g Minimun	n DFT	Max	dimun	n DFT	Shop (S) o Field (F) Applied	r Rem	narks		
First	t Coat	Hot-Dip Galvani:	zing						Galv	anizing ex	ists.	
Tou	chup	EPZ	2 mils (50	) µm)	3 mi	ils (75	μm)	S, F	Touo galva	chup for h anizing.	ot-dip	
Com Syst	pleted em		2 mils (50	) µm)	3 mi	ils (75	μm)		Dry : verif SSPC	film thicki fied in acc C-PA 2.	ness to b ordance	e with
						2	12/29/14	General	Revision Revision		JTD GMA	RHW RHW
3	03/31/16	Biennial Rev	view	GMA	BPL	0	06/01/08	Initial Issue BPL RHV			RHW	
REV BLAC	DATE	REVISIONS AND	COATING SY	BY STEM DA	APP	REV	- SYSTEM	REVISIONS	AND RECORD OF Drawing	No.	BY	APP Rev 3

Ę	Buildin	CK & V	<b>EATCH</b> of difference.		Ep Ej	оху Р роху∣	'henolic ( Phenolic	(EPP)/ (EPP)		Соа	ting Sys 1313	tem
Proj	ject		Energy-Std-2-0	3880-014	420							
Dese	cription		Epoxy phenolic	with epo	oxy pher	10lic fi	inish					
Surf	aces		Carbon and sta	inless stee	el under	insula	ation					
			First Coat			Touc	hup		Seco	ond Coat		
voc	Limits		2.83 lb/gal (34	0 g/L)	;	2.83 lł	o/gal <mark>(</mark> 34(	) g/L)	2.83	lb/gal (34	0 g/L)	
Арр	roved Pro	ducts	Coating manufa review/approv	acturers a 'al.	nd prod	lucts c	other than	ı those list	ted herein a	re subject	to Engir	ieer's
Man	ufacturer		First Coat			Touch	nup		Seco	nd Coat		
Carb	oline		Thermaline 45	0 EP		Therm	naline 450	) EP	Ther	maline 450	) EP	
Hem	pel		Hempadur 856	71	1	Hemp	adur 8567	71	Hem	padur 856	71	
Inter	national		Intertherm 228	HS	I	Intert	herm 228	HS	Inter	therm 228	HS	
Jotur	1		Tankguard Stor	rage		Fankg	uard Stor	age	Tank	guard Stor	age	
PPG	PPG Amercoat Amercoat 9 Sherwin-Williams Epo-Phen F			S		Amero	coat 90 HS	3	Ame	rcoat 90 HS	S	
Sher	win-Willian	15	Epo-Phen FF		I	Epo-P	hen FF		Epo-	Phen FF		
Surf Prep	Sherwin-Williams     Epo-Phen F       Surface     SSPC-SP 10       Preparation     SSPC-SP 16       Profile dep			ICE No. 2 I Ish-Off Bla to 3 mils	Near Wl ast Clea (50 µm	hite Bl ning c to 75	last Cleani of Non-Fei µm)	ing rrous Meta	als (Stainles	ss Steel)		
Rem	ıarks		Profile to be ve Welds to be pre	rified by ( pared in	Contrac accorda	tor usi ince w	ing ASTM rith NACE	D4417, M SP0178, A	lethod C. Ippendix C,	Designatio	on "E."	
Dry	Film Thic	kness (DF	·T)									
		Generic Coating Type	Minimun	1 DFT	Maxi	mum	DFT	Shop (S) Field (F) Applied	or Rer	narks		
First	t Coat	EPP	4 mils (10	0 μm)	6 mil	s (150	) μm)	S				
Touc	chup	EPP	4 mils (10	0 µm)	6 mils	s (150	)µm)	S, F	SSP Clea	C-SP 11 Po aning to Ba	ower Too re Meta	ol 1.
Seco	nd Coat	EPP	4 mils (10	0 μm)	6 mil	s (150	) μm)	S, F				
Com Syste	pleted em		8 mils (20	/0 μm)	12 mi	ils <mark>(</mark> 30	/0 μm)	) Dry film thickness to be verified in accordance with SSPC-PA 2.				e with
5	04/29/16	Biennial Re	view	GMA	BPL	2	04/05/13	Biennia	Review		GMA	RHW
4	12/29/14	Product Op	ange	GMA	RHW	0	06/01/08	Corpora	ate ivierger ssue		BPL	RHW
REV	DATE	REVISIONS AND	Mange         GIVIA         KHVV         O         Ob/01/05         Initial issue         BFL           ND RECORD OF ISSUE         BY         APP         REV         DATE         REVISIONS AND RECORD OF ISSUE         BY				APP					
BLAC	K & VEATC	н	COATING	i SYSTEM	DATA S	HEET	S - SYSTEI	M 1313	Drawi 81113	ing No. -DM-0647		Rev 5

BLACK 8 Building a wor	VEATCH	Eŗ	ooxy Ti	e Coa	at <mark>(</mark> EPS)/	Epoxy (EPS	i)	Coa	nting Sy 1314	stem
Project	Energy-Std-2-	03880-014	<b>420</b>							
Description	Epoxy tie coat	with epox	y finish							
Surfaces	Pre-painted ca	rbon steel	l							
	First Coat		:	Seco	nd Coat		Thir	d Coat		
VOC Limits	Exists		:	1.66 ll	b/gal (200	) g/L)	1.25	lb/gal (15	60 g/L)	
Approved Products	Coating manuf review/appro	facturers a val.	nd prod	lucts o	other thar	n those listed	herein a	re subject	t to Engir	ieer's
Manufacturer	First Coat		:	Secon	nd Coat		Thire	d Coat		
Carboline	N/A		]	Rustb	ond		Sanit	ile 255		
International	N/A		]	Devra	n 203		Tru-O	Glaze-WB	4428	
PPG	N/A		1	Amerl	lock 2/40	0	Amer	lock 2/40	00 VOC	
Sherwin-Williams N/A Macropoxy 5000 Pro Industrial Water Based Catalyzed Epoxy								ased		
Surface PreparationSSPC-SP2 Hand Tool Cleaning or SSPC-SP3 Power Tool Cleaning as recommended by coating manufacturer.								oating		
Remarks	Measure and r for adhesion b	ecord dry efore full a	film thi applicat	cknes ion.	s before a	pplication of	second a	and third o	coats. Sp	ot test
Dry Film Thickness	(DFT)									
Gene Coati Type	ric ng Minimu	ım DFT	Maxi	mum	DFT	Shop (S) or Field (F) Applied	Ren	narks		
First Coat							Firs for l	t coat exis ater use.	sts. Reco	rd DFT
Second Coat EPS	Per Manufa	cturer	Per Manu	factu	rer	F	Reco later	ord wet fi r use.	lmthickr	less for
Third Coat EPS	2 mils (	50 µm)	3 mil	s (75 j	μm)	F				
Completed System (Third Coat Only)	2 mils (50 μm)       3 mils (75 μm)       Dry film thickness to be verified in accordance wit SSPC-PA2.					e with				
				2	12/31/15	6 Biennial Re	view		RJT	BPL
				0	02/28/11	Initial Issue	n		GMA	RHW
REV DATE REVISIONS	AND RECORD OF ISSUE	BY	APP	REV	DATE	REVISIONS AND	RECORD OF	ISSUE	BY	АРР
BLACK & VEATCH	COATING	SYSTEM I	DATA S	SHEE	TS - SYST	TEM 1314	Draw 8111	ing No. 3-DM-06	578	Rev 2

Ę	BL/Buildi	ACK & V	<b>EATCH</b> of difference.	Ерох	.y Mas	onry	Filler (El	PS)/Epoxy (	(EPS)	Coa	iting Sy 1315	stem
Pro	ject		Energy-Std-2-(	)3880-01	420							
Des	cription		Epoxy masonr	y filler wi	th epoxy	y finisl	h					
Sur	faces		Concrete and c	oncrete n	nasonry	/						
			First Coat			Seco	nd Coat					
voc	Limits		1.66 lb/gal (20	0 g/L)		1.25 lł	b/gal (15)	0 g/L)				
Арр	roved Pr	oducts	Coating manuf review/approv	acturers a /al.	ind proc	ducts o	other thar	a those listed	herein ar	re subject	t to Engir	ieer's
Man	ufacturer		First Coat			Secon	ıd Coat					
Carb	oline		Sanitile 600			Saniti	le 255					
Inter	mational		Tru-Glaze-WB	4015		Tru-G	laze-WB	4428				
PPG			Amerlock 400	3F		Amerl	lock 2/40	0 VOC				
Sher	win-Willia	ms	Kem Cati-Coat	į	Pro In Cataly	dustrial V zed Epox	Nater Based y					
Tner	Tnemec     EpoxoBlock WB 1254     Enviro-Pox Series 287											
Surf Pre	face paration		In accordance w	-SP13/I	NACE	No. 6 and	as recommen	nded by c	oating ma	anufactu	rer.	
Ren	narks											
Dry	Film Thi	ckness (DI	FT)									
		Generic Coating Type	; Minimu	ım DFT	Maxi	imum	DFT	Shop (S) or Field (F) Applied	Ren	narks		
First	t Coat	EPS	Per Manufa	turer	Per Manu	ufactu	rer	F				
Seco	ond Coat	EPS	2 mils (!	50 µm)	3 mil	ls (75 j	μm)	F				
Com Syst (Sec Only	pleted em ond Coat /)		2 mils (5	i0 μm)	3 mil	s (75 µ	um)					
				$\square$	<b>—</b>	2	12/27/1:	3 Added Jotr	un		GMA	RHW
Ļ	10/04/45						08/31/17	General Re	evision		GMA	RHW
3 REV	12/31/15	Bienniai Kev		RJI	APPL	0 REV	02/28/1J	I Initial Issue	B RECORD OF	ICCLIF		
BLA	CK & VEA	TCH	COATING S	YSTEM	DATA	SHEE	TS - SYS	TEM 1315	Draw 8111	ing No. 3-DM-06	579	Rev 3



Ę	BL/	ACK & V ng a world o	EATCH			Inorg	;anic Zinc	(IZ)		Coat	ting Sys 1401	stem
Proj	ject		Coating Syst	em and Bl	last Med	dia Sel	lection Pro	ocedure				
Des	cription		Inorganic zir	ic with or	ganic zi	nc tou	ıchup					
Surf	faces		Carbon steel									
Reg	ulatory C	ompliance	Volatile organized regulations f	nic compo or the poi	ound (V int of ar	/OC) co pplicat	ontent of a tion and, a	all materials r is required, th	nust cor le site lo	nply with a cation.	applicab	le
Арр	roved Pro	oducts	Coating man review/appr	ufacturer: oval.	s and pr	roduct	ts other th	an those liste	d hereir	1 are subje	ct to En	gineer's
Man	ufacturer		First Coat			Τοι	ıchup					
Carb	oline		Carbozinc 11	L		Car	bozinc 85	9				
Hem	pel		Galvosil 156	30		Zin	c Rich Epc	xy 178 US				
Inter	rnational		Interzinc 22			Inte	erzinc 315	·				
JotunResist 78Barrier PlusPPGDimetcote 9Amercoat 68 HS												
PPG			Resist /8     Barrier Plus       Dimetcote 9     Amercoat 68 HS       Zinc Clad II     Zinc Clad III HS									
Sherwin-Williams Zinc Clad II Zinc Clad III HS												
Surf Prej	face paration		SSPC-SP6/NA Profile depth	ACE No. 3 1 1 to 3 mi	Comme ils (25 µ	ercial um to	Blast Clea 75 µm)	ning				
Ren	ıarks		Profile to be Welds to be	verified b prepared	y Contra in accor	actor dance	using AST e with NA(	M D4417 Met E SP0178, Ar	hod C. opendix	C, Designat	tion "E."	
Dry	Film Thi	ckness (DF	Г)									
		Generic Coating Type	Minimu	m DFT	Maxi	imum	DFT	Shop (S) or Field (F) Applied	Rer	narks		
First	t Coat	IZ	3 mils (7	′5 μm)	4 mil	s (100	) μm)	S	0.50 surf	) slip factor faces.	r for fay	ing
Touc	chup	EPZ	3 mils (7	'5 μm)	4 mils	s (100	) µm)	S, F	SSP Clea Onl	C-SP 3 Pow ming (Nom y).	ver Tool rusted A	Areas
SSPC-SP 15 Commercial Power Tool Cleaning (Ba Metal or Rusted Areas).							al Grade Bare ).					
Com Syste	pleted em		3 mils (7	′5 μm)	4 mils	s (100	)µm)		Dry veri SSP	film thickn fied in acco C-PA 2.	iess to b ordance	e with
5	10/28/16	Slip-Critical Jo	int Updates	RJT	BPL	2	06/20/12	General Rev	/ision		GMA	RHW
4	12/28/15	Biennial Revie	W	GMA	BPL	1	09/19/11	0/11 Corporate Merger GMA RH				
REV	DATE	REVISIONS AND R	ECORD OF ISSUE	BY	APP	REV	DATE	REVISIONS AND	RECORD O	FISSUE	BY	APP
BLAC	CK & VEAT(	СН	COATING	SYSTEM	DATA S	SHEET	S - SYSTEP	vi 1401	Drawi 81113	ng No. -DM-0648		Rev 5

Ę	BL/ Buildi	ACK & V	<b>EATCH</b> of difference.	In	organic	: Zinc	: (IZ)/Sil	licor	ne Acrylic	(SLA)	Coat	ting S 161	ystem 3
Pro	ject		Energy-Std-2-0	3880-01	1420								
Des	cription		Inorganic zinc	primer w	vith amb	ient te	emperatu	ire ci	ured high te	emperature fi	inish		
Surf	faces		Carbon steel										
			First Coat		Touch	up		S	econd Coat	t 7	Third C	oat	
voc	Limits		4.17 lb/gal (50	0 g/L)	4.17 lb,	/gal (£	500 g/L)	3.	.5 lb/gal (4	20 g/L) 3	3.5 lb/g	al <b>(</b> 42,	0 g/L)
Арр	roved Pro	ducts	Coating manufa review/approv	acturers : /al.	and proc	lucts o	other tha	n the	ose listed he	erein are sub	ject to F	Engine	eer's
Man	ufacturer		First Coat		Touch	ap		S	econd Coat	t T	Third C	oat	
Carb	oline		Carbozinc 11 S	eries	Carboz	inc 11	Series	T	hermaline 4	4000 AL	N/A		
InternationalInterzinc 22Interzinc 22Intertherm 50Intertherm 50PPGDimetcote 9Dimetcote 9Hi-Temp 1000 VN/A							)						
PPG			Dimetcote 9		Dimeto	ote 9		H	i-Temp 10(	1 V 00	N/A		
Surf Prej	Surface       SSPC-SP10/NACE No. 2 Near-White Metal Blast Cleaning         Preparation       Profile depth 1 mil (25 μm) to 2 mils (50 μm)         Remarks       Profile to be verified by Contractor using ASTM D4417 Method C.												
RemarksProfile to be verified by Contractor using ASTM D4417 Method C. Welds to be prepared in accordance with NACE RP0178, Appendix C, Designation "E."													
Dry	Film Thic	kness (DFT)											
		Generic Coating Type	Minimu	n DFT	Maxi	imum	DFT	Sho Fie Ap	op (S) or ld (F) plied	Remarks			
First	t Coat	IZ	2 mils (5	0 µm)	3 mil	s (75	μm)	S					
Tou	chup	IZ	2 mils (50	0 μm)	3 mil	s (75 j	μm)	S, F		SSPC-SP11 Cleaning t metal or r	1 Power to Bare I rusted ai	r Tool Metal reas).	(bare
Seco	nd Coat	SLA	Per manufact recomme	turer's endation	Per manu recor	ıfactw mmen	rer's dation	S, F					
Thir	d Coat	SLA	1 mil (25	μm)	1.2 m	ils (30	0 μm)	S, F	1	Internatio	onal pair	nt only	у.
Com Syst	pleted em	IZ/SLA	Per manufact recomme	turer's endation	Per manu recor	ıfactu nmen	rer's dation			Dry film th verified in SSPC-PA2	hickness 1 accord	s to be lance 1	e with
				—		2	02/10/1	/10/16 General Revision RJT		BPL			
┣──	+	+		+	'	0	03/29/1	.5 13	General Ne	vision			RHW
REV	DATE	REVISIONS AND	RECORD OF ISSUE	BY	APP	REV	DATE	_	REVISIONS AN	D RECORD OF ISSUE	B	Y	APP
BLA	CK & VEA	АТСН	COATING S	SYSTEM	DATA	SHEE	TS - SYS	STEN	<b>/ 1613</b>	Drawing N 81113-DN	No. <b>M-069</b> 1	ι	Rev 2



Building a world of	EATCH f difference.	Ер	oxy Zin	c (EPZ	Z)/Polyure	ethane (URA	)	Соа	ating Sys 1712	stem
Project	Coating Syst	em and Bl	ast Med	ia Sel	ection Pro	cedure				
Description	Organic zinc	with high	-build p	olyur	ethane fini	sh				
Surfaces	Carbon steel									
Regulatory Compliance	Volatile orga regulations f	nic comp or the poi	ound (V nt of ap	OC) co plicat	ontent of a ion and, as	ll materials n required, th	nust cor e site lo	nply with cation.	applicab	ole
Approved Products	Coating man review/appr	ufacturer: oval.	s and pr	oduct	s other tha	an those liste	d hereir	n are subje	ect to En	gineer's
Manufacturer	First Coat			Του	ıchup		Se	cond Coat	t	
Carboline	Carbozinc 85	59		Car	bozinc 859		Ca	rbothane	133 LH	
Hempel	Zinc Rich Ep	oxy 178U	S	Zino	Rich Epoz	xy 178US	He	mpathane	HS 556	10
International	Interzinc 31	5		Inte	erzinc 315		Int	erthane 8	70UHS	
PPG	Amercoat 68	8 HS		Am	ercoat 68 I	łS	An	nershield		
Sherwin-Williams	Zinc Clad III	HS		Zino	: Clad III H	S	Ac	rolon 218	HS	
SurfaceSSPC-SP 6/NACE No. 3 Commercial Blast CleaningPreparationProfile depth 1 to 3 mils (25 μm to 75 μm)										
Remarks       Profile to be verified by Contractor using ASTM D4417 Method C.         Welds to be prepared in accordance with NACE SP0178, Appendix C, Designation "E."										
Dry Film Thickness (DFT	[)									
Generic Coating Type	Minimu	m DFT	Maxii	mum	S I DFT A	Shop (S) or Field (F) Applied	Ren	narks		
First Coat EPZ	3 mils (7	75 µm)	4 mils	s <mark>(</mark> 100	μm) S	6, F	0.50 fayi	) minimun ng surface	n slip fac s.	tor for
Touchup EPZ	3 mils (7	75 µm)	4 mils	s (100	μm) S	6, F	SSP Clea Only	C-SP 3 Por ming (Nor y).	wer Tool n-Rusted	Areas
							SSP Pow Met	C-SP 15 Co ver Tool C al or Rust	ommerci leaning ( ed Areas	ial Grade Bare ).
Second Coat         URA         3 mils (75 μm)         5 mils (125 μm)         S, F         Do not applisurfaces.							not apply f aces.	to faying	[	
Completed System	6 mils (1	ils (150 μm) 9 mils (225 μm) Dry film thickness to be verified in accordance with SSPC-PA 2.						e with		
			6 10/28/16 Major Revision RJT B			BPL				
		PV	0 06/01/08 Initial Issue BPL RH				RHW			
BLACK & VEATCH	COATING	SYSTEM	DATA S	HEET	S - SYSTEN	11712	Drawi 81113	ng No. -DM-0654		Rev 6

Ę	Buildi	ACK & V	EATCH	E	poxy (I	E <b>PS)/</b>	Polyure	thane (URA)	)	Соа	ating Sy 1713	stem
Pro	ject		Coating Syst	em and B	last Mee	dia Sel	lection Pr	ocedure				
Des	cription		Epoxy tie co	at with po	olyureth	iane fi	nish					
Sur	faces		Hot-dip galv	anized (H	iDG) ste	el						
Reg	ulatory C	ompliance	Volatile orga regulations	nic comp for the po	ound (V int of ar	/OC) co pplicat	ontent of tion and, a	all materials n is required, th	nust con e site lo	nply with cation.	applical	ole
Арр	proved Pro	oducts	Coating man review/app	ufacturer roval.	s and pi	roduct	ts other th	ian those liste	d hereir	ı are subj	ect to En	gineer's
Mar	ufacturer		First Coat		S	econd	l Coat		Thire	d Coat		
Carb	ooline		HDG		С	arbog	uard 60		Carbo	othane 13	34 HG	
Inte	rnational		HDG		Iı	nterse	al 670HS		Inter	thane 990	OV	
Jotu	n		HDG		Р	engua	ard Univer	rsal	Hard	top XP		
PPG	i		HDG		А	merlo	ock 2		Amer	rcoat 450	Н	
Sher	rwin-Willia	ms	HDG		Μ	lacror	ooxy 646		Acrol	lon Ultra		
Sur Pre	Sherwin-Williams Surface Preparation		SSPC-SP 1 Sc chromate or Cleaning of 1	)lvent Clea silicate si Non-Ferro	aning ar urface ti ous Meta	nd as r reatm als.	recommer ents are p	ided by coatin resent, then S	ig manu SPC-SP	facturer. 16 Brush	Caution: -Off Blas	lf t
Ren	narks											
Dry	/ Film Thi	ckness (DF	Г)									
		Generic Coating Type	Minimu	ım DFT	Maxi	imum	DFT	Shop (S) or Field (F) Applied	Ren	narks		
Firs	t Coat	HDG							Touc CSD befc	ch up galv S 1302 (E ore procee	vanizing EPZ), if re eding.	with equired,
Seco	ond Coat	EPS	2 mils (!	50 µm)	3 mil	s (75	μm)	S, F				
Thir	rd Coat	URA	2 mils (!	50 µm)	3 mil	s (75	μm)	S, F				
Com Syst	ipleted tem		4 mils (1	100 µm)	6 mil	s (150	)µm)					
Ē.			2 12/27/13 Added Jotur			<u> </u>		GMA	RHW			
4	10/28/16	Biennial Revie	w/VOC Change	VOC Change RJT BPL 1 07/12/13 General Rev GMA BPL 0 02/28/11 Initial Issue		ision		GMA	RHW			
REV	DATE	REVISIONS AND R	CORD OF ISSUE BY APP REV DATE REVISIONS AND					RECORD OF	FISSUE	BY	APP	
BLA	CK & VEAT	сн	COATING	SYSTEM	DATA S	SHEET	S - SYSTE	M 1713	Drawi 81113	ng No. -DM-0668	3	Rev 4



Ę	Buildin	CK & V	EATCH of difference."	Ej	poxy (E	:PS)/	Polyureth	ane (URA)		Coatin 1	g Sy 714	stem
Proj	ject		Coating Syst	em and B	last Med	lia Sel	ection Proc	edure				
Desc	cription		Epoxy tie co	at with pc	lyureth	ane fir	nish					
Surf	laces		Pre-painted	carbon st	eel							
Reg	ulatory Co	ompliance	Volatile orga regulations f	nic comp for the po	ound (V int of ap	OC) co plicat	ontent of all ion and, as	l materials m required, the	ust com site loca	ply with app ation.	olicał	ole
Арр	roved Pro	ducts	Coating man review/app	ufacturer roval.	s and pr	roduct	ts other that	n those listed	l herein	are subject t	to En	gineer's
Man	ufacturer		First Coat		Se	cond (	Coat		Third	Coat		
Carb	oline		N/A		Ru	stbon	.d		Carbo	thane 134 H	G	
Inter	national		N/A		Int	tersea	l 670HS		Intert	hane 990V		
Jotun N/A Jotamastic 80 Hardtop XP												
PPG         N/A         Amerlock Sealer         Amercoat 450H												
Sher	win-Willian	ns	N/A		Ma	acropo	oxy 5000		Acrolo	on Ultra		
Surf Prej	ace paration		Clean surface prepare surf Cleaning.	e in accor ace in acc	dance w cordance	/ith SS e with	SPC-SP 1 So SSPC-SP 2	lvent Cleanin Hand Tool Cl	ıg. If exi leaning	sting coating or SSPC-SP 3	g is d 3 Pov	amaged, wer Tool
Rem	narks											
Dry	Film Thic	kness (DF	Г)									
		Generic Coating Type	Minimu	m DFT	Maxiı	mum	Sh Fi DFT Aj	10p (S) or Ield (F) pplied	Rema	arks		
First	t Coat	Existing Paint										
Seco	nd Coat	EPS	1 mil (2)	5 µm)	2 mil	s (50 j	μm) F					
Thir	d Coat	URA	2 mils (!	50 μm)	3 mil	s (75 j	μm) F					
Com Syste	pleted em		3 mils (7	/5 μm)	5 mils	s (125	; μm)					
						2	12/28/15	<b>Biennial Revi</b>	iew	GN	AN	BPL
_	40/20/10	D' del Der				1	12/27/13	Added Jotun		GN	AN	RHW
3 REV	10/28/16	Biennial Rev	RECORD OF ISSUE	RJI	APP	0 REV	02/28/11	8/11 Initial Issue GMA RHV			APP	
BLAC	CK & VEATO	СН	COATING	SYSTEM	DATAS	SHEET	S - SYSTEN	/ 1714	Drawir 81113-	ng No. DM-0669		Rev 3



Ŗ	Building	CK & VE	EATCH difference.*	Vinyl	Ester (	(SPC),	/Vinyl Est (SPC)	er Flake Filled	Coa	iting Sys 2011	stem	
Projec	t		Energy-Std-2-03	880-0142	0							
Descr	iption		Vinyl ester with v	vinyl ester	second	l coat a	and vinyl est	er finish				
Surfac	es		Carbon steel									
		F	irst Coat		:	Second	l Coat	Thiı	rd Coat			
VOC Li	mits		2.80 lb/gal (340 g	/L)	:	2.80 lb,	/gal <mark>(</mark> 340 g/L	.) 2.80	lb/gal <mark>(</mark> 340	g/L)		
Approv	ved Produ	ıcts	Coating manufact review/approval	turers and	d produ	cts oth	er than thos	e listed herein are s	ubject to Ei	ngineer's		
Manufa	acturer		First Coat			Secon	d Coat	Thiı	rd Coat			
Carboli	ne		Plasite 4310		1	Plasite	4310	Plas	ite 4310			
Hempel	l		Versiline Primer	205	1	Versili	ne TL-280 S	GF Vers	iline TL-28	0 AR		
Interna	tional		Ceilcote 380 Prin	ner	(	Ceilcot	e 242	Ceile	cote 242AR			
Jotun			Chemclear		(	Chemf	ake Special	Chei	nflake Spec	ial		
KCC Cor	rrosion Cor	ntrol	P3.3			VE 62		VE 6	2			
Surfac	e Prepara	tion	SSPC-SP 5 White	Metal Bla	ist Clear	ning Pr	ofile depth	3 to 5 mils (75 µm t	το 125 μm)			
			Weld profile to b Maintain minimu Third coat Taber 1,000 g and CS-1 Second and third measured in acco	e prepare um of 1/8 abrasion 7 wheel, t coat moi ordance w	ed in acc in. radiu test res ested in sture pe vith AST	ordan 15 on a sult(s) accor ermeal ME96	ce with NAC ll corners ar shall be less dance with A bility shall be	E SP0178, Designat ad edges. than or equal to 20 ASTM D4060. e less than or equal	tion "C" pro ) mg loss pe to 0.0010 p	file. er 1,000 c perm-inch	ycles with h when	
Dry Fil	m Thickn	ess (DFT)										
		Generic Coating Type	Minimum D	FT	Max	imum	DFT	Shop (S) or Field (F) Applied	Remarks			
First Co	bat	SPC	20 mils (500 In accordanc manufacture	μm) ce with er	25 n In ac man	nils (62 corda ufactu	25 μm) nce with rer	F	Carboline o Others. Record wet later use.	only. t film thic	kness for	
Second	Coat	SPC	20 mils (500 30 mils (750	μm) μm)	25 n 40 n	nils (62 nils (1,	25 μm) 000 μm)	F	Carboline o Others.	only.		
Third (	Coat	SPC	20 mils (500 15 mils (375 30 mils (750	μm) μm) μm)	25 n 25 n 40 n	nils (62 nils (62 nils (1,	25 μm) 25 μm) 000 μm)	F	Carboline o Internation Others.	only. Ial only.		
Comple System (Carbo First, S and Th Coats) (Others Second Third C Only)	eted line, econd, ird s, and coats		60 mils (1,50 45 mils (1,12 60 mils (1,50	00 μm) 25 μm) 00 μm)	75 n 65 n 80 n	nils (1, nils (1, nils (2,	875 μm) 625 μm) 000 μm)		Carboline of Internation Others. Dry film thi verified in a SSPC-PA 2. Holiday tess performed NACE SP01 manufactur	only. ial only. ickness to accordand ting shall in accord 88 and co rer's instr	be ce with be lance with pating ructions.	
						2	04/29/16	Biennial Review		I Coat b/gal (340 g/L) bject to Engineer's I Coat e 4310 ine TL-280 AR ote 242AR flake Special 125 μm) on "C" profile. mg loss per 1,000 cycles w o 0.0010 perm-inch when o 0.0010 perm-inch when cecord wet film thickness for arboline only. thers. arboline only. thers. arbolin		
						0	06/01/08	General Revision		bject to Engineer's bject to Engineer's lCoat e 4310 ine TL-280 AR te 242AR flake Special 125 μm) on "C" profile. mg loss per 1,000 cycles wi o 0.0010 perm-inch when o 0.0010 perm-inch when emarks arboline only. thers.		
REV	DATE	REVISIONS AND	RECORD OF ISSUE	BY	APP	REV	DATE	REVISIONS AND RECORD	OFISSUE	BY	APP	



# Passaic Valley Sewerage Commission Power Generation System

BLACK	( & VEATC	н	COATING SY	STEM D	OATA S	HEET	S - SYSTEN	<b>N 2011</b>	Drawing No. 81113-DM-06	55	Rev 2
Ш7	BLA	CK & V	EATCH	Adhes	ive Pr	imer Tape	(SPC)/Cold ∍ (SPC)	l Applied	Coatin 3	g Systo 011	em
Proj	ject		Energy-Std-2-03	880-014	20						
Des	cription		Adhesive primer	with AV	WWA C2	209 Ty	pe II cold ap	plied tape f	inish (≤ 120° F; ≤	49°C)	
Surf	faces		Carbon steel or s	tainless	steel						
		I	First Coat			Touc	hup		Second Coat		
voo	Limits		1.66 lb/gal (200	g/L)	]	N/A			N/A		
Арр	proved Pro	oducts	Coating manufac review/approva	cturers an l.	nd proc	lucts o	other than th	ose <mark>l</mark> isted h	erein are subject	to Engii	neer's
Man	ufacturer		First Coat			Touch	աթ		Second Coat		
Berr	y Plastics		Polyken 1033a						Polyken 930-35		
Dens	50		Denso Butyl Prir	ner					Denso Butyl 35	Tape	
TapecoatTC Omni-prime									H35 Gray		
Surf Prej	face paration		SSPC-SP3 Power	<sup>.</sup> Tool Cle	aning						
Ren	narks		Welds to be prep	oared in a	accorda	nce w	ith NACE RP	0178, Appe	ndix C, Designatio	on "E."	
Dry	Film Thic	kness (DF	'T)								
		Generic Coating Type	Minimum	DFT	М	aximu	ım DFT	Shop (S) Field (F) Applied	or Remarks		
First	t Coat	SPC	1 mil (25 µ	um)	2	nils (!	50 µm)	S, F			
Tou	chup		N/A		N/	'A					
Seco	Touchup Second Coat SPC		56 mils (1,	400 μm)	70	) mils	(1,750 µm)	S, F	Add molda fill voids. 50 percen	able sea t overla	lant to p.
Com Syste	pleted em		57 mils (1,	425 μm)	72	mils	(1,800 µm)				
						2	07/12/13	Expanded	to Stainless	GMA	RHW
3	02/29/16	Biennial Rev	view	GMA	BPI	0	06/01/08	Initial Issue		BPI	RHW
REV	DATE	REVISIONS AND	RECORD OF ISSUE	BY	APP	REV	DATE	REVISIONS AND RECORD OF ISSUE BY APP			APP
BLAC	CK & VEATC	н	COATING	SYSTEM	DATA S	HEET	S - SYSTEM 3	011	Drawing No. 81113-DM-0662		Rev 3



Building a world	<b>/EATCH</b> of difference.*	Adhes	ive Pri	mer (	SPC)/Cold / (SPC)	Applied Tape	e Coating System 3012					
Project	Energy-Std-2-0	)3880-01	420									
Description	Adhesive prim	er with A	WWA	C209 1	Гуре II cold	applied tape	finish					
Surfaces	Carbon steel of	r stainles:	ssteel									
	First Coat			Tou	chup		Second Coat					
VOC Limits	1.66 lb/gal (20	0 g/L)		N/A			N/A					
Approved Products	Coating manuf review/approv	acturers a 7al.	and pr	oducts	other than	those listed h	erein are subject	to Engir	ieer's			
Manufacturer	First Coat			Tou	chup		Second Coat					
Tapecoat	,					HT/MB						
Surface Preparation	omme (25 µ	rcial B m to 5	last Clean 0 μm)									
Remarks	Use aluminum Profile to be ve Welds to be pr	e aluminum oxide grit on stainless steel. ofile to be verified by Contractor using ASTM D4417 Method C. elds to be prepared in accordance with NACE RP0178, Appendix C, Designation "E."										
Dry Film Thickness (D	FT)											
Generic Coating Type	Minimum	DFT	Max	kimun	n DFT	Shop (S) or Field (F) Applied	Remarks					
First Coat SPC	6 mils (150	μm)	10 1	nils (2	50 µm)	S, F						
Touchup	N/A		N/A	1								
Second Coat SPC	38 mils (95	0 µm)	42 1	nils (1	,050 μm)	S, F	Add moldab voids. 50 pe	le sealar ercent ov	nt to fill verlap.			
Completed System	82 mils (2,0	)50 µm)	94 1	mils (2	,350 μm)							
				2	11/20/13	Biennial Rev	iew	GMA	RHW			
2 02/29/16 Biomini Pr	view	GMA	<b>B</b> DI	1	06/16/10	Product Upd	ate	GMA	RHW			
REV DATE REVISIONS AN	D RECORD OF ISSUE	BY	APP	REV	DATE	REVISIONS AND	RECORD OF ISSUE	BY	APP			
BLACK & VEATCH	COATING	SYSTEM	DATA	SHEE	TS - SYSTEN	1 3012	Drawing No. 81113-DM-0663	Rev 3				

Ę	BLA Buildir	ICK & V	<b>EATCH</b> of difference.		Ероху	r, Fus	ion Bon	ıde	ed (EPB)		Coating S 330	ystem L	
Proj	ect		Energy-Std-2-0	3880-014	<b>120</b>								
Desc	cription		Fusion bonded	epoxy									
Surf	aces		Carbon steel or	stainless	steel								
			First Coat			Touc	hup	_					
voc	Limits		2.83 lb/gal (340	) g/L)	;	2.83 ll	o/gal (34	<b>10 g</b> /	(/L)				
App	roved Pro	ducts	Coating manufa review/approv	cturers a al.	nd prod	lucts c	other tha	n th	hose listed he	erein are sul	bject to Eng	ineer's	
Man	ufacturer		First Coat			Touch	up	_					
3M			6233		;	323							
Jotun	1		Jotapipe AC 101	10   Jotapipe RC 490									
Surf Prep	ace paration		SSPC-SP10/NA0 SSPC-SP16 Brus and Non-Ferrou Profile depth 2	CE No. 2 N sh-Off Bla is Metals to 4 mils	lear Wh ist Clear (Stainle (50 µm	ite Bla ning of ess Ste to 10	ast Cleani f Coated a eel) 0 µm)	ing and	(Carbon Stee l Uncoated G	el) alvanized St	teel, Stainle	ss Steel,	
Rem	arks		Profile to be ver Welds to be pre	Profile to be verified by Contractor using ASTM D4417 Method C. Welds to be prepared in accordance with NACE RP0178, Appendix C, Replica "E."									
Dry	Film Thic	kness (DI	. <b>'T)</b>										
		Generic Coating Type	Minimum I	)FT	Maxii	mum	DFT	Sho Fie Ap	op (S) or eld (F) oplied	Remarks			
First	Coat	EPB	14 mils (350	) μm)	20 mi	ls (50	0 µm)	S					
Touc	hup	SPC	25 mils (625	iμm)	28 mi	ls (70)	0 μm)	S, F	F	SSPC-SP11 Power Tool Cleaning.			
Completed System			14 mils (350	28 mil	nils (700 µm)				Dry film thickness to be verified in accordance with NACE RP0394. Holiday testing required in accordance with NACE RP0490.				
				<b>—</b>	<u> </u>	2	07/12/1	.3	Expanded to S	Stainless	GMA	RHW	
3	02/29/16	<b>Biennial Re</b>	view	GMA	BPL	0	06/01/0	8	Initial Issue		BPL	RHW	
REV	DATE	REVISIONS AND	RECORD OF ISSUE	BY	APP	REV	DATE		REVISIONS AND R	ECORD OF ISSUE	BY	APP	
BLAC	K & VEATC	н	COATING	SYSTEM	DATA S	HEET	S - SYSTE	<b>M</b> 3	3301	81113-DM-(	5. 0664	Rev 3	

Ę	BLACK & VEATCH           Building a world of difference.           Project				Ep Ep	оху ( ооху	Coal Tai Coal Ta	r (EP ir (EP	т)/ т)		Coating System 3311			
Proj	ject		Energy-Std-2-0	3880-01	420									
Dese	cription		Epoxy coal tar p	orimer w	ith epox	y coal	l tar finis	h						
Surf	faces		Carbon steel or	stainles	ssteel									
			First Coat			Touc	hup			Seco	nd Coat			
voc	Limits		2.83 lb/gal (34	) g/L)						2.83 l	b/gal (340	) g/L)		
Арр	roved Pro	oducts	Coating manufa review/approv	cturers al.	and proc	lucts o	other tha	in the	ose listed h	erein ai	rein are subject to Engineer's			
Man	ufacturer		First Coat			Fouch	ոսթ			Seco	nd Coat			
Carb	oline		Bitumastic 300	М						Bitun	nastic 300	М		
PPG 78HB										78HE	3			
Sherwin-Williams Tar Guard			Tar Guard							Tar G	uard			
Tnemec Series 46H									Serie	s 46H				
SurfaceSSPC-SP10PreparationSSPC-SP16Profile dept			SSPC-SP10/NA SSPC-SP16 Brus Profile depth 2	CE No. 2 shoff Bla to 4 mils	Near Wl st Cleani s (50 µm	nite Bl ng of I to 10	last Clear Nonferro 0 µm)	ning ( ous M	(Carbon St etals (Stain	eel) nless Ste	eel)			
Remarks Profile to Welds to			Profile to be ver Welds to be pre	ified by pared in	Contract accorda	tor usi nce w	ing ASTM vith NACH	1 D44 E RP0	17 Metho 178, Appe	d C. endix C, I	Designatio	n "E."		
Dry	Film Thic	kness (DF	T)											
		Generic Coating Type	Minimum D	Ŧ	Maxim	um D	)FT	Shoj Fiel App	p (S) or d (F) lied	Rem	arks			
First	t Coat	EPT	8 mils (200 µ	m)	12 mils	s (300	μm)	S						
Touc	chup		N/A											
Seco	nd Coat	EPT	8 mils (200 µ	m)	12 mils	s (300	μm)	S						
Completed System			16 mils (400	24 mils (600 μm)					Dry film thickness to be verified in accordance with SSPC-PA2. Holiday testing required in accordance with NACE SP0188					
						2	12/29/1	12/29/14 Ge		evision	n JTD		RHW	
3	02/29/16	Biennial Re	view	GMA	BPL	0	06/01/0	1/11 General )1/08 Initial Iss		General Revision		BPL	RHW	
REV BLAC	DATE	REVISIONS AND		BY SYSTEM	BY APP REV DATE REVISIONS AN SYSTEM DATA SHEETS - SYSTEM 3311						D RECORD OF ISSUE BY			
										81113-	DIVI-0665			

# Q301 Manufacturer's Standard Coating

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

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

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

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

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

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

No coating shall be applied to surfaces within 3 inches of field welded connections.

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

# **Q301.1 Control and Electrical Equipment**

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

# Q301.2 Mechanical Equipment

Mechanical equipment, including pumps, compressors, valves, valve operators, external piping surfaces, and other similar equipment, shall be cleaned, prepared, and primed. If mechanical equipment will operate at temperatures above 200° F and will not be insulated, a high temperature coating system designed for the operating temperatures shall be applied.

# Q302 Buyer Specified Shop Coating

Shop coating systems for ferrous metal surfaces of equipment shall be as specified on the Coating System Data Sheets in Technical Supplemental Q300 or listed in the Technical Specifications. Where specific products are not listed, the coating materials shall meet the criteria indicated. Information ensuring conformance with the specified criteria shall be submitted to Buyer.

Paint materials shall conform with and shall be applied in accordance with the regulations of the air quality management agency having jurisdiction. Paint materials that cannot be guaranteed by the



manufacturer to so conform, whether or not specified by product designation, shall not be used. Alternate materials that do conform shall be proposed. Information on the alternate materials shall be submitted to Buyer for acceptance prior to application. Materials shall contain no greater than 0.06 percent lead or chromium in the dried film.

Surfaces shall be cleaned, prepared, and coated in accordance with the Coating System Data Sheets and application specifications. Surfaces to be painted shall be prepared, as necessary, to provide a smooth, uniform base for painting.

Coating films that show defects such as sags, checks, blisters, teardrops, fat edges, chips, gouges, and scratches will not be accepted. Any coated surface that contains any of the previously mentioned defects shall be repaired in accordance with the manufacturer's recommended practice or, if necessary, completely removed from the surface or unit involved and recoated.

Seller shall furnish sufficient touchup paint for repairing 10 percent of the area on all factory painted surfaces of each item of electrical equipment. The touchup paint shall be of the same type and color as the factory applied paint and shall be carefully packed to avoid damage during shipment. Complete painting instructions shall be furnished.

Coatings shall not be applied when the surface temperature is within 5° F of the dew point. No paint shall be applied to surfaces within 3 inches of field welded connections.

# **Q302.1** Control and Electrical Equipment

Control and electrical equipment, including panels, cabinets, switchgear, motor control centers, transformers, motors, and other similar equipment, shall be cleaned and prepared, and given a complete finish coating system as specified on the Coating System Data Sheets. Control instruments and devices and computer equipment shall be furnished with the manufacturers' standard paint.

# Q302.2 Mechanical Equipment

Mechanical equipment, including pumps, compressors, valves, valve operators, dampers, damper drives, mills, grinding apparatus, external piping surfaces, conveying machinery, and other similar equipment, shall be cleaned, prepared, and primed as specified on the Coating System Data Sheets.

This requirement applies to equipment operating up to 200° F and to equipment operating above 200° F that will be insulated.

# Q302.3 Structural Steel and Miscellaneous Metals

Structural steel and miscellaneous metals not specified to be galvanized, including all items fabricated of structural and miscellaneous steel such as ducts, tanks, hangers, supports, and similar fabricated steel assemblies, shall be cleaned, prepared, and primed as specified on the Coating System Data Sheets.

# Q302.4 Hot Metal Surfaces

Hot metal surfaces include metal surfaces of electrical or mechanical equipment or structural steel and miscellaneous metals as defined above that have an operating or service temperature above 200° F. Hot metal surfaces shall be cleaned, prepared, and primed as specified on the Coating System Data Sheets.

# Q302.5 Codes and Standards

Work performed under this specification shall be done in accordance with the following codes and standards. The version that is latest adopted, published, and effective shall apply unless specifically stated otherwise. In the following table, SSPC refers to the Society for Protective Coatings:

Application	Code/Standard					
Shop, field, and maintenance painting	SSPC-PA1					

Application	Code/Standard					
Measurement of dry paint thickness	SSPC-PA2					

# Q302.6 Documentation

Shop drawings shall identify the shop-applied coating systems. Data to be provided shall include the coating system manufacturer's name and product designation, the degree of surface preparation, dry film thickness, finish color, and Safety Data Sheets (SDSs).

Coating dry film thicknesses shall be measured using a magnetic or electronic thickness detector in accordance with SSPC-PA2. Additional coating shall be applied to all areas that show a deficiency in dry film thickness. Final test results shall be submitted to Buyer for verification.

# **Q400** General Equipment Requirements

# Q400.1 Miscellaneous Materials and Services

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

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

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

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

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

Coupling guards for all exposed shafts and couplings.

Leveling blocks, soleplates, thrust blocks, matching blocks, and shims.

Erection drawings, prints, information, instructions, and other data for use by the Installation Contractor.

Detailed storage requirements and lubrication requirements (including frequencies) for use by the Installation Contractor.

Lifting eyes and lugs for offloading and setting equipment.

# **Q400.2 Fabrication Restrictions**

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

Asbestos containing materials will not be allowed.

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

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

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

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

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

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

# Q400.3 Nameplates and Tags

Nameplates and tags shall be furnished and shop installed for all equipment with a Buyer's identification number based upon the guidelines provided herein. The Buyer will annotate the Seller's drawings on initial submittals of technical drawings of the equipment. The information will include the nameplate description, tag number, physical size, and lettering height. The type of nameplate will vary because of size constraints, equipment location and/or orientation, or the environment in which the equipment is located.

In general, nameplates shall be furnished for major equipment, including all operator interfaces, control and electrical panels, cabinets, and instrument racks.

Stainless steel tags shall be furnished for field instrumentation, process valves, and other small devices that a plant operator is not likely to have any direct interface with, as directed by the Buyer.

Separate nameplates are not required for pressure indicators. They may be provided instead with nameplate information, as described above, permanently engraved on the faces. Face engraving text size and layout shall be readable without magnification.

# Q400.4 Factory Assembly

Equipment shall be shipped completely factory assembled, except when the physical size, arrangement or configuration of the equipment, or shipping and handling limitations make the shipment of completely assembled equipment impracticable, in which case the equipment shall be assembled and shipped as stated in the Seller's proposal. Any deviations after Contract Documents award could result in Seller's performance of some assembly at the site or backcharges to the Seller for others required to perform such assembly. When proposals are submitted without statements describing sectional shipments, it will be understood that no field assembly of the equipment will be required and the Seller shall be responsible for all costs encountered in the field for assembly of sections, accessories, or appurtenances not listed in the Proposal as requiring field assembly.

When indicated in the Schedule of Submittals, the Seller shall submit a Shipping Plan confirming and detailing the field assembly requirements as stated in the proposal.

All separately packaged accessory items and parts shall be shipped with the equipment. Containers for separately packaged items shall be marked so that they are identified with the main equipment. An itemized packing slip indicating what is in that container only shall be attached to the outside of each container used for packaging. A similar list shall be inside each container. A master packing slip



covering all accessory items for a given piece of equipment which are shipped in separate containers shall be attached to one container.

# **Q500** Shop Drawings and Instruction Manuals

This section, in conjunction with the Schedule of Submittals, stipulates the requirements for engineering data that Seller shall submit for design information and review. Document submittal procedures shall be in accordance with the requirements of these Contract Documents.

# **Q500.1 Submittal Requirements**

Technical data shall be submitted in electronic format. Hard copy prints of the electronic files shall also be submitted, as specified below.

Electronic technical data submittals shall be made using the Buyer's project collaboration system, a Webbased file transfer service. Buyer will provide the required credentials for access upon Contract Documents award.

Notification to Buyer that submittals have been posted to Buyer's project collaboration system shall be in accordance with the correspondence requirements of these Contract Documents.

The hard copy prints shall be submitted to the address indicated for Technical Documents in these Contract Documents. The following number of prints shall be submitted unless otherwise indicated in the Schedule of Submittals:

# **Q500.2** Compliance Reports

Reports shall be submitted that record the tests and/or calculations required in the specification technical sections. Reports shall be submitted for each piece of equipment or each plant system. Specified drawings shall be submitted with the compliance reports.

# **Q500.3 Motor and Electric Actuator Information**

If required by the Specifications, Motor and Electric Actuator Information shall be submitted in accordance with Supplemental Q502.

# Q500.4 Drawings

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

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

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

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



Each drawing title shall be unique and shall be descriptive of the specific drawing content. Transmittal letters for resubmitted drawings shall include the Buyer's drawing numbers.

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

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

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

# Q500.4.1 Drawing Submittal

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

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

If hard copies are required for submittal, the separately submitted hard copy drawing prints shall be black line on white background. Blue line on white background or color prints are not acceptable. Buyer will use an electronic imaging system in processing the hard copy drawings. All drawings shall be suitable for electronic imaging and shall have the maximum contrast. Print size shall not exceed 34 inches by 44 inches. Drawings shall be folded to 8-1/2 inches by 11 inches. Drawings shall be collated in sets.

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

# Q500.4.2 Drawing Processing

Seller's engineering schedule shall allow a minimum of three (3) weeks for mailing, processing, and review of drawings and data by Buyer.

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

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

**Q500.4.2.2 Exceptions Noted (EN)**. Upon receipt of a submittal marked "Exceptions Noted" and if Seller concurs with Buyer's comments, Seller shall incorporate same and may proceed with its Work to the extent of and in accordance with the annotated submittal. Seller shall submit to Buyer within fourteen calendar days a revision to the original submittal in which Buyer's comments have been incorporated. If Seller determines that it cannot incorporate Buyer's comments without prejudice to Seller's warranty or

other obligations under these Contract Documents, Seller shall so advise Buyer in writing within seven calendar days of its receipt of Buyer's comments, stating the reasons therefore. Seller may proceed with its Work to the extent of and in accordance with the annotated submittal only upon Buyer and Seller resolving Buyer's comments.

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

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

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

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

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

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

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

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



**Q500.4.2.9 File Returns to Seller**. The Project Central web service will be used by Buyer to return TIFF or PDF files to Seller.

A copy of the manifest will be returned to Seller indicating drawings statused as NE (No Exceptions Noted).

Each packet of drawings returned to Seller will include a manifest generated by Buyer. The manifest will include a list of drawings transmitted, manufacturer's drawing numbers, Buyer's assigned drawing numbers, Buyer's drawing titles, and the status of the drawings.

Files returned to Seller will be in TIFF Group 4 or PDF format.

# **Q500.5 Wiring Diagrams**

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

#### **Q500.6 Instruction Manuals**

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



Enter Here	Enter Seller Information Here Project: Project Name				Transmittal Shee	Date: XX/XX/XXXX Sheet: 1 OF XX						
Proje	ct: Proje	ct Nam	е		1							
Contr Comb Turbi	act: oustion ne Genei	rator	Contra 67.912	ct No.: 0	Packet Designation: XX	ľ	Transn No.: X	nittal XXX	New Submittal 🔲 Resubmittal 🗌			
Seller Drawing Data							PVSC Standby Power Project		PVSC Standby Power Project Document Data from the Schedule of Submittals			
ltem No.	Doc No.	Rev No.	Docum	nent Title	9:	1 1	Drawin No.	g	Doc Class	Drawing Series	ltem No.	
Rema	irks:								·	<u> </u>		

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# **Q501** Instruction Manuals

SPGF

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This section, in conjunction with Section Q500 and the Schedule of Submittals of these Contract Documents, stipulates the requirements for Instruction Manuals that Seller shall submit for design information and review. Document submittal procedures shall be in accordance with the requirements of these Contract Documents, Section Q500, and the following.

#### **Q501.1 Submittal Requirements**

Hard copies shall be submitted to the address indicated for Technical Documents these Contract Documents for the documents listed below. The following number of copies shall be submitted unless otherwise indicated in the Schedule of Submittals:

Submittal Description	Copies Required
Proof Copies	Electronic
Final Copies	Six (6)

#### Q501.2 Instruction Manuals

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

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

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

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

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

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

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

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

Installation instructions.

Inspection procedures.



Troubleshooting guide.

All fluid systems schematics and piping diagrams.

Control logic diagrams, as applicable.

Electrical wiring diagrams, as applicable.

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

Motor Information Sheets, as applicable.

Electric Actuator Information Sheets, as applicable.

Control Panel Arrangements, as applicable.

Seller and Sub-Seller operating and maintenance manuals.

Illustrated parts breakdown.

Assembly drawings.

Parts lists.

List of acceptable lubricants.

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

List of recommended spare parts.

List of maintenance tools furnished with the equipment.

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

#### Q501.2.1 Binding

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

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

# TYPICAL INSTRUCTION BOOK COVER

NAME	CLIENT'S NAME	36
OF	NAME OF UNIT	24
EQUIPMENT	UNIT NUMBER	24
		36
NAME	FOR	36
	NAME OF EQUIPMENT	36
	<b>VOLUME NUMBER*</b>	36
NAME OF	CONTRACT DOCUMENTS NUMBER**	24
UNIT	MANUFACTURER'S NAME	24
	MANUFACTURER'S ADDRESS	24
UNIT NUMBER		
CONTRACT DOCUMENTS NUMBER**		
	BLACK & VEATCH	14
	OVERLAND PARK, KANSAS	14
VOLUME NUMBER*		
(Backbone)	(Cover)	

NOTES:

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

# Q502 Electrical Data

This section, in conjunction with Section Q500 and the Schedule of Submittals included in these Contract Documents, stipulates the requirements for Electrical Data that Seller shall submit for design information and review. Document submittal procedures shall be in accordance with the requirements of these Contract Documents, Section Q500, and the following.

# **Q502.1 Submittal Requirements**

Electronic copies shall be submitted to the address indicated for Technical Documents in these Contract Documents for the documents listed below. The following number of copies shall be submitted unless otherwise indicated in the Schedule of Submittals:

Submittal Description	Copies Required
Motor Information Sheets	Electronic
Electric Actuator Information Sheets	Electronic
Wiring Diagrams	Electronic

# **Q502.2 Motor and Electric Actuator Information**

Copies of Motor Information Sheets and Electric Actuator Information Sheet are included at the end of this section. Electronic copies of these information sheets shall be downloaded from the following websites (no password required), electronically completed by filling in the requested data, and submitted by the dates shown in the Schedule of Submittals.

http://bv.com/docs/specifications/MotorInfoSheet.doc

http://bv.com/docs/specifications/Elecactuatorinfosheet.doc

An information sheet shall be completed for each motor and electric actuator furnished under the Contract Documents.

# Q502.3 Wiring Diagrams

Connection and interconnection wiring diagrams furnished by Seller shall be drawn with all devices indicated in their relative physical locations and shall accurately show the equipment and terminals arranged as they would appear to a person wiring the equipment. When accepted by Buyer, termination schedules identifying field terminations may be substituted for wiring diagrams for connections external to equipment.

When the equipment furnished by the Seller is split for shipment and provided with terminal blocks and wiring required to interconnect the shipping sections in the field, the wiring diagrams from the Seller shall clearly identify that the wiring across the shipping splits needs to be field installed.

Where interconnecting wiring from different items of equipment or sectional wiring diagrams of the same item of equipment appear on different wiring diagram sheets, all interconnections shall be clearly identified. Where sectional wiring diagrams are required for a single item of equipment, such as a relay panel or control panel, the section of the panel that is represented by each individual wiring diagram sheet shall be keyed on that sheet in a manner acceptable to Buyer.

Information indicated on Seller's drawings shall include wiring and terminal numbers of the individual panel items as they actually will appear in the panel, set points, contact arrangements of switches and relays (state of device and device contacts shall be clearly indicated), and internal wiring of relays and instruments. Spare terminals and all unused contacts of the individual panel items shall be shown on the drawings.

Elementary diagrams shall be cross-referenced to terminal markings on the connection and interconnection diagrams, but do not need to indicate complete details of circuits external to the panels, unless required by Buyer. Each item of panel mounted equipment indicated on the diagrams shall be identified by item number and name.

# Q502.3.1 As-Built Drawings

As-built prints of each final electrical wiring and elementary diagram for equipment shall be furnished in accordance with Article Q500.4.2.7. An electronic copy of each drawing shall be submitted to Buyer.



# MOTOR INFORMATION SHEET

Sheet 1 of 3

	DRIVEN	EQUIPMENT	DATA
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Name			
ID(s)			
Manufac	cturer		
Driven E	Equip Max Brake Load	Horsepower (hp) or kW at Design Conditions	

# MOTOR DATA – ALL MOTORS (check choices)

🗌 Hori	zontal		U Ve	ertical				🗌 In	duct	tion				_ S	ynchr	onous	
Manufa	acturer																
Model																	
Outline	/Wiring/Co	onnection Drav	wing Nur	nbers													
Design	Standard	*				Namep	olate:	Volts				Pha	se			Hz	
For NE	MA Motor	s - Nameplate	hp								Servio	e Fact	or				
Locked	-Rotor Co	de Letter							NE	EMA	Desi	gn Lett	er				
For IEC	C Motors -	Nameplate kV	V					1									
Max Co	ontinuous	Voltage (rated	frequen	cy)				Min C	Conti	inuo	us Vo	ltage (	rated fre	quen	icy)		
Duty Ty	/pe:	Continuous		Defini	te Time	(minu	tes)				Full	Load S	Speed (r	pm)			
Full Loa	ad Current	t at Rated hp o	or kW (ai	nps)													
Locked-Rotor Current (amps)								1									
NEMA	or IEC En	closure						Fram	e Siz	ze			1				
IEC Cooling (IC Code)							IEC N	Лour	nting	g (IM 0	Code)						
Design Ambient Temperature (°C)								Insula	ation	ı Sys	stem (	Class					
Temp F	I emp kise by kesistance (at service factor load) for NEMA Motor (°C)																
Space Heaters (SP) Furnished?					□ No	D Total SP Load: Watts							Volts			Phase	
Bearings: Type																	
		Lubricatio	n Type								Syst	tem					
		ABMA L-1	0 Rating	Life,	Not Le	ss than					Hou	rs					
		Connectio	n: (cheo	k one	e) [	Direc	x	🗌 Bel	t		] Cha	in					
Overall pascals	Mean No (0.0002 r	-Load Sound I nicrobar), Ref	Pressure erence [	Leve Distan	l, re mi ce of 3	cro- Feet											Free Air
Total N	lotor Weig	ht (lb)					ls	Motor I	Reversible?  Yes			Yes	□ No				
Stator \	Neight (Ib	)					R	otor We	eiaht	(lb)							
									Ť.	<u>, ,</u>				_	_		
Multi-C (check	onnectabl choices)	e Motors:		irt Wir	nding		Star-L	Delta			/ariab	le Torc	lne		Cons	stant Torq	ue
(	,			nstan	it Horse	epower		PAM			wo vv	inding			One	winding	
rom				ner	Amno			rpr	~				<b>mn</b> 0			P Ampo	
rpm					Amps Amps			rpr	n n				nps				
трп		FL Amps			Amps			ipi					nps			r Amps	
For Mo	tors in Ha	zardous Locat	ions: Mo	otor E	nclosur	e Maxi	mum S	Surface	Ten	npei	rature	(°C)					
Will Mo Requiri	Will Motor Contain a Surface Temperature Control Thermostat       Image: Second S																
Motor F MG-1-2 (check	Full-Load E 2006 Table one)	Efficiency as D es 12-10, 12-1	efined b 1, and 1	y NEN 2-12:	MA		lormal	Efficier	псу			Energ	y Efficie	ent		Premium	Efficiency
1						Full I	oad N	ominal	Effic	ieno	ov Rat	ina					

\*NEMA, IEC, etc.

#### MOTOR INFORMATION SHEET

Sheet 2 of 3

Name	
ID(s)	

#### ADDITIONAL MOTOR DATA TO BE SUBMITTED

#### Motors 100 hp (75 kW) and Larger and for All Motors Rated Above 1000 Volts

Efficiency, Percent Guaranteed, Load: 1/2		3/4		4/4	
Power Factor, Percent Guaranteed, Load: 1/2		3/4		4/4	
Power Factor at Locked Rotor Current					
Minimum Starting Voltage in Percent of Rated Voltage: Calculated			S	pecified	

Accelerating Time:

At Rated Voltage (seconds)	
At Minimum Specified Starting Voltage (seconds)	

Locked-Rotor Safe Stalled Time (seconds):

	<u>Rated Voltage</u>	Minimum Specified Starting Voltage
Motor Initially at Maximum Specified Ambient Temperature (Cold)		
Motor Initially at Service Factor Load Operating Temperature (Hot)		

#### For All Motors Rated Above 1000 Volts

Current and Torque Versus Speed Curves at Maximum, Rated, and Minimum Specified Starting Voltage.							
Drawing Number (Attach curves.*)							
Power Factor and Efficiency Versus Speed Curves at Rated Voltage.							
Drawing Number	Drawing Number (Attach curves.*)						
Current Versus Time Curv	es at Maximum, Ra	ted, and Minimum S	Specified Starting Volt	age.			
Drawing Number					(Attac	ch curves.*)	
Locked-Rotor Thermal Limit Curves (current versus time), Curves in Both Cold and Hot Operating Conditions, and Stator Running Thermal Overload Curves at Rated Voltage.							
Drawing Number (Attach curves.*)						ch curves.*)	
Torque in: (check one)							
Locked-Rotor Torque		Pull-up Torque		Breakdown Torq	ue		
Inertia in: (check one)	☐ lb-ft2	GD2					
Motor Rated	Motor Roto	br	Driven Equipment	0	Coupling		
Temperature Alarms and Trips for Motors Equipped with Sensors:							
Stator Winding RTD Alarm (°C) Trip (°C)							
Bearing Temperature	Alarm (°C)		Trip (°C)				
Motor Subtransient Reacta	ance		Motor Open Circui	t Time Constant			
Short-Circuit Time Consta	nt		Starting Power Fac	ctor			

#### Number of Successive Starts:

	At Rated Voltage
Motor Initially at Maximum Specified Ambient Temperature	
(cold with driven equipment connected), number	
Motor at Rated Temperature Rise Prior to Starting (hot with motor coupled), number	
Cooling Period Required After Completion of the Preceding Maximum Number	
of Successive Starts Before Making Additional Starts, minutes	
Motor Stopped Cooling Time Constant, minutes	
Motor Running Cooling Time Constant, minutes	

#### List of Drawings and Specifications:

Lubrication Oils and Greases, drawings	
External Fluid Circuits for Bearing Cooling, drawings	
External Fluid Circuits for Stator Cooling, drawings	

\*Submit tabulated data with curves for high inertia loads.

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# MOTOR INFORMATION SHEET

Sheet 3 of 3

Name	
ID(s)	

#### ADDITIONAL MOTOR DATA TO BE SUBMITTED

#### All Synchronous Motors

Rotor Construction :		
Rated Field Excitation Current	Voltage	V
Motor Preliminary parameters with proposal		
Rated Voltage (Saturated) Subtransient Reactance (Xdv")		
Rated Voltage (Saturated) Negative-Sequence Reactance (X2v)		
Rated Voltage (Saturated) Armature Time Constant (Ta3)		
Rated MVA	Rated Voltage	KV
Motor parameters after order		
Armature leakage Reactance (XI)		
Direct Axis Armature Reactance (Xad)		
Direct Axis Synchronous Reactance (saturated) (Xd)		Unsaturated
Potier Reactance (Xp)		
Direct Axis Transient Reactance (saturated) (X'd)		Unsaturated
Direct Axis Subtransient Reactance (saturated) (X"d)		Unsaturated
Quadrature Axis Armature Reactance (Xaq)		
Quadrature Axis Synchronous Reactance (saturated) (Xq)		Unsaturated
Field leakage Reactance (Xf)		
Quadrature Axis Transient Reactance (saturated) (X'q)		Unsaturated
Quadrature Axis Subtransient Reactance (saturated) (X"q)		Unsaturated
Negative sequence Reactance (saturated) (X"2)		Unsaturated
Stator Armature Resistance/Phase (Ra)		
Positive Sequence Resistance (R1)		
Negative Sequence Resistance (R2)		
Zero Sequence Resistance (R0)		
Armature Short-Circuit Time Constant (Ta), Sec		
Direct Axis Transient Open-Circuit Time Constant (T'do), Sec		
Quadrature Axis Transient Open-Circuit Time Constant (T'qo), Sec		
Direct Axis Subtransient Open-Circuit Time Constant (T"do), Sec		
Quadrature Axis Subtransient Open-Circuit Time Constant (T"qo),Sec		
Direct Axis Transient Short-Circuit Time Constant (T'd), Sec		
Direct Axis Subtransient Short-Circuit Time Constant (T"d), Sec		
Winding Capacitance Short-Circuit Time Constant (T"d), Sec		

# ELECTRIC ACTUATOR INFORMATION SHEET

Name	ID Number

#### **GENERAL INFORMATION**

Manufacturer	
Model No.	
Rated Output Torque (ft-lb)	
Factory Torque Switch Settings	
Open	
Close	
Torque Close Seating Required for This Application (Yes/No)	
Speed of Operation	
Open to Close (sec)	
Close to Open (sec)	
Maximum Differential Pressure Which Actuator is Capable of Operating Against (psi)	
Valve Stem Diameter (in.)	
Thrust Allowance for Valve Packing Friction Weight (lb)	
Gear Housing Material	
Self-Locking Gearing (Yes/No)	

# MOTOR DATA

Manufacturer		
Enclosure/Cooling Rating		
Horsepower/rpm or kW/rpm		
Voltage/Phase/Hz		
Full Load Current (amps)		
Locked-Rotor Current (amps)		
Load Current for Setting Overload Relay Protection (amps)		
Motor Time Rating at Maximum Driven Equipment Torque in a 50° C Ambient (minutes)		
Motor Space Heater (watts/volts)		
Are Motor Self-Reset Thermal Switches, if Provided, Required to be Wired in Buyer's Starter Coil Circuit? (Yes/No/Recommended)		

#### CONTROLS DATA

Enclosure Rating	
Network Communications, if Applicable	
Enclosure Space Heater (watts/volts)	
Integral Starter (Yes/No)	

#### DRAWINGS

Item	Drawing Title	Drawing Number	Revision
Outline Diagram			
Schematic/Wiring Diagram			

# Q520 OEM 3D Equipment Model Development

This section, in conjunction with the Schedule of Submittals, stipulates the requirements for Plant Equipment Layout and Modeling data that the Seller shall submit for mechanical plant arrangements and equipment modeling. Document submittal procedures shall be in accordance with the requirements of these Contract Documents.

# Q520.1 Submittal Requirements

SPGF

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Technical data shall be submitted in electronic format. Hard copy prints of the electronic files shall also be submitted, as specified below.

Electronic technical data submittals shall be made using Buyer's file sharing system.

Notification to Buyer that submittals have been posted to Buyer's file sharing system shall be in accordance with the correspondence requirements of these Contract Documents.

# Q520.2 Model Development

The Seller shall develop a three dimensional (3-D) computerized model of all equipment and components included in the scope of work. Separate models may be provided for individual major pieces of equipment. The 3-D software used to support general mechanical arrangement development shall be compatible with AutoCAD 2012. The 3-D model shall match the Seller's 2-D certified drawings.

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

The 3-D computer model shall be in AutoCAD file format (.dwg) with separate files and/or individual layers for all equipment supplied under this contract, including but not limited to: all major equipment, auxiliary equipment, tubing, piping, valves, piping insulation, pipe supports, ducting including duct stiffeners, and structural and architectural components. Separate files or layers shall be used to differentiate systems and/or components. Examples include the following:

All piping large bore and small bore systems, including supports, valves, in-line devices and other components.

Roads, sumps, manholes, construction access, and maintenance requirements.

Foundations, underground utilities, and fire hydrants.

Steel, gusset plates, angled bracing, floors, concrete, platforms, suspended floors, stairs, handrails, ladders, and other access requirements.

All cable tray, wireway, and conduit 3 inches and larger.

Architectural, including interior and exterior walls, roofs, ceilings, doors, windows, and other components.

Breeching (Ductwork, duct stiffeners, duct insulation).

Mechanical/Chemical/heating and ventilation equipment (non-major).

All information as required to prepare the site arrangement models and plant arrangement models.

Other design information as requested by the Buyer.

Pull space envelope for removal of heat exchanger bundles and swing space for manway hatches etc.

Electrical equipment (non-major), instrumentation, light fixtures, light supports, and light poles.

Material handling items such as diverter gates, surge bins, chutework, feeders, drive motors, reducers, etc.

Any items that have thermal expansion (i.e. hot and cold positions).

Each file must be have layer names which are recognizable and representative of the entities they are on, i.e., steel, walls, windows, floors, etc. Orientation, common axis points, scale, rotation, layer content, drawing units and insertion point of the Seller's model shall remain consistent between all files as well as within layers of each file as agreed with Buyer.

The Seller will provide models based on project specific requirements and shall include any database specific information necessary to fully specify the supplied equipment. This may include instances where files will be inserted or imported. AutoCAD model files shall use the following types of features):

3D Solid - (boxes, cylinders, extruded polylines, etc.) this is the preferred modeling method

3D Face - Preferred method for thin or one sided features such as fences, also acceptable for .ace of buried features such as concrete or grates

Polygon Mesh

Polyface Mesh

3D Polylines - Preferred method of modeling features such as power lines and cables. Polylines with thickness shall not be used

All non-standard objects (Architecture, MEP, Civil 3D, Plant 3D, etc.) that require object enablers to read, write and display shall be exploded or otherwise converted to 3D Solids.

A Navisworks file containing the entire computerized 3-D model of each major piece of equipment shall be provided in accordance with the Schedule of Submittals.

Clash detection/interference checking shall the responsibility of the Seller for all components within the Seller's scope of responsibility. Seller and Buyer shall coordinate where Seller has components in the Buyer's responsible area and vise versa.

AutoCAD files shall be accompanied by a cross reference document with each file name and corresponding drawing title and description. File naming convention shall be determined on a project specific basis during the initial kickoff meeting. For Seller models, the file name shall be 12 characters or less with no spaces.

# Q520.3 Piping System Requirements

Piping systems shall use Buyer specified system codes and each system shall be designed on an individual layer within one file.

# Q520.4 Model Data

3D model review meetings shall be held as specified in Article 01100.1 with a Navisworks file.

Periodic electronic interference checks shall be performed and interferences corrected in a timely manner, then follow-up electronic interference checks shall be performed until all interferences have been resolved.

Design data specifics to be included in the 3D model include the following minimum requirements:

All column row spacing.

Interfacing existing plant equipment, ductwork, piping, platforming, steel, etc.

Platform, stair, and access requirements to access equipment and piping components and personnel/life safety requirements.

Accurately modeled equipment based on preliminary information and subsequent detailed vendor models.

Location and elevation of all equipment, taking into consideration required operational and maintenance accessibility, clearance with structure and other surrounding equipment, required space for associated piping and valve layout, and base height.

I.D. of equipment including instrumentation and electrical equipment using Buyer equipment numbers.

Electronic files which are linked to a database(s) should not include any proprietary data. Proprietary information should be removed from the files before submitting to the Buyer.

# Q520.5 Out of Scope Content

Sellers are required to submit only model content within their scope. If out of content scope is found, the Buyer will ask the Seller to remove the out of scope content in future submittals. The Buyer may reject any submittal with excessive out of scope content and ask the Seller to eliminate the out of scope content and resubmit the file/model. The Buyer reserves the right to remove out of scope content from the Seller's models at the Seller's expense if the Seller refuses to take the necessary steps to eliminate out of scope content from their submittals.

If out of scope content in the files is required, this data shall be placed on layers that can be easily identified so Buyer can choose to delete some or all of its content prior to inserting them into the Buyer's 3D model.

# Q520.6 Model Submittal

Models shall be submitted electronically in AutoCAD .DWG file format.

All model files will be positively identified by revision and identified in the file name. For resubmission of models files where revisions have been performed, only those files that have been revised shall be submitted.

Seller shall fully complete and certify models for compliance with the Contract Documents requirements.

Each submitted drawing shall be project unique and shall be clearly marked with the name of the project, unit designation, Buyer's Contract Documents title, Buyer's Contract Documents file number, project equipment or structure nomenclature, component identification numbers, and Buyer's name. Equipment, instrumentation, and other components requiring Buyer-assigned identification tag numbers shall be


clearly identified on the models. If standard models are submitted, the applicable equipment and devices furnished for the project shall be clearly marked.

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

If hard copies are required for submittal, the separately submitted hard copy drawing prints shall be black line on white background. Blue line on white background or color prints is not acceptable. Buyer will use an electronic imaging system in processing the hard copy models. All copies shall be suitable for electronic imaging and shall have the maximum contrast. Print size shall not exceed 34 inches by 44 inches. Copies shall be folded to 8-1/2 inches by 11 inches. Copies shall be collated in sets.

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

Models shall be submitted with all numerical values in English units.

For technical questions regarding the model structure and scope, the point of contact shall be the vendor's appointed technician or delegate.

### Q520.6.1 Model Transfer

The frequency of model transfer between Buyer and the Seller shall be in accordance with the Schedule of Submittals. A file index spreadsheet shall be provided with each transfer, from both Buyer and the Seller. This file index spreadsheet will contain the following information:

Model name.

Model description.

Model revision.

File status.

**New** - First instance of model file being sent.

**Not Sent** - Model file has been sent previously, but there are no changes during current transfer so model file is not being sent again.

**Updated** - Model file has been sent previously, and is being sent again with changes to content.

**Superseded** - Model file has been sent previously, but is being superseded by another model file being sent.

**Deleted** - Model file has been sent previously, but is being deleted from the model entirely without replacement.

**Resent** - Model file is being resent without change.

**Renamed** - Model file has been sent previously, but has been renamed from previous model file name.

Model status.

In Progress - Normal working status of model data.

**Closed** - Model data is frozen for remainder of project, unless a change is requested.

Date of last action (when was last action performed on model file).

Comments (revision notes, significant changes, etc).

### Q520.7 Buyer's Review

Buyer's review of models and other submittals will cover only general conformity of the data to the specifications and models, external connections, interfaces with equipment and materials furnished under separate specifications, and dimensions that affect plant arrangements. Buyer's review does not include a thorough review of all dimensions, quantities, and details of the equipment, material, device, or item indicated or the accuracy of the information submitted. Review and comment by Buyer of Seller's models or other submittals shall not relieve Seller of its sole responsibility to meet the completion dates requirement of these Contract Documents and to supply goods that conform to the requirements of these Contract Documents.

### S100 Seismic Design

### S100.1 General

This article specifies the general criteria and procedures that shall be used to ensure that structures, components, and equipment meet performance objectives during and following a seismic event.

The building or structure structural system shall provide a continuous load path or paths, with adequate strength and stiffness to transfer all seismic forces from the point of application to the final point of resistance.

Structures, components, and equipment furnished by the Seller shall be designed so that seismic forces are positively transferred to the Buyer's supporting structure or foundation. The transfer method shall be acceptable to the Buyer and may include, but not be limited to, bolts, welds, guides, bumpers or shear lugs as appropriate. Frictional resistance due to gravity shall not be considered in evaluating the required resistance to seismic forces.

For seismic design of vessels, tanks, and other components, contents that are flammable, explosive, corrosive, acidic, caustic, toxic, or that otherwise present a danger if released shall be considered hazardous materials.

Seismic design shall be performed in accordance with the building code specified in Supplemental Specification D100 Site Meteorological and Seismic Data along with the applicable edition (as required by the specified building code) of the following references:

American Institute of Steel Construction (AISC), AISC 360, "Specification for Structural Steel Buildings."

American Institute of Steel Construction (AISC), AISC 341, "Seismic Provisions for Structural Steel Buildings."



American Concrete Institute (ACI), ACI 318, "Building Code Requirements for Structural Concrete."

American Concrete Institute (ACI), ACI 307, "Design and Construction of Reinforced Concrete Chimneys."

American Society of Mechanical Engineers (ASME), "Boiler and Pressure Vessel Code" and all addenda.

American National Standards Institute (ANSI), "ASME Code for Pressure Piping, ASME B31.1, Power Piping."

Manufacturers Standardization Society of the Valve and Fitting Industry (MSS), MSS SP-58, "Pipe Hangers and Supports - Materials, Design, and Manufacture."

American Petroleum Institute (API), API 650, "Welded Steel Tanks for Oil Storage."

American Water Works Association (AWWA), AWWA D100, "Welded Steel Tanks for Water Storage."

National Fire Protection Association (NFPA), NFPA 13, "Standard for the Installation of Sprinkler Systems."

Other nationally recognized and accepted design standards and references as appropriate.

### S100.2 Seismic Forces

Seismic forces shall be determined from the basic seismic parameters given in Supplemental D100. The design forces and their distribution over the height of the building or structure shall be determined using a linearly elastic analysis model and the procedures listed in the specified building code. Load combinations, including seismic, shall be in accordance with the specified building code.

 $W_p$  for tanks, bins, and silos shall represent the weight of the tank structure and appurtenances and the operating weight of the contents at maximum rated capacity. Hydrodynamic effects of contents shall be considered in the seismic design of vessels and tanks as required by the specified building code.

Seismic dynamic forces shall be considered in the seismic design of below ground structures in addition to the static soil pressures.

#### S100.3 Seismic Design and Certifications

#### S100.3.1 Buildings

Buildings shall provide sufficient strength and ductility to resist the specified seismic effects and may use any of the basic structural systems permitted by the specified building code. Usage of structural systems shall be in accordance with the limitations prescribed in the specified building code. The effects of both plan and vertical irregularities shall be considered, as required by the specified building code.

Buildings shall be seismically analyzed using either Equivalent Lateral Forces or Modal Analysis in accordance with the specified building code and shall meet all of the design, proportioning, detailing, inspection, and quality assurance provisions of the specified building code.

"W" for buildings shall include the total dead load, the total operating weight of permanent equipment and the effective contents of vessels, and applicable portions of other loads, as required by the specified building code.

### S100.3.2 Nonbuilding Structures



Nonbuilding structures include all self-supporting structures, other than buildings, bridges, and dams, that are supported by the earth; that carry gravity loads; and that may be required to resist seismic effects. These include, but are not limited to, chimneys, pipe racks, trussed towers, transmission towers and poles, and vessels. Design of nonbuilding structures shall provide sufficient strength and ductility, consistent with the requirements for buildings, to resist the specified seismic effects.

Nonbuilding structures shall be seismically analyzed using either Equivalent Lateral Forces or Modal Analysis in accordance with the specified building code, and shall meet all of the design, proportioning, detailing, inspection, and quality assurance provisions of the specified building code and other referenced codes.

"W" for nonbuilding structures shall include all dead load as defined for buildings, and shall also include all normal operating contents of vessels and piping.

# S201 Major Equipment and Structure Access Provisions

This Supplemental Specification covers design and fabrication requirements for the access provisions to structures and major or multiple pieces of equipment.

Access provisions shall consist of stairs, platforms, walkways, handrails, guardrails, and ladders necessary to provide complete and convenient access for operation, inspection, testing, and maintenance of major or multiple pieces of equipment. Arrangement drawings for access provisions shall be provided as part of the Technical Data.

### S201.1 Design Criteria

Access provisions shall conform to all applicable codes and standards and the following minimum requirements. Design shall be to the most restrictive requirements of all applicable codes and standards.

As a minimum, all egress paths and access provisions shall be designed to comply with the governing building code, OSHA, and NFPA 101 Regulations, including all addenda and interpretations. Application of these regulations shall be based on their literal translation.

### S201.1.1 Support Steel

Platform and walkways supporting steel shall be designed for a minimum live load of 60 pounds per square foot. Stairway supporting steel shall be designed for a minimum live load of 100 pounds per square foot. Fixed stairways shall also be designed for a minimum moving concentrated load of 1,000 pounds as specified in OSHA 29CFR-1910.24(c). Vertical live load deflection of steel framing members shall not exceed 1/360 of the span length. The length of landing platforms, measured in direction of travel, shall be, as a minimum, equal to the stair width, but shall not exceed 4 feet where the stairway has a straight run. Platforms shall have lateral bracing as required for rigidity and stability.

### S201.1.2 Platforms and Walkways

Platforms and walkways shall be a minimum of 36 inches wide. Platforms and walkways shall be provided with guardrails.

### S201.1.3 Stairs

Stairs shall be a minimum of 36 inches wide. Treads and risers shall be in accordance with the governing building code, OSHA, and NFPA 101. Minimum concentrated load on stair treads (on area of 4 square inches is 300 pounds. The tread depth shall be exclusive of nosings or projection. Vertical distance between floor and landing shall not exceed 12 feet. Vertical headroom clearance shall be 7 feet minimum at projections above the stairs. Stair stringers shall be channels not less than 10 inches in depth, and 15.3 pounds per foot. Slip resistant nosing shall be supplied with stair treads. Stairs shall be provided with handrails and guardrails in accordance with S201.1.4 Guardrails and Handrails.

### S201.1.4 Guardrails and Handrails

Guardrails and handrails shall be designed to comply with the governing building code, OSHA, and NFPA 101 Regulations, and all other applicable codes and standards. Design shall be to the most restrictive requirements of the referenced codes. All open stairs shall have a combination guardrail/handrail system as described in the codes. The upper surface of the top rail of guardrails shall be 42 inches above the surface of platforms, walkways, and stair treads as measured in a vertical line from the forward edge of the tread. Handrails on stairs shall be supported by brackets from the guardrail posts with the upper surface of the handrail 34 inches above the surface of stair treads in line with face of riser at the forward edge of the tread.

Railings shall be designed to meet the design loading requirements of the governing building code and other applicable codes and standards. Steel posts shall be vertical and uniformly spaced with 7 feet maximum spacing, or less as required for the post, railings, and connections to conform to the design loading requirements of the applicable codes and standards. Handrails shall be 1-1/2 inch nominal diameter steel pipe.

Railings shall be smooth, with all projecting joints and sharp corners ground smooth. Welded joints shall be of the flush type. Members shall be neatly coped and continuously welded at all junctions of posts and rails. Flattening of the rail or post ends at junctions of posts and rails will not be permitted. Fittings or other connectors shall not be used at junctions of posts and rails. For galvanized railings, joints shall have internal openings so there are no closed or blind sections of pipe. When the bottom of the handrail post is closed, a drain hole shall be provided on the vertical side of the post near the bottom.

All welding shall be done neatly and substantially, with all fillets dressed to uniform radius, all excess metal removed, and all welds ground smooth and flush.

All angles, offsets, and other changes in alignment of railings shall be made with accurately mitered joints, welded railing fittings, or smooth radius shop bends.

Where gates are required, self-closing gates shall be provided at guardrail openings (chains shall not be used).

### S201.1.5 Kickplates

Kickplates shall be provided for platforms, on equipment roofs as required, and as necessary for personnel protection and safety. Kickplates shall project a minimum of 4 inches. Minimum thickness of kickplates shall be 3/16 inch. Kickplates on roofs shall be notched for drainage. Openings in grating panels shall be provided with kickplates.

### S201.1.6 Ladders

Ladders may be used in lieu of stairways in locations where stairways would not be practical and where applicable codes and standards allow. Egress provisions must meet codes and standards criteria for ladder use. Ladders shall be designed to meet the design loading requirements and other specified requirements of the governing building code, OSHA, ANSI, and NFPA 101 Regulations, and all other applicable codes and standards.

Ladders shall not be less than 18 inches wide with 3/4 inch diameter solid steel rungs spaced 12 inches center-to-center. The distance of the first rung at the bottom of the ladder may range up to 14 inches from the surface below. The top rung shall be level with the landing or platform. Ladder side rails shall be steel bars not smaller than 3 inches by 1/2 inch. Ladder side rails shall be punched for the rungs. Rungs shall be extended to within 1/8 inch of the outside rail surface, and the remaining 1/8 inch shall be plug welded. Rungs shall be continuously fillet welded inside each rail surface. Ladder supports shall be steel brackets not less than 4 inches by 1/2 inch, spaced not more than 18 feet vertically center-to-center. The center of the rung shall be no less than 7 inches (horizontal measure) from the nearest permanent object. Cages shall be provided on ladders where the length of climb is more than 20 feet. Where the length of climb is less than 20 feet but the top of ladder is more than 20 feet above adjoining surfaces (fall potential to the ground, roofs or floors), cages shall also be provided. Ladder side rails shall extend a

minimum of 3 feet 6 inches above the top of floors and be flared to a minimum clear width of 24 inches for walk-through access, and extend a minimum of 4 feet 0 inches for side access ladders.

Self-closing gates shall be provided at all ladder entrances. (Chains shall not be used.)

### S201.2 Materials

Materials used shall be equal to or exceed the following minimal requirements:

Steel framing, kickplates, angles	ASTM A36
Ladders	ASTM A36
Connection bolts for steel framing	ASTM A325, Type 1, with washers and nuts
Rectangular bar grating 1-1/4 inch minimum depth (serrated for exterior use)	ANSI/NAAMM MBG531, W-19-4
Stair tread grating	Same as rectangular grating except bearing bars not less than 3/16 inch by 1 inch for lengths up to and including 3 feet and less. Bearing bar spacing not to exceed 1-3/16 inch
Stair tread fasteners (furnish with stair treads)	Galvanized 3/8 inch minimum diameter bolts conforming to ASTM A307, Grade A with lock washers and nuts
Nosing	Slip resistant checkered plate or acceptable equal
Guardrails and handrails - posts and rails (minimum size and strength)	ASTM A53, Type E or S, Grade B, 1-1/2 inch nominal diameter pipe, Rails Schedule 40, Posts Schedule 80, or acceptable equal
Optional rail fittings for angles, offsets, and other changes in alignment	R&B Wagner railing fittings with Wedgelock welding connectors at each end. (Slip-on fittings using set screws and open seam fittings are not acceptable.)

### S201.3 Coatings

Coatings shall be in accordance with Technical Supplemental Q300.

### S201.4 Welding

Per applicable code.

### S201.5 Technical Attachments

The following attachments accompany these specifications in either paper or electronic format. The information contained in these documents constitutes requirements under this Supplemental Specification:

Document		
Number/Description	Title	Revision

Document Number/Description	Title	Revision
81112-DS-0064	Typical Guardrail and Stair Rail Conforming to IBC 2003, 2006 & 2009 for Areas Not Accessible to the Public	9
81112-DS-0071	Typical Ladder Details	8

# V100 Noise Abatement

The near-field noise emissions for each equipment component furnished under these specifications shall not exceed a spatially-averaged free-field A-weighted sound pressure level of 85 dBA (referenced to 20 micropascals) measured along the equipment envelope at a height of 5 feet (1.5 meters) above floor/ground level and any personnel platform during normal operation. The equipment envelope is defined as the perimeter line that completely encompasses the equipment package at a distance of 3 feet (1 meter) horizontally from the equipment face. The near-field noise emissions include the contribution of all noise associated with the equipment component. Normal operation includes all operating conditions up to the equipment rated capacity exclusive of start-up, shut-down, and upset conditions.

Where the drive motors, variable frequency drives (VFDs), or mechanical drives for the equipment are also furnished under these specifications, the total combined near-field sound pressure level of the motor, VFD, or mechanical drive and the driven equipment measured as a single component, operating at design load, shall not exceed a spatially-averaged free-field A-weighted sound pressure level of 85 dBA (referenced to 20 micropascals) measured along the equipment envelope.

During off-normal and intermittent operation such as start-up, shut-down, and upset conditions the equipment sound pressure level shall not exceed a maximum of 110 dBA at all locations along the equipment envelope, including platform areas, that are normally accessible by personnel.

Seller shall identify any equipment which may not comply with the 85 dBA criteria and shall obtain Buyer's written approval for each such deviation based on Seller's predicted noise emissions level.

Compliance with the near-field noise emissions requirement shall be determined in accordance with industry standard ASME PTC 36. Compliance shall be based on not exceeding the allowable sound pressure level including background sound level corrections and excluding any correction for measurement uncertainties.



(This Page Intentionally Left Blank)



**Technical Attachments** 



### PROPOSAL BOND

KNOW ALL MEN BY THESE PRESENTS that we, the undersigned, \_\_\_\_\_\_, as Principal; and Surety, are hereby held and firmly bound unto the Passaic Valley Sewerage Commission in the penal sum of \_\_\_\_\_\_ for the payment of which, well and truly to be made, we hereby jointly and severally bind ourselves, our heirs, executors, administrators, successors and assigns.

Signed this \_\_\_\_\_\_ day of \_\_\_\_\_\_ 20\_\_\_.

The condition of the above obligation is such that whereas the Principal has submitted to the Passaic Valley Sewerage Commission an accompanying Proposal, attached hereto, and hereby made a part hereof, to enter into a contract in writing, to:

### CONTRACT NO. B129 – POWER GENERATION SYSTEM PROCUREMENT

### NOW THEREFORE,

- A. If said Proposal shall be rejected, or, in the alternate,
- B. If said Proposal shall be accepted and the Principal shall execute and deliver a contract in the form of CONTRACT attached hereto (properly completed) and shall furnish a bond for his faithful performance of said CONTRACT, and shall in all other respects perform the agreement created by the acceptance of said Proposal.

Then, this obligation shall be void, otherwise the same shall remain in force, and effect; it being expressly understood and agreed that the liability of the Surety for any and all claims hereunder shall, in no event, exceed the penal amount of this obligation as herein stated.

The Surety, for value received, hereby stipulates and agrees that the obligations of said Surety and its bond shall be in no way impaired or affected by any extension of time within which the Principal may accept such Proposal; and said Surety does hereby waive notice of any such extension.

IN WITNESS WHEREOF, the Principal and the Surety have set their hands and seals, and such of them as are corporations having caused their corporate seals to be hereto affixed and these presents to be signed by their proper officers, the day and year first set forth above.

Principal: \_\_\_\_\_

Surety: \_\_\_\_\_\_ by:\_\_\_\_\_

### CONSENT OF SURETY

KNOW ALL MEN BY THESE PRESENTS, that for and in consideration of the sum of \$1.00, lawful money of the United States, the receipt whereof is hereby acknowledged, paid the undersigned corporation, and for other valuable consideration, the

\_\_\_\_\_\_(Name of Surety) corporation organized and existing under the laws of the State of \_\_\_\_\_\_ and licensed to do business in the State of New Jersey, certifies and agrees, that if CONTRACT NO. B129 – POWER GENERATION SYSTEM PROCUREMENT is awarded to \_\_\_\_\_\_ undersigned corporation will execute the Bond or Bonds as required by the CONTRACT Documents and will become surety in the full amount of the CONTRACT price for the faithful performance of the contract and for payment of all persons supplying labor or furnishing materials in connection hence with.

Signature	e of Surety by:		
Print Nat	me:		
Title:			
Address:			
-			
-			

(To be accompanied by the usual proof of authority of officers of surety company to execute the same.)

# SURETY DISCLOSURE STATEMENT AND CERTIFICATION

Surety(ies) on the attached bond, hereby certifies(y) the following:

(1) The surety meets the applicable capital and surplus requirements of <u>R.S. 17:17-6</u> or <u>R.S.</u> <u>17:17-7</u> as of the surety's most current annual filing with the New Jersey Department of Insurance.

(2) The capital (where applicable) and surplus, as determined in accordance with the applicable laws of this State, of the surety(ies) participating in the issuance of the attached bond is (are) in the following amount(s) as of the calendar year ended December 31, \_\_\_\_\_ (most recent calendar year for which capital and surplus amounts are available), which amounts have been certified as indicated by certified public accountants (indicating separately for each surety that surety's capital and surplus amounts, together with the name and address of the firm of certified public accounts that shall have certified in those amounts):

(3) (a) With respect to each surety participating in the issuance of the attached bond that has received from the United States Secretary of the Treasury a certificate of authority pursuant to 31 U.S.C. §9305, the underwriting limitation established therein and the date as of which that limitation was effective is as follows (indicating for each surety that surety's underwriting limitation and the effective date thereof):

(b) With respect to each surety participating in the issuance of the attached bond that has not received such a certificate of authority form the United States Secretary of the Treasury, the underwriting limitation of that surety as established pursuant to <u>R.S. 17:18-9</u> as of (date on which such limitation was so established) is as follows (indicating for each such surety that surety's underwriting limitation and the date on which that limitation was established):

(4) The amount of the bond to which this statement and certification is attached is:

# SURETY DISCLOSURE STATEMENT AND CERTIFICATION (continued)

(5) If, by virtue of one or more contracts of reinsurance, the amount of the bond indicated under item (4) above exceeds the total underwriting limitation of all sureties on the bond as set forth in items (3)(a) or (3)(b) above, or both, then for each such contract of reinsurance:

(a) The name and address of each such reinsurer under that contract and the amount of that reinsurer's participation in the contract is as follows:

; and

(b) Each surety that is party to any such contract of reinsurance certifies that each reinsurer listed under item (5)(a) satisfies the credit for reinsurance requirement established under P.L. 1993, c.243 (<u>C. 17:51B-1</u> et seq.) and any applicable regulations in effect as of the date on which the bond to which this statement and certification is attached shall have been filed with the appropriate public agency.

# CERTIFICATE

(to be completed by an authorized certifying agent for each surety on the bond)

I \_\_\_\_\_\_(Name of Agent), as \_\_\_\_\_\_(Title of Agent) for \_\_\_\_\_\_ (Name of Surety), a corporation/mutual insurance company/other (circle one) domiciled in \_\_\_\_\_\_(state of domicile), DO HEREBY CERTIFY that, to the best of my knowledge, the foregoing statements made by me are true, and ACKNOWLEDGE that, if any of those statements are false, this bond is VOIDABLE.

(Signature of Certifying Agent)

(Printed Name of Certifying Agent)

(Title of Certifying Agent)

### PROPOSER'S AFFIDAVIT

State of	)	
County of	)	55:
		being duly sworn, deposes and says that he resides at
		that he is the (Title)
of		(110)

(Name of Propser)

who signed the above Proposal, that he was duly authorized to sign, and that the Proposal is a true offer of the Proposer, and the seal attached is the seal of the Proposer and that all the declarations and statements contained in the Proposal are true to the best of his knowledge and belief.

(Affiant)

Sworn to and subscribed before me

this \_\_\_\_\_ day of \_\_\_\_, 20\_\_\_

Notary Public in and for

County,

My Commission Expires

\_\_\_\_\_, 20\_\_\_

### NON-COLLUSION AFFIDAVIT

STATE OF NEW JERSEY, COUNTY OF \_\_\_\_\_\_ss.: I,\_\_\_\_\_\_, of the City of \_\_\_\_\_\_in the County of \_\_\_\_\_\_and the State of \_\_\_\_\_\_of full age, being duly sworn according to law on my oath depose and say that:

I am\_\_\_\_\_\_of the firm of \_\_\_\_\_\_the proposer making the Proposal for the above-named contract, and that I executed the said Proposal with full authority so to do; that said Proposer has not, directly or indirectly, entered into any agreement, participated in any collusion, or otherwise taken any action in restraint of free, competitive contracting in connection with the within Contract; and that all statements contained in said Proposal and in this Affidavit are true and correct, and made with full knowledge that the **Passaic Valley Sewerage Commission** relies upon the truth of the statements contained in said Proposal and in the statements contained in this Affidavit in awarding the Contract.

I further warrant that no person or selling agency has been employed or retained to solicit or secure such Contract upon an agreement or understanding for a commission, percentage, brokerage or contingent fee, except bona fide employees or bona fide established commercial or selling agencies maintained by the Proposer for the purpose of securing business.

For breach or violation of this warranty the Owner shall have the right to annul the Contract without liability or in its discretion to deduct from the Contract price or consideration the full amount of such commission, percentage, brokerage or contingent fee.

(Affiant)

Sworn to and subscribed before me

this day of , 20\_\_\_\_

Notary Public in and for

\_\_\_\_\_ County, \_\_\_\_\_

My Commission Expires

\_\_\_\_\_, 20\_\_\_\_\_

### STATEMENT OF OWNERSHIP (OWNERSHIP DISCLOSURE CERTIFICATION) N.J.S.A. 52:25-24.2 (P.L. 1977, c.33, as amended by P.L. 2016, c.43)

### This Statement Shall Be Included with All Bid and Proposal Submissions

Name of Business:

Address of Business:

### Name of person completing this form:

### N.J.S.A. 52:25-24.2:

"No corporation, partnership, or limited liability company shall be awarded any contract nor shall any agreement be entered into for the performance of any work or the furnishing of any materials or supplies, unless prior to the receipt of the bid or proposal, or accompanying the bid or proposal of said corporation, said partnership, or said limited liability company there is submitted a statement setting forth the names and addresses of all stockholders in the corporation who own 10 percent or more of its stock, of any class, or of all individual partners in the partnership who own a 10 percent or greater interest therein, or of all members in the limited liability company who own a 10 percent or greater interest therein, as the case may be.

If one or more such stockholder or partner or member is itself a corporation or partnership or limited liability company, the stockholders holding 10 percent or more of that corporation's stock, or the individual partners owning 10 percent or greater interest in that partnership, or the members owning 10 percent or greater interest in that limited liability company, as the case may be, shall also be listed. The disclosure shall be continued until names and addresses of every noncorporate stockholder, and individual partner, and member, exceeding the 10 percent ownership criteria established in this act, has been listed.

To comply with this section, a bidder or proposer with any direct or indirect parent entity which is publicly traded may submit the name and address of each publicly traded entity and the name and address of each person that holds a 10 percent or greater beneficial interest in the publicly traded entity as of the last annual filing with the federal Securities and Exchange Commission or the foreign equivalent, and, if there is any person that holds a 10 percent or greater beneficial interest, also shall submit links to the websites containing the last annual filings with the federal Securities and Exchange Commission or the foreign equivalent and the relevant page numbers of the filings that contain the information on each person that holds a 10 percent or greater beneficial interest."

The Attorney General has advised that the provisions of N.J.S.A. 52:25-24.2, which refer to corporations and partnerships apply to limited partnerships, limited liability partnerships, and Subchapter S corporations.

This Ownership Disclosure Certification form shall be completed, signed and notarized.

# <u>Failure of the bidder/proposer to submit the required information is cause for automatic</u> <u>rejection of the bid or proposal</u>

# <u>Part I</u>

Check the box that represents the type of business organization:

Sole Proprietorship (skip Parts II and III, sign and notarize at the end)

Non-Profit Corporation (skip Parts II and III, sign and notarize at the end)

Partnership Limited Partnership

Limited Liability Company

For-profit Corporation (including Subchapters C and S or Professional Corporation)

Other (be specific):

# <u>Part II</u>

I certify that the list below contains the names and addresses of all stockholders in the corporation who own 10 percent or more of its stock, of any class, or of all individual partners in the partnership who own a 10 percent or greater interest therein, or of all members in the limited liability company who own a 10 percent or greater interest therein, as the case may be.

I certify that no one stockholder in the corporation owns 10 percent or more of its stock, of any class, or no individual partner in the partnership owns a 10 percent or greater interest therein, or that no member in the limited liability company owns a 10 percent or greater interest therein, as the case may be.

Sign and notarize the form below, and, if necessary, complete the list below. (Please attach additional sheets if more space is needed):

Name:	Name:
Address:	Address:
Name:	Name:
	P-00305-2

Address:	Address:
Name:	Name:
Address:	Address:
Name:	Name:
Address:	Address:
Name:	Name:
Address:	Address:
Name:	Name:
Address:	Address:
Name:	Name:
Address:	Address:

# <u>Part III -</u> Any Direct or Indirect Parent Entity Which is Publicly Traded:

"To comply with this section, a bidder or proposer with any direct or indirect parent entity which is publicly traded may submit the name and address of each publicly traded entity and the name and address of each person that holds a 10 percent or greater beneficial interest in the publicly traded entity as of the last annual filing with the federal Securities and Exchange Commission or the foreign equivalent, and, if there is any person that holds a 10 percent or greater beneficial interest, also shall submit links to the websites containing the last annual filings with the federal Securities and Exchange Commission or the foreign equivalent and the relevant page numbers of the filings that contain the information on each person that holds a 10 percent or greater beneficial interest."

Pages attached with name and address of each person that holds a 10 percent or greater OR	ch publicly traded entity as well as the name and address of each beneficial interest.
Submit here the links to the Websites (URL the federal Securities and Exchange Com	s) containing the last annual filings with mission or the foreign equivalent.
ANI Submit here the relevant page numbers of each person holding a 10 percent or greate	<b>)</b> the filings containing the information on er beneficial interest.
Subscribed and sworn before me this day of, 20	(Affiant)
(Notary Public)	(Print name of affiant and title if applicable)
My Commission expires:	(Corporate Seal if a Corporation)

### AFFIRMATIVE ACTION AFFIDAVIT

(to be completed by firms with more than 50 employees)

\_\_\_\_\_\_ of the firm of \_\_\_\_\_\_ (name) being sworn according to law on his oath deposes and says that:

1. I am authorized to make this affidavit on behalf of:

(name of firm)

2. In addition an agreement to comply with an Affirmative Action Program for equal employment opportunity heretofore submitted as part of any pre-qualification statement, or under other conditions of this contract for a similar program, I/we do hereby further affirm that I/we will comply with the rules and regulations which will be promulgated by the State Treasurer as of the effective date therefor pursuant to the Affirmative Action Law (P.L. 1975, c. 127), as amended.

Name and Title

Signature of Authorized Representative

Subscribed and sworn to before me this \_\_\_\_\_

day of \_\_\_\_\_ 20\_\_.

Seal Notary Public of New Jersey

### AFFIRMATIVE ACTION AFFIDAVIT

(to be completed by firms with fewer than 50 employees)

I \_\_\_\_\_\_, of the (City, Town, Borough) of \_\_\_\_\_ in the County of \_\_\_\_\_\_, State of \_\_\_\_\_\_, of full age, being duly sworn according to law on my oath depose and say that:

1. I am \_\_\_\_\_, of the firm of \_\_\_\_\_, a bidder <u>or proposer</u> making a proposal upon

### <u>CONTRACT NO. B129 – POWER GENERATION SYSTEM</u> <u>PROCUREMENT</u>

- 2. does not have 50 employees or more inclusive of all officers and employees of every type.
- 3. I am familiar with the affirmative action requirements of P.L. 1975, c. 127 and rules and regulations issued by the Treasurer, State of New Jersey, pursuant thereto.
- 4. has complied with all the affirmative action requirements of the State of New Jersey, including those required by the P.L. 1975. c. 127 and rules and regulations issued by the Treasurer, State of New Jersey, pursuant thereto.
- 5. I am aware that if \_\_\_\_\_\_ does not comply with P.L. 1975, c. 127 and rules and regulations issued pursuant thereto, that no monies will be paid by the State of New Jersey, County of \_\_\_\_\_\_, (City, Town, Borough) of \_\_\_\_\_\_ until an affirmative action plan is approved. I am also aware that the contract may be terminated and the \_\_\_\_\_\_, may be debarred from all public contracts, for a period of up to five (5) years.
- 6. In the event my workforce increases to 50 employees, I must contact the State Affirmative Action Office and complete an Employee Information Report.

Name and Title

Signature of Authorized Representative

Subscribed and sworn to before me this

day of \_\_\_\_\_, 20\_\_.

Seal Notary Public of New Jersey

AFFIRMATIVE ACTION AFFIDAVIT

P-00306-2

# ACKNOWLEDGEMENT OF RECEIPT OF CHANGES TO REQUEST FOR PROPOSAL DOCUMENTS FORM

### PASSAIC VALLEY SEWERAGE COMMISSION

POWER GENERATION SYSTEM PROCUREMENT	B129
(Name of Project)	(Contract No.)

The undersigned proposer hereby acknowledges receipt of the following notices, revisions, or addenda to the request for proposal. By indicating date of receipt, proposer acknowledges the submitted proposal takes into account the provisions of the notices, revision or addendum. Note that the PVSC's record of notice to proposers shall take precedence and that failure to include provisions of changes in a proposal may be grounds for rejection of the proposal.

	How Received (mail, fax,	
Addendum No.	Pick-up, etc)	Date Received

Acknowledgement by proposer:

Name of Proposer:

By Authorized Representative:

Signature:\_\_\_\_\_

Printed Name and Title:

Date:

### DISCLOSURE OF INVESTMENT ACTIVITIES IN IRAN

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

Bidder Name:

### PART 1: CERTIFICATION BIDDERS MUST COMPLETE PART 1 BY CHECKING EITHER BOX

# FAILURE TO CHECK ONE OF THE BOXES WILL RENDER THE PROPOSAL NON-RESPONSIVE

Pursuant to Public Law 2012, c.25, any person or entity that submits a bid or proposal or otherwise proposes to enter into or renew a contract must complete the certification below to attest, under penalty of perjury, that NEITHER the person or entity, nor any of its parents, subsidiaries, or affiliates, is identified on the Department of Treasury Chapter 25 list as a person or entity engaging in investment activities in Iran. The Chapter 25 list is found on the Division's website at <a href="http://www.state.nj.us/treasury/purchase/pdf/Chapter25List.pdf">http://www.state.nj.us/treasury/purchase/pdf/Chapter25List.pdf</a>. Bidders must review this list prior to completing the below certification. Failure to complete the certification will render a bidder's proposal non-responsive. If the New Jersey Director of the Division of Purchase and Property finds a person or entity to be in violation of law, he/she shall take action as may be appropriate and provided by law, rule or contract, including but not limited to, imposing sanctions, seeking compliance, recovering damages, declaring the party in default and seeking suspension of the party.

### PLEASE CHECK THE APPROPRIATE BOX:

- □ I certify, pursuant to Public Law 2012, c.25, that neither the bidder listed above nor any of the bidder's parents, subsidiaries, or affiliates listed on the N.J. Department of the Treasury's list of entities determined to be engaged in prohibited activities in Iran pursuant to P.L. 2012, c.25 ("Chapter 25 List"). I further certify that I am the person listed above, or I am an officer or representative of the entity listed above and am authorized to make this certification on its behalf. I will skip Part 2 and sign and complete the Certification below: OR
- I am unable to certify as above because the bidder and/or one of its parents, subsidiaries, or affiliates is listed on the Department's Chapter 25 List. I will provide a detailed, accurate and precise description of the activities in Part 2 below and sign and complete the Certification below. Failure to provide such will result in the proposal being rendered as non-responsive and appropriate penalties, fines and/or sanctions will be assessed as provided by law.

PART 2: PLEASE PROVIDE FURTHER INFORMATION RELATED TO INVESTMENT ACTIVITIES IN IRAN.

You must provide a detailed, accurate and precise description of the activities of the bidding person/entity, or one of its parents, subsidiaries or affiliates, engaging in the investment activities in Iran outlined above by completing the boxes below.

# PLEASE PROVIDE THOROUGH ANSWERS TO EACH QUESTION. IF YOU NEED ADDITIONAL ROOM, ADD ADDITIONAL PAGES.

Name	Relationship to Bidder/Owner	
Description of Activities		
Duration of Engagement	Anticipated Cessation Date	
Bidder/Offeror Contact Name		

Certification: I, being duly sworn upon my oath, hereby represent and state that the foregoing information and any attachments thereto to the best of my knowledge are true and complete. I attest that I am authorized to execute this certification on behalf of the above-referenced person or entity. I acknowledge that the State of New Jersey and the Owner of the project are relying on the information contained herein and thereby acknowledge that I am under a continuing obligation from the date of this certification through the completion of any contracts with the State of New Jersey and the Owner in writing of any changes to the answers of information contained herein. I acknowledge that I am aware of that it is a criminal offense to make a false statement or misrepresentation in this certification, and if I do so, I recognize that I am subject to criminal prosecution under the law and that it will also constitute a material breach of my agreement(s) with the State of New Jersey and/or the Owner and that the State and/or the Owner at its option may declare any contract(s) resulting from this certification void and unenforceable.

Full Name (Print):	Signature:	
Title:	Date:	

Date:

Mr. Gregory A. Tramontozzi Executive Director Passaic Valley Sewerage Commission 600 Wilson Avenue Newark, New Jersey 07105

Dear Mr. Tramontozzi:

The undersigned hereby submits the enclosed proposal for the position of GOODS AND SPECIAL SERVICES OF POWER GENERATION SYSTEM PROCUREMENT CONTRACT.

The undersigned hereby undertakes and promises to provide services for GOODS AND SPECIAL SERVICES OF POWER GENERATION SYSTEM PROCUREMENT CONTRACT and to do all work requested as appropriate and required herein as well as the contract documents concerning the same, including all written amendments and changes thereto, if any, which are incorporated herein by reference and made a part of this proposal.

SIGNATURE

BUSINESS NAME

Type or Print Full Name

Title

Date

Telephone Number

Fax-Telephone Number

			Two-Y	Divi ear Chapter	State o sion of Pu 51 / Execution Isclosure of	of New rchas ve Orde	Jersey e and Pr er 117 Ven I Contribu	opei dor (	rty Certification and	CHAPT 51/EO 117-1
					For AGE		ISE ONI	v	s	
Gene	eral In	format	tion Goods	and Specia	al Services		SE ONL	T		
Solici	itation,	RFP or	Contract No.	Power Gen	eration Syst	tem	Award Amo	ount		
Desc	ription	of Serv	ices F	Procureme	nt Contract					
Ager	ncy Co	ontact	Information							
Agen	су	Passa	ic Valley Se	werage C	commissio	n_	Contact Pe	rson	Thomas A. Fuso	caldo
Phon	e Num	iber	973-817-57	02			Agency En	nail	tfuscaldo@pvs	c.com
Part 1:	Ven	dor Int	formation							
Full L	egal B	usiness	Name							
	0		(Includ	ing trade nam	e if applicable)					
Busi	ness	Туре	Corporati	0	Limited Par	Inershin		Profe	essional Corporation	General Partnership
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Vendo	or Email	-					endor FEIN	4		
1.	On or the e inclue contr	r after C ntity pu ding in-l act to th	ectober 15, 2004 rsuant to Execut kind contribution he vendor, pursu	, neither the tive Order 11 s, company lant to the te	below-named 17 (2008) has or organizatio erms of Execu	d entity solicite in contr tive Orc	nor any ind d or made : ibutions, as ler 117 (20	lividua any ci s set f 08).	al whose contributions ontribution of money, p forth below that would	are attributable to bledge of contribution, bar the award of a
a)	Withi	n the p	receding 18 ma	onths, the b	elow-named p	erson o	or organizat	tion ha	as not made a contribu	ution to:
	(i)	Any ca	andidate commi	ttee and/or e	election fund c	f any ca	andidate fo	r or he	older of the public offic	e of Governor
	Gið	or Lie	utenant Govern	nor, Inicinal polit	tical party con	mittee	OR			
	(iii)	Any le	gislative leade	rship comn	nittee.					
b)	Durin contr	i <b>g the t</b> e ibution t	erm of office of	the curren	t Governor(s	), the be	elow-named	d pers	son or organization has	s not made a
	(i) (ii)	Any ca Any S the co	andidate, comm tate, county or <i>r</i> mmencement o	ittee and/or <i>nunicipal</i> po f said Gover	election fund o blitical party co mor's term.	of the G ommitte	overnor or e nominati	<i>Lieut</i> ng su	te <i>nant Governor</i> , OR ch Governor in the ele	ction preceding
c)	Withi perso	n the 1 on or org	<b>8 months imme</b> ganization has n	diately pric	or to the first ontribution to	day of	the term o	f offic	ce of the Governor(s)	, the below-named
	(i)	Any ca Any St candid	ndidate, commi ate, county, <i>mu</i> ate(s) in the last	ttee and/or e <i>nicipal</i> politi gubernatori	lection fund o ical party com ial election.	f the G mittee o	overnor or a	<i>Lieut</i> cal pa	enant Governor, OR ity nominating the suc	cessful gubernatorial
PLEASI or contro that is a within th the term	E NOT olling r corpo ne prec n of Off	E: Price more that ration for eding 18 fice of G	or to November an 10 percent of or profit) to any o 3 months, during overnor.	15, 2008, the profits of andidate co the term of	ne only disqua or assets of a l mmittee and/o office of the o	lifying o busines or electi current (	contribution s entity (or on fund of f Governor o	s incli 10 pe the G r with	ude those made by the ercent of the stock in th overnor or to any state in the 18 months imme	e vendor or a principal ov ne case of a business en e or county political party ediately prior to the first d

CH51.1 R1/21/2009

Page 1 of 3

Part 3: Disclosure of Cont	tributions Made	CHAP 51/ EXO 117 -
Check this box if no rep	oortable contributions have been made by the	e above-named business entity
Name of Recipient	Address of Recipient	
Date of Contribution	Amount of Contribution	
Type of Contribution (i.e. curren	cy, check, loan, in-kind	
Contributor Name		
Relationship of Contributor to th	e Vendor	
Contributor Address		
City	State	Zip
	If this form is not being completed electronically, pl as necessary. Otherwise click "Add a Contribution"	lease attach pages for additional contribution "to enter additional contributions.

CH51.1 R1/21/2009

Page 2 of 3

I have read the instructions accome	CITAFT 51/2011/-5	
I certify that, to the best of my know are willfully false, I am subject to pu	anying this form prior to completing this certification on behalf of the above-named business ent ledge and belief, the foregoing statements by me are true. I am aware that if any of the statemer nishment.	ty. its
I understand that this certification does not change and/or additiona contributions are made, a new full s Disclosure, the person or entity nam	n will be in effect for two (2) years from the date of approval, provided the ownership statu al contributions are not made. If there are any changes in the ownership of the entity or additi et of documents are required to be completed and submitted. By submitting this Certification an ned herein acknowledges this continuing reporting responsibility and certifies that it will adhere to	is onal d o it.
(CHECK ONE BOX A, B or C)		
(A) I am certifying on behalf of attributable to the entity pur	the above-named business entity and all individuals and/or entities whose contributions are suant to Executive Order 117 (2008).	
(B) I am certifying on behalf of	the above-named business entity only.	
(C) I am certifying on behalf of	an individual and/or entity whose contributions are attributable to the vendor.	
Signed Name	Print Name	
Phone Number	Date	
Title/Position		
moleted Ownership Disclosure	form either electronically to cdi 32000 eas state hulls, or regular mail at Chapter 5	
empleted Ownership Disclosure nit, P.O. Box 039, 33 West State initial forms on file, and submit o	Street, 9 <sup>th</sup> Floor, Trenton, NJ 08625. The agency should save the forms locally and poper to the Chapter 51 Review Unit	keep th
ompleted Ownership Disclosure nit, P.O. Box 039, 33 West State iginal forms on file, and submit c	sorm, either electronically to consugereas state.nj.us, or regular mail at Chapter 5 Street, 9 <sup>th</sup> Floor, Trenton, NJ 08625. The agency should save the forms locally and sopies to the Chapter 51 Review Unit.	keep th
mpleted Ownership Disclosure nit, P.O. Box 039, 33 West State iginal forms on file, and submit c	sorm, either electronically to consequences.state.nj.us, or regular mail at Chapter 5 Street, 9 <sup>th</sup> Floor, Trenton, NJ 08625. The agency should save the forms locally and popies to the Chapter 51 Review Unit.	keep th
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# Technical Documents Required with Proposal Schedule

		Check if Complete
Reference		Complete
Document	Submittal Item	
11506	Selective Catalytic Reduction System & Stack	
11506	General arrangement and elevation plans of systems furnished.	
11506	Major dimensions of major pieces of equipment.	
11506	General description as to component or modular sizes and description of	
	modifications required to add steam generating capability in the future.	
11506	Predicted stack emissions for all constituents listed in Section 11506 Selective	
	Catalytic Reduction System Specification Sheet	
11508	Ammonia System	
11508	Equipment outline drawing	
11508	Performance data, including power requirements and ammonia consumption	
15220	Reciprocating Fuel Gas Compressor	
15220	Equipment outline drawing	
15220	Compressor performance data & power requirements	
15560	Small Combustion Turbine/Generators	
15560	Combustion turbine generator performance data	
15560	Preliminary/typical general arrangement Drawings showing the combustion turbine	
	generator unit(s), inlet filter(s), exhaust stack(s), all associated	
	compartments/enclosures/skids, starter unit, transformers, and radiators. A vertical	
	section shall be included showing the complete installed unit including crane	
	minimum hook height and capacity.	
15560	A complete description of all equipment proposed, together with supportive data.	
15560	A complete description of the CTG normal start sequence and timing	
15560	A complete description of the CTG fast start sequence and timing	
15560	A complete description of CTG fast start degradation impacts	
15560	Preliminary Engineering Schedule.	
15560	Preliminary Procurement/Production/Shipping Schedule.	
15560	Shipping methods and erection criteria and requirements.	
15560	Information on technical assistance provided during erection and commissioning.	
15560	Provide estimated hours to erect proposed combustion turbine generator unit.	
15560	Description of all field assembly/erection required.	
15560	Predicted start-up emissions	
15910	Blackstart Generator	
15910	Engine performance data	
	Preliminary arrangement drawings indicating overall dimensions, estimated weights,	
15910	component locations, and external connection in formation.	
15910	Exhaust gas emission data, maximum valves at loads of 1/2, 3/4, and full load.	
16031	Cylindrical Rotor Generators	
16031	Generator power factor correction curves for ASME PTC 6.1 acceptance test	
16031	Preliminary/typical one-line diagrams of generator electrical system, including ac	
	and dc auxiliary electric system. One-line diagrams shall include all auxiliary load	
	data and proposed metering and protective relaying.	

# Technical Document Schedule

# <u>Technical Documents Required with Proposal</u> <u>Schedule</u>

C1 1 10

		Спески
		Complete
Reference		
Document	Submittal Item	
16031	Preliminary/typical electrical Load List - (Provides start-up, standby, and operating	
	electrical loads)	
16031	Detailed data describing capability of the unit to operate above and below rated	
	speed, including minimum and maximum allowable speed versus cumulative time	
	duration of off-normal speed operation	
16031	Detailed information on the capability of the generator to respond to a system upset	
	situation, where a large portion of the system load is applied to the unit and load	
	shedding is required	
16031	All generator, exciter, power system stabilizer and regulator data required to	
	complete a mathematical model study of system stability.	
16031	Provide a block diagram and parameter values for the significant transfer functions	
	(representing the generator, excitation, power system stabilizer and governor)	
	satisfactory for transient and dynamic computer studies	
16031	Reactive power capability versus real power capability curve	
16031	Generator performance data including reactance, resistance, time constants, inertia,	
	damping, saturation factors and saturation curves.	
16031	Reactive capability curve to indicate generator capability at various power factors.	
16031	Generator "Vee" curves.	
16031	Generator drawing with overall length, width, and height.	
16031	Generator drawing with exciter or collector's overall length, width, and height.	
16031	Complete description of excitation system.	
16031	Generator drawing with excitation cubicle's overall length, width, and height.	
16031	Generator drawing with rotor removal clearance (straight and askew).	
16031	Description and listing of major generator assemblies for shipment.	
16031	Complete information on the generator supervisory instrumentation system,	
	including a bill of material.	
16031	Detailed listing of alarm contacts available and recommended alarms for connection	
	to DCS, including unit prices for additions or deductions.	
16031	Detailed listing of instrumentation furnished.	
16031	Complete description of cable requirements, including the cable constructions, for all	
	equipment furnished.	
16031	Complete description of any voltage level separation requirements for raceway or	
	special cable shielding requirements for all equipment furnished.	
16031	Complete description of the lube oil piping arrangement.	
16031	Complete list of other plants where the manufacturer has duplicate, or near duplicate,	
	generators under construction or in operation.	
16031	Listing of Work subcontracted to other Sellers.	
16031	Listing of SubSellers and Sellersused.	
16031	Proposer's preliminary engineering schedule.	
16031	Proposer's procurement/production/shippingschedule.	
16031	Generator maximum allowable temperature of cold coolant generator temperature	
	rise of gas and liquid.	

# <u>Technical Documents Required with Proposal</u> <u>Schedule</u>

C1 1 10

		Cileck II
Reference		Complete
Document	Submittal Item	
16031	Generator maximum allowable temperature for armature winding field winding	
10051	core and mechanical parts in contact with or adjacent to armature winding.	
	insulation: and collector rings, brushes, and brushholders	
16031	Maximum allowable temperature of cooling air and temperature rise of cooling air	
10051	waxinum anowable temperature of cooling an and temperature rise of cooling an.	
16051	Electrical Design and Equipment	
16051	Bill of quantities and materials including make, manufacturer and model for all	
	items.	
16051	Dimensional outline drawings.	
16051	One-line diagrams showing equipment provided and equipment layout.	
17053	Subsystem - Programmable Logic Control System (Gas Compressors)	
17053	Description of proposed PLC equipment, including manufacturer, model, memory	
	type and capacity, types and quantities of I/O modules provided, and preliminary	
	PLC system architecture and layout.	
17053	Description of proposed interface to plant DCS, including communication standard,	
	protocol, and media.	
17053	Subsystem - Programmable Logic Control System (Blackstart Generators)	
17053	Description of proposed PLC equipment, including manufacturer, model, memory	
	type and capacity, types and quantities of I/O modules provided, and preliminary	
	PLC system architecture and layout.	
17053	Description of proposed interface to plant DCS, including communication standard,	
	protocol, and media.	
17101	Distributed Control System	
17101	Preliminary Engineering/Production/Shipping Schedule. This schedule shall be based	
	on the milestone dates listed in the preliminary project schedule, and shall include	
	the dates for database, hardware, and software cutoff, for Seller issue of each logic	
	system configuration package for review, and for Seller issue of the graphic	
15101	configuration package for review.	
17101	System configuration drawing. The system configuration drawing shall include	
	details on the control network, the operator work station network, and any network	
17101	security components.	
1/101	Proposer's listing and description of the software (graphics configurator, alarm	
17101	manager, etc.). Dill of Material including the following:	
1/101	1) Cabinat quantity and size	
	2) Processor (control/link/other) quantity manufacturer & model/cories	
	2) Processor (control/mik/other) quantity, manufacturer & model/series	
	3) workstations quantity, manufacturer & model/series	
	4) I/O card quantity by type and cabinet, manufacturer & model/series	
	5) Network hardware (switches, routers, etc.) quantity, manufacturer & model	

### TECHNICAL DOCUMENTS REQUIRED WITH PROPOSAL

- 1. Proposer shall complete the Technical Documents Required with Proposal Schedule and include it, along with the required documentation identified, with submittal of the Proposal. Failure to completely fill out the Technical Documents Required with Proposal Schedule, with inclusion of all required attachments, may result in Proposal being declared non-responsive and rejected.
- 2. By submission of the Technical Documents Required with Proposal Schedule, Proposer agrees that the information provided represents guaranteed values and that all qualification statements are true representation of Proposer's qualifications. The information provided is to confirm general conformity to the Contract Documents by the Buyer and shall not supersede any Contract Document requirement(s).

# ATTACHMENT C

# PASSAIC VALLEY SEWERAGE COMMISION

# CONTRACT NO. B129

# POWER GENERATION SYSTEM PROCUREMENT

# COST PROPOSAL FORMS

All pricing shall be in current US dollars.

Proposer's total Capital Cost shall include the summation of each Cost Item, including PVSC's identified Allowance and Unit Price Items as described herein.

Proposer's Equipment Cost Pricing is inclusive of the Proposer's complete scope of supply.

Cost Item	Equipment	Subtotal
1	Combustion Turbine Generator No. 1	\$
2	Combustion Turbine Generator No. 2	\$
3	Combustion Turbine Generator No. 3	\$
4	CTG Exhaust System No. 1	\$
5	CTG Exhaust System No. 2	\$
6	CTG Exhaust System No. 3	\$
7	Fuel Gas Compressor No. 1	\$
8	Fuel Gas Compressor No. 2	\$
9	Fuel Gas Compressor No. 3	\$
10	Gas-Fired Blackstart Generator No. 1	\$
11	Gas-Fired Blackstart Generator No. 2	\$
12	Distributed Control System	\$
13	All Other Required Items	\$
	Subtotal I	\$

# **Cost Proposal Form I – Equipment Cost Items**

# **Cost Proposal Form II – PVSC Allowance Items**

Allowance for Additional Authorized Work – Cost Item Number 13. Payment for the work shall be made at a price agreed upon by the Buyer and shall provide full compensation for furnishing all labor, materials, equipment, and incidentals required to complete the work as necessary. The Allowance for Additional Authorized Work is intended to provide for work that may later be determined to be necessary for the completion of the project but is not covered in the other cost items. Written authorization by the Buyer for utilization of any part of the allowances for any

such work shall be required. Measurement for the Allowance for Additional Authorized Work shall be on an as needed basis.

Allowance for Buyer's Witness Test Expenses – Cost Item Number 14. For the equipment to be witness shop tested, whether of foreign or domestic manufacture, the Seller shall be responsible for the costs of employees of the Buyer and Engineer, including all transportation, food, lodging and miscellaneous expenses, for each witness shop test. The Seller shall coordinate all travel arrangements with the Buyer and Engineer. The Seller will be reimbursed by the Buyer for the actual expense amount incurred and invoiced to the Buyer. Seller shall include all receipts, itinerary and documentation with the invoice for reimbursement of Buyer's Witness Test Expenses for the Buyer and Engineer to validate and confirm the actual reimbursable costs due the Seller. Measurement for the Allowance for Buyer's Witness Test Expenses shall be on an as needed basis.

Cost Item	Equipment	Subtotal
14	Allowance for Additional Authorized Work	\$1,000,000.00
15	Allowance for PVSC's Witness Test Expenses	\$250,000.00
	Subtotal II	\$1,250,000.00

# **Cost Proposal Form III – Equipment Storage Costs**

Payment of a unit price item shall be made for the actual quantity of work performed. Quantities for the various items of work and materials are approximate only and are given solely to be used as a uniform basis for the comparison of costs and PVSC reserves the right to increase or decrease quantities, and to eliminate quantities, as PVSC may deem necessary. The Proposer will be paid on the basis of stipulated unit prices set forth when directed in writing by PVSC to use the unit price item.

Cost Item Numbers 16 through 20 is intended to provide Off-Site Storage for the Goods comprised of the entire Power Generation System in the event the PVSC, or its Assignee, is not ready and willing to receive the Goods at the Point of Destination by the Milestone 2 deliverable date. Proposer shall be responsible for preparing the items for, and placing them into, storage in such a manner as to be compliant with Proposer's standard guidelines and requirements for storage of such items. The unit price for Off-Site Storage shall include the following:

- 1. Delivery to Off-Site Storage Facility
- 2. Unloading of Goods and Placement within Off-Site Storage Facility
- 3. Storage at Off-Site Storage Facility
- 4. Loading of Goods at Off-Site Storage Facility and Readying for Transport
- 5. Delivery to the Point of Destination

Cost Item	Equipment	Units	Estimated Quantity	Unit Price <sup>1</sup>	Subtotal				
16	Combustion Turbine	Month	6	\$	\$				
17	CO Catalyst	Month	6	\$	\$				
18	SCR Catalyst	Month	6	\$	\$				
19	Fuel Gas Compressor	Month	6	\$	\$				
20	Gas-Fired Blackstart Engine-Generator	Month	6	\$	\$				
	Subtotal III \$								
All equipment not specifically listed are considered a part of the larger items included in the table. No separate payment will be made for storage of components of the equipment included in this Cost Proposal Form III.									

# **Cost Proposal Form IV – Manufacturer's Training Services**

Payment of a unit price item shall be made for the actual quantity of work performed. Quantities for the various items of work and materials are approximate only and are given solely to be used as a uniform basis for the comparison of costs and PVSC reserves the right to increase or decrease quantities, and to eliminate quantities, as PVSC may deem necessary. The Proposer will be paid on the basis of stipulated unit prices set forth, however, that is the Proposer is not directed in writing to use the unit price item, the Proposer shall have no right to such money and it shall be deducted from the total amount of the Contract.

Proposer shall provide Qualified Training Specialists to perform training of PVSC's personnel as required.

Payment will be at the unit price, which is an all-inclusive daily per diem rate, that shall only account for the Training Specialists' labor, time and expenses and does not include the remaining specified requirements for the Proposer to train PVSC's personnel. The remaining specified requirements (Preparation of Training Sessions with PVSC's Personnel, Execution of Classroom and Field Training, Development of Training Materials and Aids, Video Recording of Training and Development of Lesson Plans) shall be included in **Cost Proposal Form I**. The unit price shall include:

- 1. Seven (7) individual trips each with a duration of no less than three (3) continuous calendar days,
- 2. all salary and overhead,
- 3. all expenses traveling to and returning from the lodging local to the job site from the Manufacturer's Field Service home base of operations,

- 4. local lodging,
- 5. travel between the jobsite and local lodging,
- 6. meals and miscellaneous expenses.

A day of service shall be defined as one, eight (8) hours onsite during normal business days.

Cost Item	Equipment	Units	Estimated Quantity	Unit Price <sup>1</sup>	Subtotal
21	21 Manufacturer's Training Services		21	\$	\$
		\$			

# Cost Proposal Form V – Distributed Control System Components

Payment of a unit price item shall be made for the actual quantity of work performed. Quantities for the various items of work and materials are approximate only and are given solely to be used as a uniform basis for the comparison of costs and PVSC reserves the right to increase or decrease quantities, and to eliminate quantities, as PVSC may deem necessary. The Proposer will be paid on the basis of stipulated unit prices set forth, however, that is the Proposer is not directed in writing to use the unit price item, the Proposer shall have no right to such money and it shall be deducted from the total amount of the Contract. Measurement for Distributed Control System components shall be on an as needed basis.

Cost Item	Equipment	Units	Estimated Quantity	Unit Price <sup>1</sup>	Subtotal
22	AO Module – 4-20 mA	Each	2	\$	\$
23	AI Module – 4-20 mA	Each	5	\$	\$
24	AI Module – T/C	Each	2	\$	\$
25	AI Module – RTD	Each	2	\$	\$
26	DI Module	Each	5	\$	\$
27	DI SOE Module	Each	5	\$	\$
28	RO Module	Each	3	\$	\$
29	Processor Pair	Each	1	\$	\$

Cost Item	Equipment	Units	Estimated Quantity	Unit Price <sup>1</sup>	Subtotal
30	Foreign Device Interface – non- redundant	Each	2	\$	\$
31	Foreign Device Interface – redundant	Each	2	\$	\$
32	I/O Cabinet without I/O Hardware	Each	1	\$	\$
33	Operator Workstation	Each	1	\$	\$
Subtotal V					\$

# TOTAL CAPITAL COST (Sum of Cost Proposal Forms I, II, III, IV, V):

<u>\$</u>\_\_\_\_\_

(In Figures)

Date

Name of Proposer:

<sup>1</sup> The Unit Price shall be multiplied by the Estimated Quantity and the result entered on the corresponding Total Amount Line item
# Section P-00400

### PROPOSER'S QUALIFICATION FORM

### THE INFORMATION SUPPLIED IN THIS DOCUMENT IS CONFIDENTIAL TO THE EXTENT PERMITTED BY LAWS AND REGULATIONS

### 1. SUBMITTED BY:

2.

3.

4.

Officia	al Name of Firm:	
Addre	ss:	
SUBMITT	ED TO:	Passaic Valley Sewerage Commission
Projec	t Name:	Power Generation System Procurement
SELLER'S	S CONTACT INFORM	ATION
Contac	t Person:	
Title:		
Phone:		
Email:		
TYPE OF	ORGANIZATION:	
	SOLE PROPRIETORS	HIP
	Name of Owner:	
	Doing Business As:	
	Date of Organization:	
	<u>PARTNERSHIP</u>	
	Date of Organization:	
	Type of Partnership:	
	Name of General Partne	er(s):

State of Organization:	
Date of Organization:	
Executive Officers:	
- President:	
- Vice President(s):	
- Treasurer:	
- Secretary:	
LIMITED LIABILITY COMPANY	
State of Organization:	
Date of Organization:	
Members:	
JOINT VENTURE	
Sate of Organization:	
Date of Organization:	
Form of Organization:	
Joint Venture Managing Partner	
- Name:	
- Address:	

Joint Venture Managing Partner	
- Name:	
- Address:	
Joint Venture Managing Partner	
- Name:	
- Address:	

### 5. EXPERIENCE:

Complete the Schedule of Experience & Qualifications demonstrating experience in similar scope and size to that required under this contract.

I HEREBY CERTIFY THAT THE INFORMATION SUBMITTED HEREWITH, INCLUDING ANY ATTACHMENTS, IS TRUE TO THE BEST OF MY KNOWLEDGE AND BELIEF.

NOTARY ATTEST:

SUBSCRIBED AND SWORN TO BEFORE ME

THIS \_\_\_\_\_\_ DAY OF \_\_\_\_\_, 20\_\_\_\_

NOTARY PUBLIC - STATE OF \_\_\_\_\_\_ MY COMMISSION EXPIRES: \_\_\_\_\_

#### REQUIRED ATTACHMENTS

- 1. Schedule of Experience & Qualifications (Current Experience).
- 2. Evidence of authority for individuals listed in Section 6 to bind organization to an agreement.

# SCHEDULE OF EXPERIENCE & QUALIFICATIONS (Sheet 1 of 2)

Project Name	Seller's Contact Person	Description of Work	Combustion Turbine Generator Rated Capacity (MW)	Combustion Turbine Model No.	Generator Make and Model No.	Operating Frequency (Hz)	Operation Date	Hours of Operation	Currently in Service (Yes/No)
Name:	Name:								
Address:	Telephone:								
Name:	Name:								
Address:	Telephone:								
Name:	Name:								
Address:	Telephone:								
Name:	Name:								
Address:	Telephone:								
Name:	Name:								
Address:	Telephone:								
Name:	Name:								
Address:	Telephone:								

# SCHEDULE OF EXPERIENCE & QUALIFICATIONS (Sheet 2 of 2)

Project Name	Seller's Contact Person	Description of Work	Combustion Turbine Generator Rated Capacity (MW)	Combustion Turbine Model No.	Generator Make and Model No.	Operating Frequency (Hz)	Operation Date	Hours of Operation	Currently in Service (Yes/No)
Name: Address:	Name: Telephone:								
Name: Address:	Name: Telephone:								
Name: Address:	Name: Telephone:								
Name: Address:	Name: Telephone:								
Name: Address:	Name: Telephone:								
Name: Address:	Name: Telephone:								

End of Section

### SECTION P-00500

### CONTRACT NO. B129 PASSAIC VALLEY SEWERAGE COMMISSION 600 WILSON AVENUE NEWARK, NEW JERSEY 07105

### CONTRACT AGREEMENT

#### POWER GENERATION SYSTEM PROCUREMENT

THIS AGREEMENT, made and executed this \_\_\_\_\_ day of \_\_\_\_\_\_, 20\_\_\_\_, by and between the PASSAIC VALLEY SEWERAGE COMMISSION, a corporate body politic of the State of New Jersey, hereinafter called the "OWNER" or "BUYER", acting through its Chairman, and \_\_\_\_\_\_\_, a corporation, partnership, individual, etc. chartered under the laws of the State of \_\_\_\_\_\_ with principal offices at \_\_\_\_\_\_\_ hereinafter called the "SELLER". BUYER and SELLER, in consideration of the mutual covenants, hereinafter set forth, agree as follows:

#### Article 1 - Goods and Special Services

1.1 In consideration of the payments to be made as hereinafter provided, and of the performance by BUYER of all the matters and things to be performed by BUYER and herein provided; SELLER agrees, at its own sole cost and expense, to provide all Goods and Special Services as specified, described or indicated in the Contract Documents, as defined herein and Addenda within the time hereinafter specified and in accordance with the terms, conditions and provisions of the Contract Documents and Addenda.

#### Article 2 - Engineer

2.1 The Project has been designed by Black & Veatch Corporation, 489 Fifth Avenue, 14<sup>th</sup> Floor New York, New York 10017, who are hereinafter called ENGINEER and who are to act as BUYER's representative, assume all duties and responsibilities and have the rights and authority assigned to ENGINEER in the Contract Documents in connection with completion of the Work in accordance with the Contract Documents.

#### Article 3 - Contract Times

- 3.1 All time limits for Milestones and completion and readiness for final payment as stated in the Contract Documents are of the essence of the Contract.
- 3.2 The Contract Times shall be as follows:

<u>Milestone 1</u>: Submission of complete submittals to be completed on or before the date per the Schedule of Submittals for each identified item attached to this Agreement as Exhibit 1.

<u>Milestone 2</u>: Goods delivered to the Point of Destination completed on or before 700 calendar days, but no sooner than 665 calendar days, after execution of Agreement with BUYER.

<u>Milestone 3</u>: Initial checkout, startup and training of the Goods at the Point of Destination completed on or before 30 calendar days after Installation Contractor has completed installation.

<u>Completion</u>: Successful completion of performance testing of the Goods at the Point of Destination completed on or before 30 calendar days after completion of Milestone 3.

The Goods and Special Services shall be completed and ready for final payment in accordance with Paragraph 10.06 of Section P-00700 Standard General Conditions for Procurement Contract within the schedule specified herein after the date when the Contract Times commence to run.

- 3.3 All Submittals, Shop Drawing and Samples required by the Contract Documents shall be submitted to BUYER for ENGINEER's review according to the schedule specified herein.
- 3.4 The Goods are to be delivered to the Point of Destination and ready for BUYER's receipt of delivery according to the schedule specified herein.
- 3.5 If the Goods are scheduled to be delivered on or after the scheduled date for delivery to the Point of Destination according to the schedule specified herein, but BUYER cannot take delivery at the Point of Destination by the time after the Scheduled Delivery Date that such Goods are estimated to be delivered to the Point of Destination, due to any cause not attributable to SELLER, then, SELLER if directed by BUYER shall place Goods into Off-Site Storage. The site of such storage shall be mutually agreed between the SELLER and BUYER. If such item is placed (or kept, as applicable) in storage, including storage at the facility where it is manufactured, the following conditions shall apply:
  - A. Risk of loss (including responsibility for insurance coverage) shall remain with SELLER;
  - B. SELLER shall be responsible for preparing the items for, and placing them into, storage in such a manner as to be compliant with SELLER's standard guidelines and requirements for storage of such items;
  - C. SELLER remains responsible for shipment to the Point of Destination;
  - D. Payment to SELLER for Goods to be placed into storage shall be in accordance with Articles 4 and 5 of the Contract Agreement and any amounts payable to the SELLER upon delivery at the Point of Destination shall become payable upon delivery of the Goods to Off-Site Storage.

- 4.1 BUYER shall pay SELLER for completion of the Work in accordance with the Contract Documents in current funds at the prices agreed upon in the SELLER's Capital Cost Proposal Form attached to this Agreement. The Contract Price shall be the Total Capital Cost Price including Allowances and Unit Prices.
- 4.2 Allowances and Unit Prices are for specific contingencies for the SELLER to complete the Goods and Special Services for items and incidentals not specified in the Contract Documents or are those that are required by the BUYER as specified in the SELLER's Capital Cost Proposal Form.
- 4.3 The SELLER will be paid on the basis of stipulated unit prices set forth in the Proposer's Cost Proposal Form(s), however, that is the SELLER is not directed to use the Allowances or Unit Prices, the SELLER shall have no right to such money and it shall be deducted from the total amount of the Contract by change order.
- 4.4 Payment to SELLER post assignment of Contract shall be in accordance with Paragraph 10.06 of Section P-00700 Standard General Conditions for Procurement Contracts.

# Article 5 - Payment Procedures

- 5.1 Submittal and Processing of Payments. SELLER shall submit Applications for Payment in accordance with Article 10 of Section P-00700 Standard General Conditions for Procurement Contract. Applications for Payment will be processed by ENGINEER as provided in Section P-00700 Standard General Conditions for Procurement Contract.
- 5.2 Progress Payments. BUYER shall make progress payments toward the Contract Price on the basis of SELLER's Applications for Payment, submitted in accordance with Paragraph 10.01 of Section P-00700 Standard General Conditions for Procurement Contract and accompanied by ENGINEER's recommendation of payment in accordance with Paragraph 10.02.A of Section P-00700 Standard General Conditions for Procurement Contract and Supplemental General Conditions, as follows:
  - A. Five percent (5%) of each Lump Sum Pay Item included in Cost Proposal Form I, Payable in forty-five (45) calendar days upon Execution of Contract Agreement
  - B. Five percent (5%) of each Lump Sum Pay Item included in Cost Proposal Form I, Payable in forty-five (45) calendar days upon Engineer's acceptance of Seller's final Shop Drawing submittals
  - C. Thirty percent (30%) of each Lump Sum Pay Item included in Cost Proposal Form I, Payable in forty-five (45) calendar days upon Acceptance of Factory Tests:
  - D. Ten percent (10%) of each Lump Sum Pay Item included in Cost Proposal Form I, Payable in forty-five (45) calendar days Upon ready for shipment.
  - E. Twenty-five percent (25%) of each Lump Sum Pay Item included in Cost Proposal Form I, Payable in forty-five (45) calendar days from the respective delivery date at the Point of Destination.

- F. Five percent (5%) of the Subtotal of Cost Proposal Form I, Payable in forty-five (45) calendar days upon Successful Startup and Commissioning of Power Generation System.
- G. Ten percent (10%) of the Subtotal of Cost Proposal Form I, Payable in forty-five (45) calendar days upon Successful Performance Testing of Power Generation System as Specified.
- H. Ten percent (10%) of the Subtotal of Cost Proposal Form I, Payable in forty-five (45) calendar days after Training of Buyer's Personnel, Final Inspection and Acceptance, and final Operations and Maintenance Manuals submittal.
- I. Allowance items, payable in forty-five (45) calendar days upon Engineer's acceptance of Seller's Work associated with the respective allowance item.
- J. Unit Price items, payable in forty-five (45) calendar days upon Engineer's acceptance of Seller's Work associated with the respective unit price item.
- 5.3 Final Payment. SELLER shall submit final Application for Payment upon Completion as indicated in Paragraph 10.06 of Section P-00700 Standard General Conditions for Procurement Contracts. Upon receipt of the final Application for Payment accompanied by ENGINEER's recommendation of payment in accordance with Paragraph 10.06 of Section P-00700 Standard General Conditions for Procurement Contract, BUYER shall pay the remainder of the Contract Price as recommended by ENGINEER.

### Article 6 - Seller's Representations

In order to induce BUYER to enter into this Agreement, SELLER makes the following representations:

- 6.1 SELLER has familiarized itself with the nature and extent of the Contract Documents, Work, site, locality, and all local conditions and Laws and Regulations that in any manner may affect cost, progress, performance of the Goods and Special Services.
- 6.2 SELLER has given ENGINEER written notice of all conflicts, errors or discrepancies that he has discovered in the Contract Documents and the written resolution thereof by ENGINEER is acceptable to SELLER.
- 6.3 SELLER is financially solvent and is experienced and competent to perform the type of work or to furnish the plant, materials, supplies or equipment to be performed or furnished by him.
- 6.4 The Contract Documents are generally sufficient to indicate and convey understanding of all terms and conditions for performance and furnishing of the Goods and Special Services.

### Article 7 - Liquidated Damages and other Damages

7.1 The BUYER and SELLER recognize that TIME IS OF THE ESSENCE of this

Agreement and that BUYER will suffer financial loss if the Goods are delivered at the Point of Destination and ready for receipt of delivery by BUYER within the times specified herein, plus any extensions thereof allowed in accordance with Article 7 of Section P-00700 Standard General Conditions for Procurement Contract. The parties also recognize that the timely performance of services by others involved in the Project is materially dependent upon SELLER's specific compliance with the requirements of Paragraph 3.3 above. Further, they recognize the delays, expense and difficulties involved in providing the actual loss suffered by the BUYER if complete acceptable Goods are not delivered on time. Accordingly, instead of requiring such proof, the parties agree that the SELLER shall pay BUYER liquidated damages in the amounts set forth in the Contract Agreement.

The liquidated damages sum is hereby agreed upon, not as a penalty but as liquidated damages, which the parties hereto have agreed to be proper and reasonable, and which the BUYER will suffer by reason of such default. The BUYER reserves the right to retain and/or release liquidated damages until the SELLER has corrected the delay in the schedule or has met subsequent milestones.

### Milestone 1:

The SELLER shall pay BUYER \$300 each calendar day for each Submittal Item marked as "Yes" in the Schedule of Submittals LD Column, attached hereto as Exhibit A-1, for the first seven days of late submission.

The SELLER shall pay BUYER \$600 each calendar day after seven days of late submission for each Submittal Item marked as "Yes" in the Schedule of Submittals LD Column, attached hereto as Exhibit A-1.

### Milestone 2:

The SELLER shall pay BUYER \$10,000 each calendar day that expires after the time specified herein for Milestone 2.

### Milestone 3:

The SELLER shall pay BUYER \$3,500 each calendar day that expires after the time specified herein for Milestone 3.

#### Completion:

The SELLER shall pay BUYER \$3,500 each calendar day that expires after the time specified herein for Completion.

### Article 8 - Contract Documents

- 8.1 The Contract Documents which comprise the Contract between BUYER and SELLER are attached hereto and made a part hereof and consist of the following:
  - A. Proposal accepted by Buyer

- B. Cost Proposal Forms
- C. This Agreement and Notice to Proceed.
- D. Executive Order 117 Certificate
- E. New Jersey Business Registration Certificate
- F. Consent of Surety, P-00302
- G. Proposer's Affidavit, P-00303
- H. Non-Collusion Affidavit, P-00304
- I. Statement of Ownership, P-00305
- J. Affirmative Action Affidavit, P-00306
- K. Acknowledgement of Receipt of Changes to RFP, P-00307
- L. Disclosure of Investments Activities in Iran, P-00405
- M. Performance Bond, Payment Bond and other required Bonds.
- N. Certificate of Insurance.
- O. Standard General Conditions for Procurement Contract, EJCDC Document P-00700, 2013 edition.
- P. Procurement Supplementary Conditions, P-00800.
- Q. Technical Specifications (as listed in Table of Contents).
- R. The following which may be delivered or issued on or after the Effective Date of the Agreement and are not attached hereto:
  - 1. Change Orders.
  - 2. Written Amendment(s).
  - 3. Field Order(s).
  - 4. ENGINEER's Written Interpretation(s).
  - 5. Exhibits to this Agreement (enumerated as follows):
    - a. Exhibit A-1 Schedule of Submittals and Liquidated Damages.

- b. Exhibit B-1 to Agreement between BUYER and SELLER dated \_\_\_\_\_, Assignment of Contract; Consent to Assignment; and Acceptance of Assignment.
- c. Exhibit B-2 to Agreement between BUYER and SELLER dated , Agreement to Assignment by SELLER's Surety.
- 6. Documentation submitted by SELLER prior to Notice of Award.
- 8.2 The documents listed in Paragraph 8.1 are attached to this Agreement (except as expressly noted otherwise above).
- 8.3 There are no Contract Documents other than those listed in this Article.
- 8.4 The Contract Documents may be amended, modified, or supplemented only as provided in Paragraph 3.04 of Section P-00700 Standard General Conditions for Procurement Contract.

### Article 9 – Point Of Destination

9.1 The place where the Goods are to be delivered is defined in Section P-00700 Standard General Conditions for Procurement Contract as the Point of Destination. It is the BUYER's intention that the Point of Destination is designated as follows:

Passaic Valley Sewerage Commission WWTP 600 Wilson Avenue Newark, New Jersey 07105

### Article 10 - Miscellaneous

- 10.1 Terms used in this Agreement will have the meanings indicated in Section P-00700 Standard General Conditions for Procurement Contract and Procurement Supplementary Conditions.
- 10.2 Assignment:
  - A. SELLER shall not assign Contract without the express written consent of BUYER where consent can be given or withheld at Buyer's sole discretion.
  - B. BUYER has the right to assign the Contract for furnishing Goods and Special Services hereunder and SELLER shall accept such assignment. Sample forms documenting the assignment of the Contract and consent of SELLER's surety to the assignment are attached as exhibits to this Agreement.
    - 1. The Contract will be executed in the name of BUYER initially, and will be assigned to an Installation Contractor designated by BUYER. The assignment

will occur on the effective date of the agreement between BUYER and the Installation Contractor, which is expected to occur on or about January 2020. As of the date of acceptance of assignment by the Installation Contractor, all references in the Contract Documents to BUYER shall mean the designated contractor whose responsibilities will include the incorporation of the Goods.

- 2. The assignment of the Contract shall relieve BUYER from all further obligations and liabilities under the Contract. After assignment, SELLER shall become a subcontractor to the assignee and, except as noted herein, all rights, duties, and obligations of BUYER under the Contract shall become the rights, duties and obligations of the assignee.
- 3. After assignment:
  - a. All performance warranties, and guarantees, including, but not limited to, all insurances, additional insured status, waivers of subrogation, bond coverages, indemnifications, limitation of liability, and remedies required by the Contract Documents will continue to run for the benefit of BUYER and, in addition, for the benefit of the assignee.
  - b. Except as provided in this Paragraph 11.02.A.3.b, all rights, duties and obligations of ENGINEER to assignee and SELLER under this Contract will cease.
    - ENGINEER will review SELLER's Applications for Payment and make recommendations to assignee for payments as provided in Paragraphs 10.02 and 10.06 of Section P-00700 Standard General Conditions for Procurement Contract.
    - 2) Upon the written request of either the assignee or SELLER, ENGINEER will issue with reasonable promptness such clarifications or interpretations of the Contract Documents, which shall be consistent with or reasonably inferable from the overall intent of the Contract Documents. Such written clarifications and interpretations will be final and binding on assignee and SELLER unless:
      - 1. an appeal from ENGINEER's clarification or interpretation is made within the time limits and in accordance with the dispute resolution procedures set forth in Article 13 of Section P-00700 Standard General Conditions for Procurement Contract; or
      - 2. if no such dispute resolution procedures have been set forth, a written notice of intention to appeal is delivered by assignee or SELLER to the other within 30 days after the date of such decision, and a formal proceeding is instituted by the appealing party in a forum of competent jurisdiction within 60 days after the date of such

decision (unless otherwise agreed to in writing by assignee and SELLER), to exercise such rights or remedies as the appealing party may have with respect to such clarification or interpretation in accordance with applicable Laws and Regulations. SELLER shall proceed with work to provide the Goods and Services in accordance with the Milestone and delivery times specified herein except where otherwise agreed by the BUYER or ENGINEER. BUYER shall continue to make payments in accordance with the provisions of the Contract.

- 3) When rendering a clarification or interpretation under Paragraph 11.02.A.3.b.2, ENGINEER will not show partiality to assignee or SELLER and will not be liable in connection with any clarification or interpretation rendered in good faith.
- c. No other assignment by a party hereto of any rights under or interests in the Contract Documents will be binding on another party hereto without the written consent of the party sought to be bound. Specifically but without limitation, moneys that may become due and moneys that are due may not be assigned without such consent (except to the extent that the effect of this restriction may be limited by law). Unless specifically stated to the contrary in any written consent to an assignment, no assignment will release or discharge the assignor from any duty or responsibility under the Contract Documents.
- 10.3 Successors and Assigns. BUYER and SELLER each binds itself, its partners, successors, assigns and legal representatives to the other party hereto, its partners, successors, assigns and legal representatives in respect to all covenants, agreements and obligations contained in the Contract Documents.
- 10.4 Severability. Any provision or part of the Contract Documents held to be void or unenforceable under any Law or Regulation shall be deemed stricken, and all remaining provisions shall continue to be valid and binding upon BUYER and SELLER, who agree that the Contract Documents shall be reformed to replace such stricken provision or part thereof with a valid and enforceable provision that comes as close as possible to expressing the intention of the stricken provision.
- 10.5 Business Address. The business address of SELLER given herein is hereby designated as the place to which all notices, letters, and other communication to SELLER will be mailed or delivered. The address of BUYER appearing herein is hereby designated as the place to which all notices, letters, and other communication to BUYER shall be mailed or delivered. Either party may change its address at any time by an instrument in writing delivered to ENGINEER and the other party.

The address of the assignee as indicated in Exhibit B-1 is hereby designated as the place to which all notices, letters, and other communication to assignee shall be mailed or

delivered.

- 10.6 This Agreement shall be construed in accordance with the laws of the State of New Jersey.
- 10.7 SELLER agrees that:
  - A. It hereby voluntarily and irrevocably submits itself to the jurisdiction and venue of any court of competent jurisdiction over the subject matter of this Agreement located within the State of New Jersey in which any litigation is brought based on or arising out of this Agreement.
  - B. Any legal process or notice connected with any litigation may be served on SELLER by United States registered mail, postage prepaid, addressed to SELLER at its address stated in this Agreement for the furnishing of notices to SELLER or at SELLER's last known address, and that service in such manner shall constitute good and valid service of process upon SELLER.
  - C. SELLER hereby waives any defense which might be available to it in any such litigation based on or alleging lack of jurisdiction or venue, or, if process is served in the manner provided in subparagraph "B" immediately above, invalid service of process, and that it will duly enter its appearance in any such action.
  - D. This Agreement may be presented in court as conclusive evidence of the foregoing agreement.

(See following page)

**IN WITNESS WHEREOF:** The parties hereto have executed this agreement the day and year first above mentioned.

#### PASSAIC VALLEY SEWERAGE COMMISSION

(SEAL)

BY:\_\_\_\_\_

ATTEST BY: \_\_\_\_\_\_ PASSAIC VALLEY SEWERAGE COMMISSION

### SELLER NAME

(SEAL)

Note: If SELLER is a corporation, an affidavit giving the principal the right to sign the Agreement must accompany the executed Agreement.

### NAME OF CORPORATION:

BY:\_\_\_\_\_

(CORPORATE SEAL)

ATTEST BY:\_\_\_\_\_

#### (ADD TYPED OR PRINTED NAMES OF OFFICER AND ATTESTING WITNESS)

Date:\_\_\_\_\_

### Schedule of Submittals and Applicable Liquidated Damages

Item	Reference		Calendar			LDs
No.	Document	Submittals Item	D	Days	Event	Apply?
1	05135	Steel Stack Designed by Seller		2		11 0
1.1	05135	Copies of Certified Test and Inspection	14	After	Test/Inspection	No
		Reports				
1.2	05135	Arrangement drawings	30	After	Effective Date of the Agreement	No
1.3	05135	Drawings indicating the size and location of	30	After	Effective Date of the	No
		all ground pads			Agreement	
1.4	05135	Foundation design requirements	40	After	Effective Date of the	Yes
					Agreement	
1.5	05135	Fabrication and erection detail drawings	30	After	Effective Date of the	Yes
1.6	05125		20	10	Agreement	N
1.6	05135	Stack, liner, insulation, and lagging materials	30	After	Effective Date of the	NO
17	05135	Shop and/or field coatings data	30	After	Effective Date of the	No
1.7	03135	Shop and/or field coatings data	30	Allel	Agreement	INO
2	11506	Selective Catalytic Reduction System			rgreement	
-	11000	Sereetive entry the reduction System				
2.1	11506	Arrangement drawings	30	After	Effective Date of the	Yes
					Agreement	
2.2	11506	List of catalyst poisons and operating	30	After	Effective Date of the	No
		conditions that may reduce catalyst life,			Agreement	
		performance, or structural integrity. The list				
		of poisons shall include the maximum				
		quantities of poisons allowed (either				
		individually or combination).				
2.3	11506	Provide certified load tables, anchor bolt	40	After	Effective Date of the	Yes
		sizes and locations, and other information as			Agreement	
		needed to complete foundation design				
2.4	11506	Piping and instrument diagrams	60	After	Effective Date of the	Yes
					Agreement	
2.5	11506	Detail drawings required to indicate	45	After	Effective Date of the	No
		miscellaneous piping and wiring connections			Agreement	
2.6	11506	Drawings and data on accessory equipment	45	After	Effective Date of the	No
		including valves, fittings, and other			Agreement	
		components			-	

# Schedule of Submittals and Applicable Liquidated Damages

Item	Reference		Calendar			LDs
No.	Document	Submittals Item	Davs		Event	Apply?
2.7	11506	Control system functional loop and logic	60	After	Effective Date of the	No
		diagrams			Agreement	
2.8	11506	Control system instrumentation and I/Olists	30	After	Effective Date of the	No
					Agreement	
2.9	11506	Instrument data sheets (ISA type or equal)	60	After	Effective Date of the	No
		and installation details for control system			Agreement	
2.10	11506	Pipe layout drawings	30	After	Effective Date of the	Yes
					Agreement	
2.11	11506	Drawings indicating the size and location of	30	After	Effective Date of the	No
		all ground pads			Agreement	
2.12	11506	Recommended location for all pipe supports,	30	After	Effective Date of the	No
		recommended type of pipe supports at each			Agreement	
		location, and loads on each pipe support				
3	11508	<u>Ammonia System</u>				
2.1	11500	A manual transferra	20	A C	Effective Data a fille	V
3.1	11508	Arrangement drawings	30	After	Effective Date of the	Yes
2.2	11509	Dravida cartified lead tables, anabar halt	40	After	Agreement	Var
3.2	11508	provide certified load tables, anchor bolt	40	Atter	Effective Date of the	res
		sizes and locations, and other information as			Agreement	
2.2	11509	Diving and instrument diagrams	60	After	Effective Date of the	Vac
5.5	11508	Piping and instrument diagrams	00	Alter	Agreement	res
3.4	11508	Detailed drawings indicating pipe connection	60	After	Effective Date of the	No
5.4	11500	points	00	11101	Agreement	110
3.5	11508	Drawings indicating the size and location of	30	After	Effective Date of the	No
		all ground pads			Agreement	
3.6	11508	Electrical wiring schematics	60	After	Effective Date of the	Yes
					Agreement	
3.7	11508	Drawings and data on accessory equipment	60	After	Effective Date of the	No
		including valves, fittings, and other			Agreement	
		components			-	
3.8	11508	Control system functional loop and logic	60	After	Effective Date of the	No
		diagrams			Agreement	
3.9	11508	Control system instrumentation lists	60	After	Effective Date of the	No
		including Buyer tag numbers, description,			Agreement	
		manufacturer, model number, range, units,			-	
		signal type, set-point, and drawing				
		references.				

# Schedule of Submittals and Applicable Liquidated Damages

			Submittal Dates			
Item	Reference		Calendar			LDs
No.	Document	Submittals Item	D	<b>Days</b>	Event	Apply?
3.10	11508	Instrument data sheets (ISA type or equal)	60	After	Effective Date of the	No
		and installation details for control system			Agreement	
3.11	11508	Pipe / duct layout drawings	30	After	Effective Date of the	Yes
					Agreement	
3.12	11508	Pipe support drawings and loads	30	After	Effective Date of the	No
					Agreement	
3.13	11508	Recommended plant control system graphic	60	After	Effective Date of the	Yes
2.14	11509	displays	14	A ft an	Agreement	N
3.14	11508	system operation and maintenance	14	Atter	Supment of Equipment	INO
3.15	11508	DCS logic diagrams for programming	60	After	Effective Date of the	No
5.15	11000	Des logie diagrams for programming		111101	Agreement	110
4	15220	Reciprocating Fuel Gas Compressor				
4.1	15220	Compressor performance curve showing	30	After	Effective Date of the	No
		capacity, power, discharge pressure, and			Agreement	
		efficiency				
4.2	15220	Compressor speed vs. torque curves	30	After	Effective Date of the	No
					Agreement	
4.3	15220	Motor current, power factor and speedvs.	30	After	Effective Date of the	No
4.4	15220	torque curves	20	After	Agreement	Var
4.4	13220	dimensions of the equipment and	50	Aller	Agreement	res
		components including dismantling			Agreement	
		dimensions, size, and location of all piping				
		connections, drains, ground pads, electrical				
		junction boxes, and conduit connections				
4.5	15220	Assembly/cross-section drawings of all	30	After	Effective Date of the	No
		component equipment showing materials of			Agreement	
		construction				
4.6	15220	Hazardous area classification drawings	30	After	Effective Date of the	No
		indicating location of leak sources, extent of			Agreement	
		area classification, and Code basis for area				
		classification.				
4.7	15220	Provide certified load tables, anchor bolt	40	After	Effective Date of the	Yes
		sizes and locations, and other information as			Agreement	
		needed to complete foundation design				

# Schedule of Submittals and Applicable Liquidated Damages

			Submittal Dates			
Item	Reference		Cal	Calendar		LDs
No.	Document	Submittals Item	D	ays	Event	Apply?
4.8	15220	Control panel outline and layout drawings	60	After	Effective Date of the	No
					Agreement	
4.9	15220	Electrical cabinet outline and layout	60	After	Effective Date of the	No
		drawings			Agreement	
4.10	15220	Drawings and data on all accessory	60	After	Effective Date of the	No
		equipment, including valves			Agreement	
4.11	15220	Flow diagrams for cooling systems, lube	30	After	Effective Date of the	Yes
		system, and gas path			Agreement	
4.12	15220	Electrical schematic, wiring, and tubing	60	After	Effective Date of the	No
		diagrams			Agreement	
4.13	15220	Elementary diagrams, logic diagrams, or	90	After	Effective Date of the	No
		programming information			Agreement	
4.14	15220	Instrument data sheets (ISA)	90	After	Effective Date of the	No
					Agreement	
4.15	15220	Detailed erection sequence and procedure	120	Before	Shipment	No
	155(2	Combustion Tarkins				
5	15502	<u>Compustion 1 urbine</u>				
51	15562	Certified design data and performance curves	40	After	Effective Date of the	Yes
5.1	10002	eranes design data and performance eta ves		11101	Agreement	105
5.2	15562	Calculation showing that the combustion	30	After	Effective Date of the	Yes
		turbine generators can start the wastewater			Agreement	
		treatment plant motors as required			č	
5.3	15562	Certified performance correction curves	40	After	Effective Date of the	No
		-			Agreement	
5.4	15562	Arrangement Drawings required for plant	30	After	Effective Date of the	Yes
		layout indicating physical arrangement and			Agreement	
		dimensions of equipment furnished				
5.5	15562	Hazardous area classification drawings	45	After	Effective Date of the	No
0.0	10002	indicating location of leak sources, extent of			Agreement	110
		area classification, and Code basis for area				
		classification.				
5.6	15562	Arrangement Drawings for all auxiliary	45	After	Effective Date of the	Yes
		equipment indicating physical arrangement			Agreement	
		and dimensions of equipment furnished				

# Schedule of Submittals and Applicable Liquidated Damages

Item	Reference		Cal	endar		LDs
No.	Document	Submittals Item	D	Days	Event	Apply?
5.7	15562	Foundation interface Drawings for all furnished equipment indicating loads, dimensions, anchor bolt locations, embedded conduit, and other necessary details	45	After	Effective Date of the Agreement	Yes
5.8	15562	Duct outline Drawings including movements and clearances for insulation, lagging, stiffeners, and expansion joints	60	After	Effective Date of the Agreement	No
5.9	15562	CT exhaust expansion joint outline drawing and bill of materials	60	After	Effective Date of the Agreement	No
5.10	15562	Detail Drawings indicating all Buyer'spiping and wiring connections including locations, sizes, types, materials, cable type, etc.	60	After	Effective Date of the Agreement	No
5.11	15562	Piping and Instrument Diagrams	60	After	Effective Date of the Agreement	Yes
5.12	15562	Control panel and operator Work station outline and layout Drawings	90	After	Effective Date of the Agreement	No
5.13	15562	Drawings and data on accessory equipment including valves, fittings, and other components	90	After	Effective Date of the Agreement	No
5.14	15562	All turbine and governor data required to complete a mathematical model study of system stability	30	After	Effective Date of the Agreement	No
5.15	15562	A block diagram with significant transfer functions representing the turbine and governor satisfactory for computer studies	30	After	Effective Date of the Agreement	No
5.16	15562	Drawings indicating the size and location of all turbine ground pads	45	After	Effective Date of the Agreement	No
5.17	15562	Control system functional loop and logic diagrams	90	After	Effective Date of the Agreement	No
5.18	15562	Control operator HMI graphic display pages with descriptions of operator control actions linked to the graphics	120	After	Effective Date of the Agreement	No
5.19	15562	Control system and instrumentation input/output tabulations with descriptions and interface functions	90	After	Effective Date of the Agreement	No

# Schedule of Submittals and Applicable Liquidated Damages

Item	Reference		Calendar			LDs
No.	Document	Submittals Item	D	ays	Event	Apply?
5.20	15562	Instrument data sheets (ISA type or equal) and installation details for all control system input and output devices such as transmitters and control drives	120	After	Effective Date of the Agreement	No
5.21	15562	Recommended detailed erection sequence and procedure	120	Before	Shipment	No
5.22	15562	Two draft copies of CommissioningManual	90	Before	Start of commissioning	No
5.23	15562	Four final copies of CommissioningManual	30	Before	Start of commissioning	No
5.24	15562	As-built Drawings	60	Before	Completion of commissioning	No
6	15910	Gas Fired Blackstart Engine Generator				
6.1	15910	Manufacturer, model and type: Engine, Alternator, Battery Charger and Battery, Remote Radiator, Emission Control/Silencer, Generator Synchronizing Switchgear, Neutrol Ground Resistor, SpeedIncreaser	30	After	Effective Date of the Agreement	No
6.2	15910	Ratings at Specified Conditions Engine(net HP), Engine (max performance HP bare engine), Generator kW at specified power factor, Volts and Amperes.	30	After	Effective Date of the Agreement	No
6.3	15910	Engine output horsepower and efficiency curves at rated capacity	30	After	Effective Date of the Agreement	No
6.4	15910	Mechanical and structural outline and assembly drawings, including weights	30	After	Effective Date of the Agreement	Yes
6.5	15910	Provide certified load tables, anchor bolt sizes and locations, and other information as needed to complete foundation design	40	After	Effective Date of the Agreement	Yes
6.6	15910	Fuel gas suppply requirements including pressure and flow	30	After	Effective Date of the Agreement	Yes
6.7	15910	Fuel gas systemMAWP	30	After	Effective Date of the Agreement	No

# Schedule of Submittals and Applicable Liquidated Damages

Item	Reference		Cal	Calendar		LDs
No.	Document	Submittals Item	D	Days	Event	Apply?
6.8	15910	Hazardous area classification drawings	30	After	Effective Date of the	No
		indicating location of leak sources, extent of			Agreement	
		area classification, and Code basis for area				
		classification.				
6.9	15910	Automatic Lube Oil Make-Up System	30	After	Effective Date of the Agreement	No
6.10	15910	Mechanical piping and instrument diagrams	30	After	Effective Date of the Agreement	Yes
6.11	15910	Remote Radiater dimension, weight and	30	After	Effective Date of the	Yes
		dimensional drawing including location and size of pipe connections			Agreement	
6.12	15910	Remote Radiater Performance Data: heat	30	After	Effective Date of the	No
-		rejection rate, sound pressure level, fluid			Agreement	
		pressure dop, ambient capability, air flow per			C	
		fan, motor nameplate data				
6.13	15910	Mechanical piping certified drawings	60	After	Effective Date of the	Yes
		indicating all oil, water, fuel, etc., piping			Agreement	
		connections to Buyer's piping				
6.14	15910	Exhaust gas emission data (max values at	45	After	Effective Date of the	No
		1/2, $3/4$ and full loads)			Agreement	
6.15	15910	Electrical one-line diagrams including the	30	After	Effective Date of the	Yes
		engine control panel, switchgear and engine			Agreement	
		generator master control panel				
6.16	15010	Detailed schemetic drawings of all cleatrical	120	After	Effective Data of the	No
0.10	13910	and control wiring	120	Allel	Agreement	INO
6.17	15910	Instrument and service air requirements	30	After	Effective Date of the	No
		1			Agreement	
6.18	15910	Erection details	90	After	Effective Date of the	No
					Agreement	
6.19	15910	Atmospheric temperature power correction	30	After	Effective Date of the	No
( 20	1/010	curves	20		Agreement	
6.20	15910	Atmospheric temperature heat rate correction	30	Atter	Effective Date of the	No
6.21	15010	curves	20	Aftan	Agreement	Na
0.21	13910	ratings and winding pitch	30	Alter		1NO
l		ratings and winding pitch			Agreement	

# Schedule of Submittals and Applicable Liquidated Damages

Item	Reference		Cal	endar		LDs
No.	Document	Submittals Item	Davs		Event	Apply?
6.22	15910	Voltage magnitude and frequency curves	30	After	Effective Date of the	No
-		during the starting sequence of adding the			Agreement	
		specified load blocks			6	
6.23	15910	Maximum output short circutie kvA	30	After	Effective Date of the	No
		available.			Agreement	
6.24	15910	Complete description of generator excitation	30	After	Effective Date of the	No
		system.			Agreement	
6.25	15910	Generator loss curves	30	After	Effective Date of the	No
					Agreement	
6.26	15910	Voltage dip and speed deviation curves	30	After	Effective Date of the	No
		versus time			Agreement	
6.27	15910	Reactive capability versus kilowatt load	30	After	Effective Date of the	No
		curves			Agreement	
6.28	15910	Thermal damage curve illustrating volts/hertz	30	After	Effective Date of the	No
		versus time for the generator			Agreement	
6.29	15910	Generator voltage decay curve with loss of	30	After	Effective Date of the	No
		exciter			Agreement	
6.30	15910	Generator "V" curves	30	After	Effective Date of the	No
					Agreement	
6.31	15910	Zero power factor rated current saturation	30	After	Effective Date of the	No
		curve			Agreement	
6.32	15910	No-load saturation curve	30	After	Effective Date of the	No
6.00	1.5010	~	•		Agreement	
6.33	15910	Synchronous impedance curve	30	After	Effective Date of the	No
6.2.1	1.5010		2.0		Agreement	
6.34	15910	Current transformer ratio correction factor	30	After	Effective Date of the	No
6.25	15010	and excitation curves	20	1.0	Agreement	N
6.35	15910	Generator design parameters	30	After	Effective Date of the	No
( )(	15010		20	1.0	Agreement	N
6.36	15910	Direct axis subtransient reactance, Xd", in	30	After	Effective Date of the	No
( 27	15010	percent (machine base)	20	1.0	Agreement	NT
6.37	15910	Direct axis transient reactance, Xd', in	30	Aner	Effective Date of the	No
( 29	15010	percent (machine base)	20	A G	Agreement	N
0.38	13910	Armature A/K rano	30	Anter	Effective Date of the	INO
6.20	15010	Zara saguanas resistanas. Va inneresent	20	After	Agreement	No
0.39	13910	(machine base)	30	Aller	A gracmont	INO
		(machine base)			Agreement	

# Schedule of Submittals and Applicable Liquidated Damages

			Submittal Dates			
Item	Reference		Calendar			LDs
No.	Document	Submittals Item	D	<b>Days</b>	Event	Apply?
6.40	15910	Negative sequence reactance, X2, inpercent (machine base)	30	After	Effective Date of the Agreement	No
6.41	15910	Equipment storage requirements, including inside or outside requirements, requirements for controlled temperature or humidity, etc.	60	After	Effective Date of the Agreement	No
6.42	15910	Provide recommendation for mounting the engine-generator for the specified seismic parameters.	30	After	Effective Date of the Agreement	No
6.43	15910	Confirmation that the exhaust through the exhaust silencer does not exceed 1/2 of the maximum pressure loss at the specified power outage capacity of the unit and that the exhaust silencer provides sound attenuation equal to or greater at the specified frequencies.	30	After	Effective Date of the Agreement	No
7	16031	Cylindrical Rotor Generators				
7.1	16031	Generator power factor correction curves for ASME PTC 6.1 acceptance test	30	After	Effective Date of the Agreement	No
7.2	16031	Electrical one-line diagrams indicating electrical scope	60	After	Effective Date	No
7.3	16031	Electrical elementaries, schematic, wiring, block and tubing diagrams, cable block diagrams, raceway layout, and cable entry into equipment	120	After	Effective Date	No
7.4	16031	Arrangement Drawings required for plant layout indicating physical arrangement and dimensions of equipment furnished	30	After	Effective Date of the Agreement	Yes
7.5	16031	Detailed data describing capability of the unit to operate above and below rated speed, including minimum and maximum allowable speed versus cumulative time duration of off- normal speed operation	30	After	Effective Date of the Agreement	No

# Schedule of Submittals and Applicable Liquidated Damages

Item	Reference		Cal	endar		LDs
No.	Document	Submittals Item	Γ	Days	Event	Apply?
7.6	16031	Detailed information on the capability of the generator to respond to a system upset situation, where a large portion of the system load is applied to the unit and load shedding is required	30	After	Effective Date of the Agreement	Yes
7.7	16031	All generator, exciter, power system stabilizer and regulator data required to complete a mathematical model study of system stability.	30	After	Effective Date of the Agreement	Yes
7.8	16031	Provide a block diagram and parameter values for the significant transfer functions (representing the generator, excitation, power system stabilizer and governor) satisfactory for transient and dynamic computer studies	30	After	Effective Date of the Agreement	Yes
7.9	16031	Reactive power capability versus real power capability curve	30	After	Effective Date of the Agreement	No
7.10	16031	Generator performance data including reactance, resistance, time constants, inertia, damping, saturation factors and saturation curves.	30	After	Effective Date of the Agreement	No
7.11	16031	Electrical Load List - (Provides start-up, standby, and operating electrical loads)	30	After	Effective Date of the Agreement	No
7.12	16031	Generator/Medium Voltage Single-Line Diagram - (Shows overall power system configuration, scope of supply, metering and relaying. This is an initial issue and must be reviewed by the Buyer. The drawing shall be revised per Buyer comments.)	30	After	Effective Date of the Agreement	No
7.13	16031	Three-Line diagram - (Shows the generator and medium voltage three-line diagram for the Seller's scope of supply)	30	After	Effective Date of the Agreement	No
7.14	16031	Critical speeds of generator	30	After	Effective Date of the Agreement	No

# Schedule of Submittals and Applicable Liquidated Damages

Item	Reference		Cal	endar		LDs
No.	Document	Submittals Item	D	Days Event		Apply?
7.15	16031	Generator loss curve and excitation power	30	After	Effective Date of the	No
		requirement curve including total electrical			Agreement	
		losses for generation capability for rated and			C	
		unity power factors. Curve shall include the				
		total mechanical or fixed losses.				
7.16	16031	Generator "Vee" curves	30	After	Effective Date of the	No
					Agreement	
7.17	16031	Zero and rated power factor current	30	After	Effective Date of the	No
		saturation curves			Agreement	
7.18	16031	No load saturation curves	30	After	Effective Date of the	No
					Agreement	
7.19	16031	Generator allowable negative sequence	30	After	Effective Date of the	No
		versus time curve			Agreement	
7.20	16031	Generator current decrement curves for 3-	30	After	Effective Date of the	No
		phase, line-to-line, and line-to-neutral short-			Agreement	
7.21	16031	Generator current transformer secondary	30	After	Effective Date of the	No
		excitation characteristic curve			Agreement	
7.22	16031	Generator current transformer ratio	30	After	Effective Date of the	No
		correction factor curve			Agreement	
7.23	16031	Generator current transformer thermalrating	30	After	Effective Date of the	No
					Agreement	
7.24	16031	Generator current transformer mechanical	30	After	Effective Date of the	No
		rating			Agreement	
7.25	16031	Generator current transformer ANSI	30	After	Effective Date of the	No
		metering and relaying accuracy class			Agreement	
7.26	16031	Generator current transformer secondary	30	After	Effective Date of the	No
		resistance at 77.0° F			Agreement	
7.27	16031	Generator current transformer phase angle	30	After	Effective Date of the	No
		correction factor curves			Agreement	
7.28	16031	Generator current transformer correction	30	After	Effective Date of the	No
		factor curves			Agreement	
7.29	16031	Complete listing of all accessory equipment	90	After	Effective Date of the	No
		with instrument ranges and recommended			Agreement	
		contact set points				
7.30	16031	List of all control devices and/or process set	90	After	Effective Date of the	No
		points, ranges, and flow quantities			Agreement	
7.31	16031	Listing of accessory equipment to be shipped	120	After	Effective Date of the	No
		loose to jobsite			Agreement	

# Schedule of Submittals and Applicable Liquidated Damages

Item	Reference		Cal	endar		LDs
No.	Document	Submittals Item	D	Days	Event	Apply?
7.32	16031	Drawings of all separately mounted	60	After	Effective Date of the	No
		equipment indicating information required			Agreement	
		for setting, piping, and wiring the items				
7.33	16031	Drawings indicating location of all generator	90	After	Effective Date of the	No
		junction boxes and electrical accessories			Agreement	
		requiring embedded conduit in the turbine				
		generator pedestal, including recommended				
		junction how or piece of equipment				
7.34	16031	Drawings indicating the size and location of	90	After	Effective Date of the	No
,	10001	all generator ground pads		111111	Agreement	1.0
7.35	16031	Drawings indicating electrical connection	90	After	Effective Date of the	No
		details to the generator terminals, generator			Agreement	
		neutral enclosure, and generator current				
		transformers				
7.36	16031	Detailed schematic drawings of all electrical	90	After	Effective Date of the	No
	1 (021	control wiring	0.0		Agreement	N
1.37	16031	All certified drawings required to indicate	90	After	Effective Date of the	No
		miscellaneous piping and wring connections			Agreement	
		not indicated on previous drawings. This				
		shall include piping diagrams as required to				
		indicate manufacturer's requirements for the				
		Buyer's piping systems.				
7.38	16031	Arrangement drawings of all piping and	90	After	Effective Date of the	No
1.00	10001	accessories furnished, as required for the	20		Agreement	110
		Engineer's check of the layout of these items			U	
7.39	16031	Drawings as required to indicate the details	180	After	Effective Date of the	No
		of construction and internal wiring of all			Agreement	
		equipment and equipment components				
		furnished. Detail drawings of standard				
		gauges, instruments, valves, and similar				
		miscellaneous items.				

# Schedule of Submittals and Applicable Liquidated Damages

Item	Reference		Cal	endar		LDs
No.	Document	Submittals Item	D	ays	Event	Apply?
7.40	16031	Generator terminal enclosure outline and loading data	90	After	Effective Date of the Agreement	No
7.41	16031	Foundation interface Drawings for all furnished equipment indicating loads, dimensions, anchor bolt locations, embedded conduit, and other necessary details	45	After	Effective Date of the Agreement	Yes
7.42	16031	Equipment storage requirements, including inside or outside requirements, requirements for controlled temperature or humidity, etc.	45	After	Effective Date of the Agreement	Yes
7.43	16031	Complete list of necessary special tools. The listing shall provide a complete description and quantity of each item, including a discussion or designation of particular items required for erection and/or maintenance.	45	After	Effective Date of the Agreement	Yes
8	16051	Electrical Design and Equipment				
8.1	16051	Arrangement and fabrication/erection drawings	90	After	Effective Date of the Agreement	No
8.2	16051	MCC & 125VDC Single-Line Diagram and bill of materials - (Describes the electrical system supporting the operation of the combustion turbine equipment with all low voltage MCC and 125VDC auziliary loads)	30	After	Effective Date of the Agreement	No
8.3	16051	Time overcurrent curves for each overload, molded case circuit breaker, and solid-state protective device used	30	After	Effective Date of the Agreement	No
8.4	16051	I/O database and I/O wiring diagrams		Upon	Shipment	No
9	17053	Subsystem - Programmable LogicControl System - GasCompressors		-		
9.1	17053	Outline drawings including overall height, length, width, center of gravity location, and weight.	30	After	Effective Date of the Agreement	Yes

# Schedule of Submittals and Applicable Liquidated Damages

Item	Reference		Cal	endar		LDs
No.	Document	Submittals Item	D	ays	Event	Apply?
9.2	17053	PLC System equipment layout	30	After	Effective Date of the	No
					Agreement	
9.3	17053	Complete Bill of Materials for PLC System	30	After	Effective Date of the	No
					Agreement	
9.4	17053	PLC System internal wiring	45	After	Effective Date of the	No
					Agreement	
9.5	17053	PLC System external connection diagrams	45	After	Effective Date of the	Yes
					Agreement	
9.6	17053	Preliminary PLC to DCS I/O data interface	60	After	Effective Date of the	No
0.7	15050	list	60		Agreement	27
9.7	17053	Preliminary recommended DCS graphic	60	After	Effective Date of the	No
0.0	17052	displays	00		Agreement	N
9.8	17053	PLC external hardwired I/O list	90	After	Effective Date of the	No
0.0	17050		100		Agreement	N
9.9	17053	Final PLC to DCS I/O data interface list	180	After	Effective Date of the	No
0.10	17052	First mean ded DCS and his displayer	100	A G	Agreement	N
9.10	17053	Final recommended DCS graphic displays	180	Aner	Effective Date of the	NO
0.11	17052	Complete set of handsony printent of all	190	After	Agreement	No
9.11	17055	complete set of hardcopy printout of an	180	Atter	Effective Date of the	INO
0.12	17052	I local control		Linen	Agreement	No
9.12	17055	program		Opon	Shiphien	INO
10	17053	Subsystem - Programmable Logic Control				
	1,000	System - Blackstart Generators				
10.1	17053	Outline drawings including overall height.	30	After	Effective Date of the	Yes
		length, width, center of gravity location, and			Agreement	
		weight.			c	
10.2	17053	PLC System equipment layout	30	After	Effective Date of the	No
					Agreement	
10.3	17053	Complete Bill of Materials for PLC System	30	After	Effective Date of the	No
					Agreement	
10.4	17053	PLC System internal wiring	45	After	Effective Date of the	No
					Agreement	
10.5	17053	PLC System external connection diagrams	45	After	Effective Date of the	Yes
					Agreement	
10.6	17053	Preliminary PLC to DCS I/O data interface	60	After	Effective Date of the	No
		list			Agreement	
10.7	17053	Preliminary recommended DCS graphic	60	After	Effective Date of the	No
		displays			Agreement	

# Schedule of Submittals and Applicable Liquidated Damages

Item	Reference		Cal	endar		LDs
No.	Document	Submittals Item	D	Days	Event	Apply?
10.8	17053	PLC external hardwired I/O list	90	After	Effective Date of the	No
					Agreement	
10.9	17053	Final PLC to DCS I/O data interface list	180	After	Effective Date of the	No
					Agreement	
10.10	17053	Final recommended DCS graphic displays	180	After	Effective Date of the	No
					Agreement	
10.11	17053	Complete set of hardcopy printout of all	180	After	Effective Date of the	No
		graphic displays for local control			Agreement	
10.12	17053	Hard copy printouts of final PLC application		Upon	Shipment	No
		program				
11	17101	Distributed ControlSystem				
11.1	17101	Partitioned DCS I/O List, With Termination	80	After	Effective Date of the	Yes
		Information			Agreement	
11.2	17101	Detailed Job Specific System Hardware	80	After	Effective Date of the	Yes
		Layout Drawings			Agreement	
11.3	17101	Detailed Job Specific Equipment Dimension	80	80 After	Effective Date of the	Yes
11.4	17101	Drawings			Agreement	37
11.4	17101	Detailed Job Specific Power and Grounding	90	After	Effective Date of the	Yes
11.5	17101	Wiring Diagrams			Agreement	Var
11.5	1/101	Detailed Job Specific Communications	90	After	Effective Date of the	res
11.6	17101	Drawings Snowing an Ports and Connections			Agreement	No
11.0	1/101	Interconnection Drawings	90	After	Agroomont	INO
11.7	17101	Control Logic Configuration Software Users			Effective Date of the	No
11.7	1/101	Manual	90	After		NO
11.8	17101	Graphic Displays Configuration Software			Effective Date of the	No
11.0	1/101	Users Manual	90	After	Agreement	110
11.9	17101	Console Arrangement Drawings, Billof			Effective Date of the	No
		Material and Assembly Instructions	120	After	Agreement	
11 10	17101	Trip Dushbutton Danel Arrangement			Effective Date of the	No
11.10	1/101	Drawings Bill of Material and Wiring	120	After		NO
11 11	17101	Cabinet Internal Arrangement Diagrams with			Effective Date of the	No
	1/101	Terminal Block Layouts	150	After	Agreement	110
11.12	17101	Hardware Factory Acceptance Test			rigiteintein	No
		Procedure	60	60 Before	Test	
11.13	17101	Hardware Factory Acceptance Test	100		Effective Date of the	No
			180	After	Agreement	

# Schedule of Submittals and Applicable Liquidated Damages

				Submittal Dates				
Item	Reference		Cal	endar		LDs		
No.	Document	Submittals Item	D	)ays	Event	Apply?		
11.14	17101	Graphic Displays ColorPrintout	210	After	Effective Date of the Agreement	Yes		
11.15	17101	Modulating/Discrete Control Configuration Dwgs	210	After	Effective Date of the Agreement	Yes		
11.16	17101	Software Factory Acceptance Test Procedure	60	Before	Test	No		
11.17	17101	Notification of inspection/test (forB&V hold/witness points)	60	Before	Test/Inspection	No		
11.18	17101	Submit Comprehensive I/O and AlarmLists	240	After	Effective Date of the Agreement	No		
11.19	17101	Software Factory Acceptance Test	270	After	Effective Date of the Agreement	No		
11.20	17101	Copies of Certified Test and Inspection Reports	14	After	Test or Inspection	No		
11.21	17101	As-Shipped Drawings and Documentation	15	After	Equipment Shipment	No		
11.22	17101	Final As-Built Drawings and Documentation	60	After	Final Acceptance	No		
12	E640	Low Voltage Induction Motors						
12.1	E640	Motor dimensional drawings	60	After	Effective Date of the Agreement	No		
12.1	E640	Motor nameplate data	60	After	Effective Date of the Agreement	No		
13	K100	Instrumentation General Requirements						
13.1	K100	Instrument Location PlanDrawings	90	After	Effective Date of the Agreement	No		
13.2	K100	Instrument factory calibration sheets		Upon	Shipment of Instruments	No		
13.3	K100	ISA-format datasheets for all Instruments	120	After	Effective Date of the Agreement	No		

# Schedule of Submittals and Applicable Liquidated Damages

Item	Reference		Cal	Calendar		LDs
No.	Document	Submittals Item	D	)ays	Event	Apply?
14	K105	<u>Flow Elements</u>				
14.1	K105	Flow element calculation data sheets showing beta ratio, dP, flow	120	After	Effective Date of the Agreement	No
15	K120	Instrument Valves and Instrument Primary Piping-Tubing				
15.1	K120	Instrument Installation Details	90	After	Effective Date of the Agreement	No
16	Q302	Buyer Specified Shop Coating				
16.1	Q302	Manufacturer's product datasheets	30	After	Release to Proceed	No
16.2	Q302	Manufacturer's color cards	30	After	Release to Proceed	No
16.3	Q302	Manufacturer's surface preparation and coating application procedures. Include manufacturer's construction standards and recommended practices for surface contamination testing, crack and joint treatment, edge treatment, coating penetration and termination.	30	After	Release to Proceed	No
17	Q400	General Equipment Requirements				
17.1	Q400	Shipment Plan providing details of field assembly work required as described in the Seller's Proposal.	30	After	Effective Date of the Agreement	No
18	Q500	Shop Drawings and Instruction Manuals				
18.1	Q500	For instruction manual submittal requirements, refer to Technical Supplemental Q501 and the commercial		Upon	30 Days Before Shipment of Equipment	No
19	Q502	Electrical Data				
19.1	Q502	Completed motor information sheets	60	After	Effective Date of the Agreement	Yes
19.2	Q502	Completed electric actuator information sheet	60	After	Effective Date of the Agreement	No

# Schedule of Submittals and Applicable Liquidated Damages

				Sub		
Item	Reference		Cal	endar		LDs
No.	Document	Submittals Item	D	ays	Event	Apply?
20	Q520	OEM 3D Equipment Model				
20.1	Q520	3D Model of all equipment within Seller's	40	After	Effective Date of the	No
		scope. Multiple models are acceptable.			Agreement	
21	V100	Noise Abatement				
21.1	V100	Predicted equipment noise levels	30	After	Effective Date of the	
					Agreement	No

**EXHIBIT B-1** to Agreement Between Buyer and Seller

Dated

# ASSIGNMENT OF CONTRACT, CONSENT TO ASSIGNMENT, AND ACCEPTANCE OF ASSIGNMENT

This assignment will be effective on the Effective Date of the Agreement between Buyer and Installation Contractor.

The Contract between Passaic Valley Sewerage Commission ("Buyer") and \_\_\_\_\_

\_\_\_\_\_("Seller") for furnishing Goods and Special Services under the Contract Documents entitled Passaic Valley Sewerage Commission Power Generation System Procurement is hereby assigned, transferred, and set over to

\_\_\_\_\_("Installation Contractor"). Installation Contractor shall be totally responsible for the performance of Seller and for the duties, rights and obligations of Buyer, not otherwise retained by Buyer, under the terms of the Contract between Buyer and Seller.

ASSIGNMENT DIRECTED BY:	Passaic Valley Sewerage Commission
	Buyer
(If Buyer is a corporation, attach evidence of authority to sign. If Buyer is a public body, attach evidence of authority to sign	By:(Signature) (Title)
and resolution or other documents authorizing execution of Buyer-Seller Agreement.)	Address for giving notices To Be Determined
	600 Wilson Avenue
	<u>Newark, NJ 07105</u>
ASSIGNMENT ACKNOWLEDGED AND ACCEPTED BY:	
	Seller
(If Seller is a corporation, attach evidence of authority to sign.)	By:(Signature) (Title)
ASSIGNMENT ACCEPTED BY:	Installation Contractor
(If Installation Contractor is a corporation, attach evidence of authority to sign.)	Ву:
	Address for giving notices

**EXHIBIT B-2** to Agreement Between Buyer and Seller

Dated

### AGREEMENT TO ASSIGNMENT BY SELLER'S SURETY

Surety hereby acknowledges and agrees that the Contract for furnishing Goods and Special Services under the Contract Documents entitled Passaic Valley Sewerage Commission Power Generation System Procurement by and between Passaic Valley Sewerage Commission ("Buyer") and \_\_\_\_\_\_

("Seller") may be assigned, transferred, and set over to \_\_\_\_\_\_ ("Installation Contractor"), in accordance with Paragraph 11.02 of Agreement between Buyer and Seller.

Surety further agrees that, upon assignment of the Contract, the Installation Contractor shall have all the rights of the Buyer under the Procurement Performance Bond and Procurement Maintenance Bond.

(Corporate Seal)

Surety

Company: \_\_\_\_\_

By: \_\_\_\_\_ Signature and Title (Attach Power of Attorney)

Address for giving notices
#### SECTION P-00601

#### MAINTENANCE BOND

KNOW ALL MEN BY THESE PRESENTS, that we		, hereinafter
called Principal, as Principal, and	, a corpora	tion of the State of
, hereinafter called Surety, as Surety, a	re held and firr	nly bound unto
		, hereinafter called
Obligee in the sum of	gee, or its suc b bind ourselv aly by these pre	DOLLARS, lawful money cessors or assigns, to the yes, our heirs, executors, esents.
SIGNED, sealed and dated this	day of	, 20
WHEREAS, the Principal entered into a contract with the said O	bligee, dated _	
for		
		and
WHEREAS, the Obligee requires that these presents be execute acceptance of said contract and	ed on or before	e the final completion and
WHEREAS said contract was completed and accepted on the		day of
, 20		
NOW, THEREFORE, THE CONDITION OF THIS OBLIGAT remedy, without cost to the Obligee, any defects which may d from the date of completion and acceptance of the work pe defective or inferior materials or workmanship, then this obligati remain in full force and effect.	ION IS SUCH levelop during erformed under on shall be voi	, that if the Principal shall a period of r the contract, caused by d; otherwise it shall be and
Attest:		
By: Principal		
Attest:		
By: Surety		

# PERFORMANCE BOND FOR PROCUREMENT CONTRACTS

Any singular reference to Seller, Surety, Buyer, or other party shall be considered plural where applicable.

SELLER (Name and Address):

SURETY (Name and Address of Principal Place of Business):

BUYER (Name and Address):

CONTRACT Date: Amount: Description (Name and Location):

BOND

Date (Not earlier than Contract Date): Bond Number: Amount: Modifications to this Bond Form:

Surety and Seller, intending to be legally bound hereby, subject to the terms set forth below, do each cause this Performance Bond to be duly executed on its behalf by its authorized officer,  $agent_{\frac{1}{2}}$  or representative.

Seller as Principal		Surety	
Company:	(Corp. Seal)	Company:	(Corp. Seal)
Signature:		Signature:	
Name and Title:		Name and Title:	
		(Attach Power of Attorney)	
		Address:	
		Telephone Number:	
(Space is provided below	v for signatures of addit	ional parties, if required.)	
Seller as Principal		Surety	
Company:	(Corp. Seal)	Company:	(Corp. Seal)
Signature:		Signature:	
Name and Title:		Name and Title:	
		Address:	
		Telephone Number:	

EJCDC P-610 Performance Bond for Procurement Contracts

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- 1. Seller and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors and assigns to Buyer for the performance of the Contract, which is incorporated herein by reference. For purposes of this bond, Buyer means Buyer's assigns, if and when Buyer has assigned the Contract.
- 2. If Seller performs the Contract, Surety and Seller have no obligation under this Bond, except to participate in conferences as provided in Paragraph 3.1.
- 3. If there is no Buyer Default, Surety's obligation under this Bond shall arise after:
  - 3.1. Buyer has notified Seller and Surety pursuant to Paragraph 10 that Buyer is considering declaring a Seller Default and has requested and attempted to arrange a conference with Seller and Surety to be held not later than 15 days after receipt of such notice to discuss methods of performing the Contract. (If Buyer, Seller, and Surety agree, Seller shall be allowed a reasonable time to perform the Contract, but such an agreement shall not waive Buyer's right, if any, subsequently to declare a Seller Default); and
  - 3.2. Buyer has declared a Seller Default and formally terminated Seller's right to complete the Contract. Such Seller Default shall not be declared earlier than 20 days after Seller and Surety have received notice as provided in Paragraph 3.1; and
  - 3.3. Buyer has agreed to pay the Balance of the Contract Price to:
    - a. Surety in accordance with the terms of the Contract;
    - b. Another seller selected pursuant to Paragraph 4.3 to perform the Contract.
- 4. When Buyer has satisfied the conditions of Paragraph 3, Surety shall promptly and at Surety's expense take one of the following actions:
  - 4.1. Arrange for Seller, with consent of Buyer, to perform and complete the Contract; or
  - 4.2. Undertake to perform and complete the Contract itself, through its agents or through independent contractors; or
  - 4.3. Obtain bids or negotiated proposals from qualified sellers acceptable to Buyer for a contract for performance and completion of the Contract, arrange for a contract to be prepared for execution by Buyer and a seller selected with Buyer's concurrence, to be secured with performance and payment bonds executed by a qualified surety equivalent to the Bonds issued on the Contract, and pay to Buyer the amount of damages as described in Paragraph 6 in excess of the Balance of the Contract Price incurred by Buyer resulting from Seller Default; or
  - 4.4. Waive its right to perform and complete, arrange for completion, or obtain a new seller, and with reasonable promptness under the circumstances, either:
    - a. determine the amount for which it may be liable to Buyer and, as soon as practicable after the amount is determined, tender payment therefor to Buyer; or

- b. deny liability in whole or in part and notify Buyer citing reasons therefor.
- 5. If Surety does not proceed as provided in Paragraph 4 with reasonable promptness, Surety shall be deemed to be in default on this Bond 15 days after receipt of an additional written notice from Buyer to Surety demanding that Surety perform its obligations under this Bond, and Buyer shall be entitled to enforce any remedy available to Buyer. If Surety proceeds as provided in paragraph 4.4, and Buyer refuses the payment tendered or Surety has denied liability, in whole or in part, without further notice Buyer shall be entitled to enforce any remedy available to Buyer.
- 6. After Buyer has terminated Seller's right to complete the Contract, and if Surety elects to act under Paragraph 4.1, 4.2, or 4.3, then the responsibilities of Surety to Buyer shall not be greater than those of Seller under the Contract, and the responsibilities of Buyer to Surety shall not be greater than those of Buyer under the Contract. To a limit of the amount of this Bond, but subject to commitment by Buyer of the Balance of the Contract Price to mitigation of costs and damages on the Contract, Surety is obligated without duplication for:
  - 6.1. the responsibilities of Seller for correction or replacement of defective Goods and Special Services and completion of the Contract;
  - 6.2. Additional legal, design professional, and delay costs resulting from Seller's Default, and resulting from the actions of or failure to act of Surety under Paragraph 4; and
  - 6.3. Liquidated damages, or if no liquidated damages are specified in the Contract, actual damages caused by delayed performance or non-performance of Seller.
- 7. Surety shall not be liable to Buyer or others for obligations of Seller that are unrelated to the Contract, and the Balance of the Contract Price shall not be reduced or set off on account of any such unrelated obligations. No right of action shall accrue on this Bond to any person or entity other than Buyer or its heirs, executors, administrators, successors, or assigns.
- 8. Surety hereby waives notice of any change, including changes of time, to the Contract or to related subcontracts, purchase orders and other obligations.
- 9. Any proceeding, legal or equitable, under this Bond may be instituted in any court of competent jurisdiction in the location of the Point of Destination, and shall be instituted within two years after Seller Default or within two years after Seller ceased working or within two years after Surety refuses or fails to perform its obligations under this Bond, whichever occurs first. If the provisions of this paragraph are void or prohibited by law, the minimum period of limitation available to sureties as a defense in the jurisdiction of the suit shall be applicable.
- 10. Notice to Surety, Buyer or Seller shall be mailed or delivered to the address shown on the signature page.
- 11. When this Bond has been furnished to comply with a statutory or other legal requirement in the location of the Point of Destination, any provision in this Bond conflicting with said statutory or legal requirement shall be deemed deleted herefrom and provisions conforming to such statutory or other

legal requirement shall be deemed incorporated herein. The intent is that this Bond shall be construed as a statutory bond and not as a common law bond.

- 12. Definitions.
  - 12.1. *Balance of the Contract Price:* The total amount payable by Buyer to Seller under the Contract after all proper adjustments have been made, including allowance to Seller of any amounts received or to be received by Buyer in settlement of insurance or other Claims for damages to which Seller is entitled, reduced by all valid and proper payments made to or on behalf of Seller under the Contract.
  - 12.2. *Contract:* The agreement between Buyer and Seller identified on the signature page, including all Contract Documents and changes thereto.
  - 12.3. *Seller Default:* Failure of Seller, which has neither been remedied nor waived, to perform or otherwise to comply with the terms of the Contract.
  - 12.4. *Buyer Default:* Failure of Buyer, which has neither been remedied nor waived, to pay Seller as required by the Contract or to perform and complete or comply with the other terms thereof.

# PAYMENT BOND FOR PROCUREMENT CONTRACTS

Any singular reference to Seller, Surety, Buyer or other party shall be considered plural where applicable.

SELLER (Name and Address):

SURETY (Name and Address of Principal Place of Business):

BUYER (Name and Address):

CONTRACT Date: Amount: Description (Name and Location):

BOND

Date (Not earlier than Contract Date): Bond Number: Amount: Modifications to this Bond Form:

Surety and Seller, intending to be legally bound hereby, subject to the terms set forth below, do each cause this Payment Bond to be duly executed on its behalf by its authorized officer, agent, or representative.

Seller as Principal		Surety	
Company:	(Corp. Seal)	Company:	(Corp. Seal)
Signature:		Signature:	
Name and Title:		Name and Title:	
		(Attach Power of Attorney)	
		Address:	
		Telephone Number:	

(Space is provided below for signatures of additional parties, if required.)

Company:(Corp. Seal)Company:(Corp. Seal)Signature:Name and Title:Name and Title:Name and Title:Address:The lawName and Title:	Seller as Principal		Surety	
Signature:Signature:Name and Title:Name and Title:Address:Total and Name	Company:	(Corp. Seal)	Company:	(Corp. Seal)
Telephone Number:	Signature: Name and Title:		Signature: Name and Title: Address: Telephone Number:	

- 1. Seller and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors and assigns to Buyer to pay for labor, materials and equipment furnished for use in the performance of the Contract, which is incorporated herein by reference. For purposes of this bond, Buyer means Buyer's assigns, if and when Buyer has assigned the Contract.
- 2. With respect to Buyer, this obligation shall be null and void if Seller:
  - 2.1. Promptly makes payment, directly or indirectly, for all sums due Claimants, and
  - 2.2. Defends, indemnifies and holds harmless Buyer from all claims, demands, liens or suits by any person or entity who furnished labor, materials or equipment for use in the performance of the Contract, provided Buyer has promptly notified Seller and Surety (at the addresses described in Paragraph 12) of any claims, demands, liens or suits and tendered defense of such claims, demands, liens or suits to Seller and Surety, and provided there is no Buyer Default.
- 3. With respect to Claimants, this obligation shall be null and void if Seller promptly makes payment, directly or indirectly, for all sums due.
- 4. Surety shall have no obligation to Claimants under this Bond until:
  - 4.1. Claimants who are employed by or have a direct contract with Seller have given notice to Surety (at the address described in Paragraph 12) and sent a copy, or notice thereof, to Buyer stating that a claim is being made under this Bond and, with substantial accuracy, the amount of the claim.
  - 4.2. Claimants who do not have a direct contract with Seller:
    - a. Have furnished written notice to Seller and sent a copy, or notice thereof, to Buyer, within 90 days after having last performed labor or last furnished materials or equipment included in the claim stating, with substantial accuracy, the amount of the claim and the name of the party to whom the materials were furnished or supplied or for whom the labor was done or performed; and
    - b. Have either received a rejection in whole or in part from Seller or not received within 30 days of furnishing the above notice any communication from Seller by which Seller had indicated the claim will be paid directly or indirectly; and
    - c. Not having been paid within the above 30 days, have sent a written notice to Surety (at the address described in Paragraph 12) and sent a copy, or notice thereof, to Buyer stating that a claim is being made under this Bond and enclosing a copy of the previous written notice furnished to Seller.
- 5. If a notice required by Paragraph 4 is given by Buyer to Seller or to Surety, that is sufficient compliance.
- 6. Reserved.
- 7. Surety's total obligation shall not exceed the amount of this Bond, and the amount of this bond shall be credited for any payments made in good faith by Surety.
- 8. Amounts owed by Buyer to Seller under the Contract shall be used for the performance of the Contract and to satisfy claims, if any, under any Performance Bond. By Seller furnishing and Buyer

accepting this Bond, they agree that all funds earned by Seller in the performance of the Contract are dedicated to satisfy obligations of Seller and Surety under this Bond, subject to Buyer's priority to use the funds for the completion of the furnishing the Goods and Special Services.

- 9. Surety shall not be liable to Buyer, Claimants or others for obligations of Seller that are unrelated to the Contract. Buyer shall not be liable for payment of any costs or expenses of any Claimant under this Bond, and shall have under this Bond no obligation to make payments to, give notices on behalf of, or otherwise have obligations to Claimants under this Bond.
- 10. Surety hereby waives notice of any change, including changes of time, to the Contract or to related subcontracts, purchase orders, and other obligations.
- 11. No suit or action shall be commenced by a Claimant under this Bond other than in a court of competent jurisdiction in the location in which the Goods relevant to the claim are located or after the expiration of one year from the date (1) on which the Claimant gave the notice required by Paragraph 4.1 or paragraph 4.2.3, or (2) on which the last labor or service was performed by anyone or the last materials or equipment were furnished by anyone under the Contract, whichever of (1) or (2) first occurs. If the provisions of this paragraph are void or prohibited by law, the minimum period of limitation available to sureties as a defense in the jurisdiction of the suit shall be applicable.
- 12. Notice to Surety, Buyer or Seller shall be mailed or delivered to the addresses shown on the signature page. Actual receipt of notice by Surety, Buyer or Seller, however accomplished, shall be sufficient compliance as of the date received at the address shown on the signature page.
- 13. When this Bond has been furnished to comply with a statutory or other legal requirement in the location where the Contract was to be performed, any provision in this Bond conflicting with said statutory or legal requirement shall be deemed deleted herefrom and provisions conforming to such statutory or other legal requirement shall be deemed incorporated herein. The intent is that this Bond shall be construed as a statutory Bond and not as a common law bond.
- 14. Upon request of any person or entity appearing to be a potential beneficiary of this Bond, Seller shall promptly furnish a copy of this Bond or shall permit a copy to be made.
- 15. Definitions
  - 15.1 *Claimant:* An individual or entity having a direct contract with Seller or with a Subcontractor of Seller to furnish labor, materials or equipment for use in the performance of the Contract. The intent of this Bond shall be to include without limitation in the terms "labor, materials or equipment" that part of water, gas, power, light, heat, oil, gasoline, telephone service or rental equipment used in the Contract, architectural and engineering services required for furnishing the Goods and Special Services by Seller and Seller's Subcontractors, and all other items for which a mechanic's lien may be asserted in the jurisdiction where the labor, materials or equipment were furnished.
  - 15.2. *Contract:* The agreement between Buyer and Seller identified on the signature page, including all Contract Documents and changes thereto.
  - 15.3. *Buyer Default:* Failure of Buyer, which has neither been remedied nor waived, to pay Seller as required by the Contract or to perform and complete or comply with the other terms thereof.

# **STANDARD GENERAL CONDITIONS** FOR PROCUREMENT CONTRACTS

Prepared by



and

Issued and Published Jointly by











AMERICAN COUNCIL OF ENGINEERING COMPANIES

AMERICAN SOCIETY OF CIVIL ENGINEERS

ASSOCIATED GENERAL CONTRACTORS OF AMERICA

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# STANDARD GENERAL CONDITIONS FOR PROCUREMENT CONTRACTS

## **ARTICLE 1 – DEFINITIONS AND TERMINOLOGY**

#### 1.01 Defined Terms

- A. Whenever used in the Bidding Requirements or Contract Documents and printed with initial capital letters, the terms listed below will have the meanings indicated which are applicable to the singular or plural thereof. In addition to terms specifically defined, terms with initial capital letters in the Contract Documents include references to identified articles and paragraphs, and the titles of other documents or forms.
  - 1. *Addenda*—Written or graphic instruments issued prior to the opening of Bids which clarify, correct, or change the Bidding Requirements or the proposed Contract Documents.
  - 2. *Agreement*—The written instrument signed by both Buyer and Seller covering the Goods and Special Services and which lists the Contract Documents in existence on the Effective Date of the Agreement.
  - 3. *Application for Payment*—The form acceptable to Buyer which is used by Seller in requesting progress and final payments and which is accompanied by such supporting documentation as is required by the Contract Documents.
  - 4. *Bid* The offer or proposal of a Seller submitted on the prescribed form setting forth the prices for the Goods and Special Services to be provided.
  - 5. *Bidder*—The individual or entity that submits a Bid directly to Buyer.
  - 6. *Bidding Documents*—The Bidding Requirements and the proposed Contract Documents (including all Addenda).
  - 7. *Bidding Requirements*—The advertisement or invitation to bid, Instructions to Bidders, Bid security of acceptable form, if any, and Bid Form with any supplements.
  - 8. *Buyer*—The individual or entity purchasing the Goods and Special Services.
  - 9. *Change Order*—A document which is signed by Seller and Buyer and authorizes an addition, deletion, or revision to the Contract Documents or an adjustment in the Contract Price or the Contract Times, issued on or after the Effective Date of the Agreement. Change Orders may be the result of mutual agreement by Buyer and Seller, or of resolution of a Claim.

- 10. *Claim*—A demand or assertion by Buyer or Seller seeking an adjustment of Contract Price or Contract Times, or both, or other relief with respect to the terms of the Contract. A demand for money or services by a third party is not a Claim.
- 11. *Contract*—The entire and integrated written agreement between Buyer and Seller concerning the Goods and Special Services. The Contract supersedes prior negotiations, representations, or agreements, whether written or oral.
- 12. Contract Documents—Those items so designated in the Agreement. Shop Drawings and other Seller submittals are not Contract Documents, even if accepted, reviewed, or approved by Engineer or Buyer.
- 13. *Contract Price*—The moneys payable by Buyer to Seller for furnishing the Goods and Special Services in accordance with the Contract Documents as stated in the Agreement.
- 14. *Contract Times*—The times stated in the Agreement by which the Goods must be delivered and Special Services must be furnished.
- 15. *Drawings*—That part of the Contract Documents prepared or approved by Engineer which graphically shows the scope, extent, and character of the Goods and Special Services to be furnished by Seller. Shop Drawings and other Seller submittals are not Drawings as so defined.
- 16. *Effective Date of the Agreement*—The date indicated in the Agreement on which it becomes effective, but if no such date is indicated, it means the date on which the Agreement is signed and delivered by the last of the two parties to sign and deliver.
- 17. Engineer—The individual or entity designated as such in the Agreement.
- 18. *Field Order*—A written order issued by Engineer which requires minor changes in the Goods or Special Services but which does not involve a change in the Contract Price or Contract Times.
- 19. *General Requirements*—Sections of Division 1 of the Specifications. The General Requirements pertain to all sections of the Specifications.
- 20. *Goods*—The tangible and movable personal property that is described in the Contract Documents, regardless of whether the property is to be later attached to realty.
- 21. *Goods and Special Services*—The full scope of materials, equipment, other items, and services to be furnished by Seller, including Goods, as defined herein, and Special Services, if any, as defined herein. This term refers to both the Goods and the Special Services, or to either the Goods or the Special Services, and to any portion of the Goods or the Special Services, as the context requires.

- 22. *Laws and Regulations; Laws or Regulations*—Any and all applicable laws, rules, regulations, ordinances, codes, and orders of any and all governmental bodies, agencies, authorities, and courts having jurisdiction.
- 23. *Milestone*—A principal event specified in the Contract Documents relating to an intermediate completion date or time prior to the Contract Times.
- 24. *Notice of Award*—The written notice by Buyer to the Successful Bidder stating that upon timely compliance by the Successful Bidder with the conditions precedent listed therein, Buyer will sign and deliver the Agreement.
- 25. *Notice to Proceed*—A written notice given by Buyer to Seller fixing the date on which the Contract Times commence to run and on which Seller shall start to perform under the Contract.
- 26. *Point of Destination*—The specific address of the location where delivery of the Goods shall be made, as stated in the Agreement.
- 27. *Project*—The total undertaking of which the Goods and Special Services may be the whole, or only a part.
- 28. *Project Manual*—The documentary information prepared for bidding and furnishing the Goods and Special Services. A listing of the contents of the Project Manual is contained in its table of contents.
- 29. *Samples*—Physical examples of materials, equipment, or workmanship that are representative of some portion of the Goods and Special Services and which establish the standards by which such portion of the Goods and Special Services will be judged.
- 30. *Seller*—The individual or entity furnishing the Goods and Special Services.
- 31. *Shop Drawings*—All drawings, diagrams, illustrations, schedules, and other data or information which are specifically prepared or assembled by or for Seller and submitted by Seller to illustrate some portion of the Goods and Special Services.
- 32. *Special Services*—Services associated with the Goods to be furnished by Seller as required by the Contract Documents.
- 33. *Specifications*—That part of the Contract Documents consisting of written requirements for materials, equipment, systems, standards and workmanship as applied to the furnishing of the Goods and Special Services, and certain administrative requirements and procedural matters applicable thereto.
- 34. *Successful Bidder*—The Bidder submitting a responsive Bid, to whom Buyer makes an award.

- 35. *Supplementary Conditions*—That part of the Contract Documents which amends or supplements these General Conditions.
- 36. *Work Change Directive*—A written statement to Seller issued on or after the Effective Date of the Agreement and signed by Buyer ordering an addition, deletion, or other revision in the Contract Documents with respect to the Goods and Special Services. A Work Change Directive will not change the Contract Price or the Contract Times but is evidence that the parties expect that the change ordered or documented by a Work Change Directive will be incorporated in a subsequently issued Change Order following negotiations by the parties as to its effect, if any, on the Contract Price or Contract Times.

#### 1.02 Terminology

A. The words and terms discussed in Paragraphs 1.02.B and 1.02.C are not defined, but have the indicated meanings when used in the Bidding Requirements or Contract Documents.

#### B. Intent of Certain Terms or Adjectives:

- 1. The Contract Documents include the terms "as allowed," "as approved," "as ordered," "as directed" or terms of like effect or import to authorize an exercise of professional judgment by Engineer. In addition, the adjectives "reasonable," "suitable," "acceptable," "proper," "satisfactory," or adjectives of like effect or import are used to describe an action or determination of Engineer as to the Goods and Special Services. It is intended that such exercise of professional judgment, action, or determination will be commercially reasonable and will be solely to evaluate, in general, the Goods and Special Services for compliance with the requirements of and information in the Contract Documents and conformance with the design concept of the completed Project as a functioning whole as shown or indicated in the Contract Documents (unless there is a specific statement indicating otherwise). The use of any such term or adjective shall not be effective to assign to Engineer any duty or authority to supervise or direct the furnishing of Goods or Special Services or any duty or authority to undertake responsibility contrary to any other provision of the Contract Documents.
- 2. The word "non-conforming" when modifying the words "Goods and Special Services," "Goods," or "Special Services," refers to Goods and Special Services that fail to conform to the Contract Documents.
- 3. The word "receipt" when referring to the Goods, shall mean the physical taking and possession by the Buyer under the conditions specified in Paragraph 8.01.B.3.
- 4. The word "day" means a calendar day of 24 hours measured from midnight to the next midnight.
- 5. The word "furnish," when used in connection with the Goods and Special Services shall mean to supply and deliver said Goods to the Point of Destination (or some other

specified location) and to perform said Special Services fully, all in accordance with the Contract Documents.

C. Unless stated otherwise in the Contract Documents, words or phrases that have a well-known technical or construction industry or trade meaning are used in the Contract Documents in accordance with such recognized meaning.

# **ARTICLE 2 – PRELIMINARY MATTERS**

- 2.01 Delivery of Bonds
  - A. When Seller delivers the executed counterparts of the Agreement to Buyer, Seller also shall deliver such bonds as Seller may be required to furnish.
- 2.02 Evidence of Insurance
  - A. When Seller delivers the executed counterparts of the Agreement to Buyer, Seller shall deliver to Buyer, with copies to each additional insured identified by name in the Supplementary Conditions, certificates of insurance (and other evidence of insurance which either of them or any additional insured may reasonably request) which Seller is required to purchase and maintain in accordance with Article 4.
- 2.03 Copies of Documents
  - A. Buyer shall furnish Seller up to five printed or hard copies of the Contract Documents. Additional copies will be furnished upon request at the cost of reproduction.

### 2.04 Commencement of Contract Times; Notice to Proceed

A. The Contract Times will commence to run on the thirtieth day after the Effective Date of the Agreement or, if a Notice to Proceed is given, on the day indicated in the Notice to Proceed. A Notice to Proceed may be given at any time within 30 days after the Effective Date of the Agreement. In no event will the Contract Times commence to run later than the sixtieth day after the day of Bid opening or the thirtieth day after the Effective Date of the Agreement, whichever date is earlier.

### 2.05 *Designated Representatives*

- A. Buyer and Seller shall each designate its representative at the time the Agreement is signed. Each representative shall have full authority to act on behalf of and make binding decisions in any matter arising out of or relating to the Contract.
- 2.06 Progress Schedule
  - A. Within 15 days after the Contract Times start to run, Seller shall submit to Buyer and Engineer an acceptable progress schedule of activities, including at a minimum, Shop Drawing and Sample submittals, tests, and deliveries as required by the Contract Documents. No progress payment will be made to Seller until an acceptable schedule is submitted to Buyer and Engineer.

B. The progress schedule will be acceptable to Buyer and Engineer if it provides an orderly progression of the submittals, tests, and deliveries to completion within the specified Milestones and the Contract Times. Such acceptance will not impose on Buyer or Engineer responsibility for the progress schedule, for sequencing, scheduling, or progress of the work nor interfere with or relieve Seller from Seller's full responsibility therefor. Such acceptance shall not be deemed to acknowledge the reasonableness and attainability of the schedule.

### 2.07 Preliminary Conference

A. Within 20 days after the Contract Times start to run, a conference attended by Seller, Buyer, Engineer and others as appropriate will be held to establish a working understanding among the parties as to the Goods and Special Services and to discuss the schedule referred to in Paragraph 2.06.A, procedures for handling Shop Drawings and other submittals, processing Applications for Payment, and maintaining required records.

# 2.08 Safety

A. Buyer and Seller shall comply with all applicable Laws and Regulations relating to the safety of persons or property, or to the protection of persons or property from damage, injury, or loss. When Seller's personnel, or the personnel of any subcontractor to Seller, are present at the Point of Destination or any work area or site controlled by Buyer, the Seller shall be responsible for the compliance by such personnel with any applicable requirements of Buyer's safety programs that are made known to Seller.

# **ARTICLE 3 – CONTRACT DOCUMENTS: INTENT AND AMENDING**

### 3.01 Intent

- A. The Contract Documents are complementary; what is called for by one is as binding as if called for by all.
- B. Any labor, documentation, services, materials, or equipment that may reasonably be inferred from the Contract Documents or from prevailing custom or trade usage as being required to produce or furnish the indicated Goods and Special Services will be provided, whether or not specifically called for, at no additional cost to Buyer.
- C. Clarifications and interpretations of, or notifications of minor variations and deviations in, the Contract Documents, will be issued by Engineer as provided in Article 9.
- 3.02 Standards, Specifications, Codes, Laws and Regulations
  - A. Reference to standards, specifications, manuals, or codes of any technical society, organization, or association, or to Laws and Regulations, whether such reference be specific or by implication, shall mean the standard, specification, manual, code, or Laws and Regulations in effect at the time of opening of Bids (or on the Effective Date of the Agreement if there were no Bids), except as may be otherwise specifically stated in the Contract Documents.

B. No provision of any such standard, specification, manual or code, or any instruction of a supplier shall be effective to change the duties or responsibilities of Buyer or Engineer, or any of their subcontractors, consultants, agents, or employees from those set forth in the Contract Documents, nor shall any such provision or instruction be effective to assign to Buyer or Engineer, or any of their consultants, agents, or employees any duty or authority to supervise or direct the performance of Seller's obligations or any duty or authority to undertake responsibility inconsistent with the provisions of the Contract Documents.

## 3.03 Reporting and Resolving Discrepancies

- A. Reporting Discrepancies:
  - 1. Seller's Review of Contract Documents Before the Performance of the Contract: Before performance of the Contract, Seller shall carefully study and compare the Contract Documents and check and verify pertinent figures therein and all applicable field measurements. Seller shall promptly report in writing to Engineer any conflict, error, ambiguity, or discrepancy which Seller discovers or has actual knowledge of and shall obtain a written interpretation or clarification from Engineer before proceeding with the furnishing of any Goods and Special Services affected thereby.
  - 2. Seller's Review of Contract Documents During the Performance of the Contract: If, during the performance of the Contract, Seller discovers any conflict, error, ambiguity, or discrepancy within the Contract Documents or between the Contract Documents and any provision of any Law or Regulation applicable to the performance of the Contract, any standard, specification, manual or code, or of any instruction of any Supplier, Seller shall promptly report it to Engineer in writing. Seller shall not proceed with the furnishing of the Goods and Special Services affected thereby until an amendment to or clarification of the Contract Documents has been issued.
  - 3. Seller shall not be liable to Buyer or Engineer for failure to report any conflict, error, ambiguity, or discrepancy in the Contract Documents unless Seller had actual knowledge thereof.
- B. *Resolving Discrepancies:* Except as may be otherwise specifically stated in the Contract Documents, the provisions of the Contract Documents shall take precedence in resolving any conflict, error, ambiguity, or discrepancy between the provisions of the Contract Documents and:
  - 1. the provisions of any standard, specification, manual, code, or instruction (whether or not specifically incorporated by reference in the Contract Documents); or
  - 2. the provisions of any Laws or Regulations applicable to the furnishing of the Goods and Special Services (unless such an interpretation of the provisions of the Contract Documents would result in violation of such Law or Regulation).

#### 3.04 Amending and Clarifying Contract Documents

- A. The Contract Documents may be amended to provide for additions, deletions, and revisions to the Goods and Special Services or to modify contractual terms and conditions by a Change Order.
- B. Buyer may issue a Work Change Directive providing for additions, deletions, or revisions to the Goods and Special Services, in which case (1) the Contract Price shall be equitably adjusted to account for any reasonable and necessary credits to Buyer for any such deletion, or for costs (including reasonable overhead and profit) incurred by Seller to accommodate such an addition or revision and (2) the Contract Times shall be equitably adjusted to account for any impact on progress and completion of performance. Such adjustments subsequently shall be duly set forth in a Change Order.
- C. The requirements of the Contract Documents may be supplemented, and minor variations and deviations in the Goods and Special Services may be authorized, by one or more of the following ways:
  - 1. A Field Order;
  - 2. Engineer's approval of a Shop Drawing or Sample (subject to the provisions of Paragraph 5.06.D.3); or
  - 3. Engineer's written interpretation or clarification.

# **ARTICLE 4 – BONDS AND INSURANCE**

- 4.01 *Bonds* 
  - A. Seller shall furnish to Buyer performance and payment bonds, each in an amount at least equal to the Contract Price, as security for the faithful performance and payment of all of Seller's obligations under the Contract Documents. These bonds shall remain in effect until 1) one year after the date when final payment becomes due or 2) completion of the correction period specified in Paragraph 8.03, whichever is later, except as provided otherwise by Laws or Regulations or by the Contract Documents. Seller shall also furnish such other bonds as are required by the Contract Documents.
  - B. All bonds shall be in the form prescribed by the Contract Documents except as provided otherwise by Laws or Regulations, and shall be executed by such sureties as are named in the current list of "Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies" as published in Circular 570 (amended) by the Financial Management Service, Surety Bond Branch, U.S. Department of the Treasury. All bonds signed by an agent or attorney-in-fact must be accompanied by a certified copy of that individual's authority to bind the surety. The evidence of authority shall show that it is effective on the date the agent or attorney-in-fact signed each bond.
  - C. If the surety on any bond furnished by Seller is declared bankrupt or becomes insolvent or its right to do business is terminated in any state where any part of the Project is located or it ceases

to meet the requirements of Paragraph 4.01.B, Seller shall promptly notify Buyer and Engineer and shall, within 20 days after the event giving rise to such notification, provide another bond and surety, both of which shall comply with the requirements of Paragraphs 4.01.B and 4.02.

#### 4.02 Insurance

- A. Seller shall provide insurance of the types and coverages and in the amounts stipulated in the Supplementary Conditions.
- B. Failure of Buyer to demand certificates of insurance or other evidence of Seller's full compliance with these insurance requirements or failure of Buyer to identify a deficiency in compliance from the evidence provided shall not be construed as a waiver of Seller's obligation to maintain such insurance.
- C. Upon assignment of this Contract, Seller shall comply with the written request of assignee to provide certificates of insurance to assignee.
- D. Buyer does not represent that insurance coverage and limits established in this Contract necessarily will be adequate to protect Seller.
- E. The insurance and insurance limits required herein shall not be deemed as a limitation on Seller's liability under the indemnities granted to Buyer in the Contract Documents.
- 4.03 Licensed Sureties and Insurers
  - A. All bonds and insurance required by the Contract Documents to be purchased and maintained by Buyer or Seller shall be obtained from surety or insurance companies that are duly licensed or authorized in the jurisdiction in which the Project is located to issue bonds or insurance policies for the limits and coverages so required. Such surety and insurance companies shall also meet such additional requirements and qualifications as may be provided in the Supplementary Conditions.

### **ARTICLE 5 – SELLER'S RESPONSIBILITIES**

- 5.01 Supervision and Superintendence
  - A. Seller shall supervise, inspect, and direct the furnishing of the Goods and Special Services competently and efficiently, devoting such attention thereto and applying such skills and expertise as may be necessary to perform its obligations in accordance with the Contract Documents. Seller shall be solely responsible for the means, methods, techniques, sequences, and procedures necessary to perform its obligations in accordance with the Contract Documents. Seller shall not be responsible for the negligence of Buyer or Engineer in the design or specification of a specific means, method, technique, sequence, or procedure that is shown or indicated in and expressly required by the Contract Documents.

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#### 5.02 Labor, Materials and Equipment

- A. Seller shall provide competent, qualified and trained personnel in all aspects of its performance of the Contract.
- B. All Goods, and all equipment and material incorporated into the Goods, shall be as specified, and unless specified otherwise in the Contract Documents, shall be:
  - 1. new, and of good quality;
  - 2. protected, assembled, connected, cleaned, and conditioned in accordance with the original manufacturer's instructions; and
  - 3. shop assembled to the greatest extent practicable.

#### 5.03 *Laws and Regulations*

- A. Seller shall give all notices required by and shall comply with all Laws and Regulations applicable to the performance of its obligations in accordance with the Contract Documents. Except where otherwise expressly required by such Laws and Regulations, neither Buyer nor Engineer shall be responsible for monitoring Seller's compliance with any Laws or Regulations.
- B. If Seller furnishes Goods and Special Services knowing or having reason to know that such furnishing is contrary to Laws or Regulations, Seller shall bear all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such performance. It shall not be Seller's responsibility to make certain that the Specifications and Drawings are in accordance with Laws and Regulations, but this provision shall not relieve Seller of Seller's obligations under Paragraph 3.03.
- C. Changes in Laws or Regulations not known at the time of opening of Bids (or, on the Effective Date of the Agreement if there were no Bids) having an effect on the cost or time of performance shall be the subject of an adjustment in Contract Price or Contract Times. If Buyer and Seller are unable to agree on entitlement to or on the amount or extent, if any, of any such adjustment, a Claim may be made therefor as provided in Paragraph 9.06.

### 5.04 Or Equals

A. Whenever the Goods, or an item of material or equipment to be incorporated into the Goods, are specified or described in the Contract Documents by using the name of a proprietary item or the name of a particular supplier or manufacturer, the specification or description is intended to establish the type, function, appearance, and quality required. Unless the specification or description contains or is followed by words reading that no like, equivalent, or "or-equal" item is permitted, other items of material or equipment or material or equipment of other suppliers or manufacturers may be submitted to Buyer for Engineer's review.

- 1. If in Engineer's sole discretion, such an item of material or equipment proposed by Seller is functionally equal to that named and sufficiently similar so that no change in related work will be required, it may be considered by Engineer as an "or-equal" item.
- 2. For the purposes of this paragraph, a proposed item of material or equipment may be considered functionally equal to an item so named only if:
  - a. in the exercise of reasonable judgment, Engineer determines that: 1) it is at least equal in quality, durability, appearance, strength, and design characteristics; 2) it will reliably perform at least equally well the function imposed by the design concept of the completed Project as a functioning whole; 3) it has an acceptable record of performance and availability of responsive service; and
  - b. Seller certifies that if approved: 1) there will be no increase in any cost, including capital, installation or operating costs, to Buyer; and 2) the proposed item will conform substantially to the detailed requirements of the item named in the Contract Documents.
- B. *Engineer's Evaluation:* Engineer will be allowed a reasonable time within which to evaluate each proposal or submittal made pursuant to Paragraph 5.04.A. Engineer will be the sole judge of whether to accept or reject such a proposal or submittal. No "or-equal" will be ordered, manufactured or utilized until Engineer's review is complete, which will be evidenced by an approved Shop Drawing. Engineer will advise Buyer and Seller in writing of any negative determination. Notwithstanding Engineer's approval of an "or-equal" item, Seller shall remain obligated to comply with the requirements of the Contract Documents.
- C. *Special Guarantee:* Buyer may require Seller to furnish at Seller's expense a special performance guarantee or other surety with respect to any such proposed "or-equal."
- D. *Data:* Seller shall provide all data in support of any such proposed "or-equal" at Seller's expense.
- 5.05 Taxes
  - A. Seller shall be responsible for all taxes and duties arising out of the sale of the Goods and the furnishing of Special Services. All taxes are included in the Contract Price, except as noted in the Supplementary Conditions.
- 5.06 Shop Drawings and Samples
  - A. Seller shall submit Shop Drawings and Samples to Buyer for Engineer's review and approval in accordance with the schedule required in Paragraph 2.06.A. All submittals will be identified as required and furnished in the number of copies specified in the Contract Documents. The data shown on the Shop Drawings will be complete with respect to quantities, dimensions, specified performance and design criteria, materials, and similar data to show Engineer the services, materials, and equipment Seller proposes to provide.

- B. Where a Shop Drawing or Sample is required by the Contract Documents, any related work performed prior to Engineer's approval of the pertinent submittal will be at the sole expense and responsibility of Seller.
- C. Submittal Procedures:
  - 1. Before submitting each Shop Drawing or Sample, Seller shall have determined and verified:
    - a. all field measurements (if required), quantities, dimensions, specified performance criteria, installation requirements, materials, catalog numbers, and similar information with respect thereto; and
    - b. that all materials are suitable with respect to the indicated application, fabrication, shipping, handling, storage, assembly, and installation pertaining to the furnishing of Goods and Special Services.
  - 2. Seller shall also have reviewed and coordinated each Shop Drawing or Sample with the Contract Documents.
  - 3. Each submittal shall bear a stamp or include a written certification from Seller that Seller has reviewed the subject submittal and confirmed that it is in compliance with the requirements of the Contract Documents. Both Buyer and Engineer shall be entitled to rely on such certification from Seller.
  - 4. With each submittal, Seller shall give Buyer and Engineer specific written notice of any variations that the Shop Drawing or Sample may have from the requirements of the Contract Documents. This notice shall be both in a written communication separate from the submittal and by specific notation on each Shop Drawing or Sample.
- D. Engineer's Review:
  - 1. Engineer will provide timely review of Shop Drawings and Samples.
  - 2. Engineer's review and approval will be only to determine if the Goods and Special Services covered by the submittals will, after installation or incorporation in the Project, conform to the information given in the Contract Documents and be compatible with the design concept of the completed Project as a functioning whole.
  - 3. Engineer's review and approval shall not relieve Seller from responsibility for any variation from the requirements of the Contract Documents unless Seller has complied with the requirements of Paragraph 5.06.C.4 and Engineer has given written approval of each such variation by specific written notation thereof incorporated in or accompanying the Shop Drawing or Sample. Engineer's review and approval shall not relieve Seller from responsibility for complying with the requirements of Paragraph 5.06.C.1.

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# E. *Resubmittal Procedures:*

1. Seller shall make corrections required by Engineer and shall return the required number of corrected copies of Shop Drawings and submit<sub>2</sub> as required new Samples for review and approval. Seller shall direct specific attention in writing to any revisions other than the corrections called for by Engineer on previous submittals.

#### 5.07 *Continuing Performance*

- A. Seller shall adhere to the progress schedule established in accordance with Paragraph 2.06.A., and the Goods shall be delivered and the Special Services furnished within the Contract Times specified in the Agreement.
- B. Seller shall carry on furnishing of the Goods and Special Services and adhere to the progress schedule during all disputes or disagreements with Buyer. No furnishing of Goods and Special Services shall be delayed or postponed pending resolution of any disputes or disagreements, except as permitted by Paragraphs 11.03 or 11.04, or as Buyer and Seller may otherwise agree in writing.

### 5.08 Seller's Warranties and Guarantees

- A. Seller warrants and guarantees to Buyer that the title to the Goods conveyed shall be proper, its transfer rightful, and free from any security interest, lien, or other encumbrance. Seller shall defend, indemnify, and hold Buyer harmless against any liens, claims, or demands contesting or affecting title of the Goods conveyed.
- B. Seller warrants and guarantees to Buyer that all Goods and Special Services will conform with the Contract Documents, and with the standards established by any Samples approved by Engineer. Engineer shall be entitled to rely on Seller's warranty and guarantee. If the Contract Documents do not otherwise specify the characteristics or the quality of the Goods, the Goods shall comply with the requirements of Paragraph 5.02.B.
- C. Seller's warranty and guarantee hereunder excludes defects or damage caused by:
  - 1. abuse, improper modification, improper maintenance, or improper operation by persons other than Seller; or
  - 2. corrosion or chemical attack, unless corrosive or chemically-damaging conditions were disclosed by Buyer in the Contract Documents and the Contract Documents required the Goods to withstand such conditions;
  - 3. use in a manner contrary to Seller's written instructions for installation, operation, and maintenance; or
  - 4. normal wear and tear under normal usage.
- D. Seller's obligation to furnish the Goods and Special Services in accordance with the Contract Documents shall be absolute. None of the following will constitute an acceptance of Goods and

Special Services that are non-conforming, or a release of Seller's obligation to furnish the Goods and Special Services in accordance with the Contract Documents:

- 1. observations by Buyer or Engineer;
- 2. recommendation by Engineer or payment by Buyer of any progress or final payment;
- 3. use of the Goods by Buyer;
- 4. any acceptance by Buyer (subject to the provisions of Paragraph 8.02.D.1) or any failure to do so;
- 5. the issuance of a notice of acceptance by Buyer pursuant to the provisions of Article 8;
- 6. any inspection, test or approval by others; or
- 7. any correction of non-conforming Goods and Special Services by Buyer.
- E. Buyer shall promptly notify Seller of any breach of Seller's warranties or guarantees.
- F. Seller makes no implied warranties under this Contract.
- 5.09 Indemnification
  - A. To the fullest extent permitted by Laws and Regulations, Seller shall indemnify and hold harmless Buyer and Engineer, and the officers, directors, members, partners, employees, agents, consultants, contractors, and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to the performance of Seller's obligations under the Contract Documents, provided that any such claim, cost, loss, or damages attributable to bodily injury, sickness, disease, or death, or to injury to or destruction of tangible property (other than the Goods themselves), including the loss of use resulting therefrom, but only to the extent cause by any negligent act or omission of Seller, or any individual or entity directly or indirectly employed by Seller or anyone for whose acts Seller may be liable.
  - B. In any and all claims against Buyer or Engineer or any of their respective assignees, consultants, agents, officers, directors, members, partners, employees, agents, consultants, contractors, or subcontractors, by any employee (or the survivor or personal representative of such employee) of Seller, any subcontractor, any supplier, or any individual or entity directly or indirectly employed by any of them to furnish any of the Goods and Special Services, or anyone for whose acts any of them may be liable, the indemnification obligation under Paragraph 5.09.A shall not be limited in any way by any limitation on the amount or type of damages, compensation, or benefits payable by or for seller or any such subcontractor, supplier, or other individual or entity under workers' compensation acts, disability benefit acts, or other employee benefit acts.

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- C. The indemnification obligations of Seller under Paragraph 5.09.A shall not extend to the liability of Engineer and Engineer's officers, directors, partners, employees, agents, and consultants arising out of:
  - 1. the preparation or approval of, or the failure to prepare or approve, maps, Drawings, opinions, reports, surveys, Change Orders, designs, or Specifications; or
  - 2. giving directions or instructions, or failing to give them, if that is the primary cause of the injury or damage.

## 5.10 Delegation of Professional Design Services

- A. Seller will not be required to provide professional design services unless such services are specifically required by the Contract Documents or unless such services are required to carry out Seller's responsibilities for furnishing the Goods and Special Services. Seller shall not be required to provide professional services in violation of applicable law.
- B. If professional design services or certifications by a design professional related to the Goods and Special Services are specifically required of Seller by the Contract Documents, Buyer and Engineer will specify all performance and design criteria that such services must satisfy. Seller shall cause such services or certifications to be provided by a properly licensed professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, Shop Drawings and other submittals prepared by such professional. Shop Drawings and other submittals related to the Goods and Special Services designed or certified by such professional, if prepared by others, shall bear such professional's written approval when submitted to Engineer.
- C. Buyer and Engineer shall be entitled to rely upon the adequacy, accuracy and completeness of the services, certifications or approvals performed by such design professionals, provided Buyer and Engineer have specified to Seller all performance and design criteria that such services must satisfy.
- D. Pursuant to this Paragraph 5.10, Engineer's review and approval of design calculations and design drawings will be only for the limited purpose of checking for conformance with performance and design criteria given and the design concept expressed in the Contract Documents. Engineer's review and approval of Shop Drawings and other submittals (except design calculations and design drawings) will be only for the purpose stated in Paragraph 5.06.D.2.
- E. Seller shall not be responsible for the adequacy of the performance or design criteria required by the Contract Documents.

# **ARTICLE 6 – SHIPPING AND DELIVERY**

### 6.01 *Shipping*

A. Seller shall select the carrier and bear all costs of packaging, transportation, insurance, special handling and any other costs associated with shipment and delivery.

#### 6.02 *Delivery*

- A. Seller shall deliver the Goods F.O.B. the Point of Destination in accordance with the Contract Times set forth in the Agreement, or other date agreed to by Buyer and Seller.
- B. Seller shall provide written notice to Buyer at least 10 days before shipment of the manner of shipment and the anticipated delivery date. The notice shall also include any instructions concerning special equipment or services required at the Point of Destination to unload and care for the Goods. Seller shall also require the carrier to give Buyer at least 24 hours notice by telephone prior to the anticipated time of delivery.
- C. Buyer will be responsible and bear all costs for unloading the Goods from carrier.
- D. Buyer will assure that adequate facilities are available to receive delivery of the Goods during the Contract Times for delivery set forth in the Agreement, or another date agreed by Buyer and Seller.
- E. No partial deliveries shall be allowed, unless permitted or required by the Contract Documents or agreed to in writing by Buyer.

#### 6.03 *Risk of Loss*

- A. Risk of loss and insurable interests transfer from Seller to Buyer upon Buyer's receipt of the Goods.
- B. Notwithstanding the provisions of Paragraph 6.03.A, if Buyer rejects the Goods as nonconforming, the risk of loss on such Goods shall remain with Seller until Seller corrects the nonconformity or Buyer accepts the Goods. If rejected Goods remain at the Point of Destination pending modification and acceptance, then Seller shall be responsible for arranging adequate protection and maintenance of the Goods at Seller's expense.

#### 6.04 Progress Schedule

- A. Seller shall adhere to the progress schedule established in accordance with Paragraph 2.06 as it may be adjusted from time to time as provided below.
  - 1. Seller shall submit to Engineer for acceptance (to the extent indicated in Paragraph 2.06) proposed adjustments in the progress schedule that will not result in changing the Contract Times. Such adjustments will comply with any provisions of the General Requirements applicable thereto.
  - 2. Proposed adjustments in the progress schedule that will change the Contract Times shall be submitted in accordance with the requirements of Article 7. Adjustments in Contract Times may only be made by a Change Order.

# **ARTICLE 7 – CHANGES: SCHEDULE AND DELAY**

# 7.01 Changes in the Goods and Special Services

- A. Buyer may at any time, without notice to any surety, make an addition, deletion, or other revision to the Contract Documents with respect to the Goods and Services, within the general scope of the Contract, by a Change Order or Work Change Directive. Upon receipt of any such document, Seller shall promptly proceed with performance pursuant to the revised Contract Documents (except as otherwise specifically provided).
- B. If Seller concludes that a Work Change Directive issued by Buyer affects the Contract Price or Contract Times, then Seller shall notify Buyer within 15 days after Seller has received the Work Change Directive, and submit written supporting data to Buyer within 45 days after such receipt. If Seller fails to notify Buyer within 15 days, Seller waives any Claim for such adjustment. If Buyer and Seller are unable to agree on entitlement to, or on the amount or extent, if any, of an adjustment in the Contract Price or Contract Times, or both, that should be allowed as a result of a Work Change Directive, a Claim may be made therefor as provided in Paragraph 9.06.
- C. Seller shall not suspend performance while Buyer and Seller are in the process of making such changes and any related adjustments to Contract Price or Contract Times.
- 7.02 Changing Contract Price or Contract Times
  - A. The Contract Price or Contract Times may only be changed by a Change Order.
  - B. Any Claim for an adjustment in the Contract Price or Contract Times shall be based on written notice submitted by the party making the Claim to the Engineer and the other party to the Contract in accordance with the provisions of Paragraph 9.06.
  - C. If Seller is prevented from delivering the Goods or performing the Special Services within the Contract Times for any unforeseen reason beyond its control and not attributable to its actions or inactions, then Seller shall be entitled to an adjustment of the Contract Times to the extent attributable to such reason. Such reasons include but are not limited to acts or neglect by Buyer, inspection delays, fires, floods, epidemics, abnormal weather conditions, acts of God, and other like matters. If such an event occurs and delays Seller's performance, Seller shall notify Buyer in writing within 15 days of knowing or having reason to know of the beginning of the event causing the delay, stating the reason therefor.
  - D. Seller shall not be entitled to an adjustment in Contract Price or Contract Times for delays within the control of Seller. Delays attributable to and within the control of Seller's subcontractors or suppliers shall be deemed to be delays within the control of Seller.
  - E. If Seller is prevented from delivering the Goods or furnishing the Special Services within the Contract Times due to the actions or inactions of Buyer, Seller shall be entitled to any reasonable and necessary additional costs arising out of such delay to the extent directly attributable to Buyer.

F. Neither Buyer nor Seller shall be entitled to any damages arising from delays which are beyond the control of both Buyer and Seller, including but not limited to fires, floods, epidemics, abnormal weather conditions, acts of God, and other like matters.

# **ARTICLE 8 - BUYER'S RIGHTS**

- 8.01 Inspections and Testing
  - A. General:
    - 1. The Contract Documents specify required inspections and tests. Buyer shall have the right to perform, or cause to be performed, reasonable inspections and require reasonable tests of the Goods at Seller's facility, and at the Point of Destination. Seller shall allow Buyer a reasonable time to perform such inspections or tests.
    - 2. Seller shall reimburse Buyer for all expenses, except for travel, lodging<sub>≥</sub> and subsistence expenses of Buyer's and Engineer's representatives, for inspections and tests specified in the Contract Documents. If as the result of any such specified testing the Goods are determined to be non-conforming, then Seller shall also bear the travel, lodging, and subsistence expenses of Buyer's and Engineer's representatives, and all expenses of re-inspection or retesting.
    - 3. Buyer shall bear all expenses of inspections and tests that are not specified in the Contract Documents (other than any re-inspection or retesting resulting from a determination of non-conformity, as set forth in Paragraph 8.01.A.2 immediately above); provided, however, that if as the result of any such non-specified inspections or testing the Goods are determined to be non-conforming, then Seller shall bear all expenses of such inspections and testing, and of any necessary re-inspection and retesting.
    - 4. Seller shall provide Buyer timely written notice of the readiness of the Goods for all inspections, tests, or approvals which the Contract Documents specify are to be observed by Buyer prior to shipment.
    - 5. Buyer will give Seller timely notice of all specified tests, inspections, and approvals of the Goods which are to be conducted at the Point of Destination.
    - 6. If, on the basis of any inspections or testing, the Goods appear to be conforming, Buyer will give Seller prompt notice thereof. If on the basis of said inspections or testing, the Goods appear to be non-conforming, Buyer will give Seller prompt notice thereof and will advise Seller of the remedy Buyer elects under the provisions of Paragraph 8.02.
    - 7. Neither payments made by Buyer to Seller prior to any tests or inspections, nor any tests or inspections shall constitute acceptance of non-conforming Goods, or prejudice Buyer's rights under the Contract.

- B. Inspection on Delivery:
  - 1. Buyer or Engineer will visually inspect the Goods upon delivery solely for purposes of identifying the Goods and general verification of quantities and observation of apparent condition in order to provide a basis for a progress payment. Such visual inspection will not be construed as final or as receipt of any Goods and Special Services that, as a result of subsequent inspections and tests, are determined to be non-conforming.
  - 2. Within ten days of such visual inspection, Buyer shall provide Seller with written notice of Buyer's determination regarding conformity of the Goods. In the event Buyer does not provide such notice, it will be presumed that the Goods appear to be conforming and that Buyer has acknowledged their receipt upon delivery.
  - 3. If, on the basis of the visual inspection specified in Paragraph 8.01.B.1, the Goods appear to be conforming, Buyer's notice thereof to Seller will acknowledge receipt of the Goods.
- C. Final Inspection:
  - 1. After all of the Goods have been incorporated into the Project, tested in accordance with such testing requirements as are specified, and are functioning as indicated, Buyer or Engineer will make a final inspection.
  - 2. If, on the basis of the final inspection, the Goods are conforming, Buyer's notice thereof will constitute Buyer's acceptance of the Goods.
  - 3. If, on the basis of the final inspection, the Goods are non-conforming, Buyer will identify the non-conformity in writing.

### 8.02 Non-Conforming Goods and Special Services

- A. If, on the basis of inspections and testing prior to delivery, the Goods and Special Services are found to be non-conforming, or if at any time after Buyer has acknowledged receipt of delivery and before the expiration of the correction period described in Paragraph 8.03, Buyer determines that the Goods and Special Services are non-conforming, then Seller shall promptly, without cost to Buyer and in response to written instructions from Buyer, either correct such non-conforming Goods and Special Services, or, if Goods are rejected by Buyer, remove and replace the non-conforming Goods with conforming Goods, including all work required for reinstallation.
- B. Buyer's Rejection of Non-Conforming Goods:
  - 1. If Buyer elects to reject the Goods in whole or in part, Buyer's notice to Seller will describe in sufficient detail the non-conforming aspect of the Goods. If Goods have been delivered to Buyer, Seller shall promptly, and within the Contract Times, remove and replace the rejected Goods.
  - 2. Seller shall bear all costs, losses and damages attributable to the removal and replacement of the non-conforming Goods as provided in Paragraph 8.02.E.

- 3. Upon rejection of the Goods, Buyer retains a security interest in the Goods to the extent of any payments made and expenses incurred in their testing and inspection.
- C. Remedying Non-Conforming Goods and Special Services:
  - 1. If Buyer elects to permit the Seller to modify the Goods to correct the non-comformance, then Seller shall promptly provide a schedule for such modifications and shall make the Goods conforming within a reasonable time.
  - 2. If Buyer notifies Seller in writing that any of the Special Services are non-conforming, Seller shall promptly provide conforming services acceptable to Buyer. If Seller fails to do so, Buyer may delete the Special Services and reduce the Contract Price a commensurate amount.
- D. Buyer's Acceptance of Non-Conforming Goods:

Instead of requiring correction or removal and replacement of non-conforming Goods discovered either before or after final payment, Buyer may accept the non-conforming Goods. Seller shall bear all reasonable costs, losses, and damages attributable to Buyer's evaluation of and determination to accept such non-conforming Goods as provided in Paragraph 8.02.E.

- E. Seller shall pay all claims, costs, losses, and damages, including but not limited to all fees and charges for re-inspection, retesting and for any engineers, architects, attorneys and other professionals, and all court or arbitration or other dispute resolution costs arising out of or relating to the non-conforming Goods and Special Services. Seller's obligations shall include the costs of the correction or removal and replacement of the non-conforming Goods and the replacement of property of Buyer and others destroyed by the correction or removal and replacement of the non-conforming Goods, and obtaining conforming Special Services from others.
- F. Buyer's Rejection of Conforming Goods:

If Buyer asserts that Goods and Special Services are non-conforming and such Goods and Special Services are determined to be conforming, or if Buyer rejects as non-conforming Goods and Special Services that are later determined to be conforming, then Seller shall be entitled to reimbursement from Buyer of costs incurred by Seller in inspecting, testing, correcting, removing, or replacing the conforming Goods and Special Services, including but not limited to fees and charges of engineers, architects, attorneys and other professionals, and all court or arbitration or other dispute resolution costs associated with the incorrect assertion of nonconformance or rejection of conforming Goods and Special Services.

#### 8.03 Correction Period

A. Seller's responsibility for correcting all non-conformities in the Goods and Special Services will extend for a period of one year after the earlier of the date on which Buyer has placed the Goods in continuous service or the date of final payment, or for such longer period of time as may be

prescribed by Laws or Regulations or by the terms of any specific provisions of the Contract Documents.

## **ARTICLE 9 – ROLE OF ENGINEER**

#### 9.01 Duties and Responsibilities

A. The duties and responsibilities and the limitations of authority of Engineer are set forth in the Contract Documents.

#### 9.02 Clarifications and Interpretations

A. Engineer will issue with reasonable promptness such written clarifications or interpretations of the Contract Documents as Engineer may determine necessary, which shall be consistent with or reasonably inferable from the overall intent of the Contract Documents. Such written clarifications and interpretations will be binding on Buyer and Seller. If either Buyer or Seller believes that a written clarification or interpretation justifies an adjustment in the Contract Price or Contract Times, either may make a Claim therefor.

#### 9.03 Authorized Variations

A. Engineer may authorize minor deviations or variations in the Contract Documents by: 1) written approval of specific variations set forth in Shop Drawings when Seller has duly noted such variations as required in Paragraph 5.06.C.4, or 2) a Field Order.

### 9.04 Rejecting Non-Conforming Goods and Special Services

- A. Engineer will have the authority to disapprove or reject Goods and Special Services that Engineer believes to be non-conforming. Engineer will also have authority to require special inspection or testing of the Goods or Special Services as provided in Paragraph 8.01 whether or not the Goods are fabricated or installed, or the Special Services are completed.
- 9.05 Decisions on Requirements of Contract Documents
  - A. Engineer will be the initial interpreter of the Contract Documents and judge of the acceptability of the Goods and Special Services. Claims, disputes and other matters relating to the acceptability of the Goods and Special Services or the interpretation of the requirements of the Contract Documents pertaining to Seller's performance will be referred initially to Engineer in writing with a request for a formal decision in accordance with this paragraph.
  - B. When functioning as interpreter and judge under this Paragraph 9.05, Engineer will not show partiality to Buyer or Seller and will not be liable in connection with any interpretation or decision rendered in good faith in such capacity. The rendering of a decision by Engineer pursuant to this Paragraph 9.05 with respect to any such Claim, dispute, or other matter (except any which have been waived by the making or acceptance of final payment as provided in Paragraph 10.07) will be a condition precedent to any exercise by Buyer or Seller of such rights

or remedies as either may otherwise have under the Contract Documents or by Laws or Regulations in respect of any such Claim, dispute, or other matter.

#### 9.06 Claims and Disputes

- A. *Notice*: Written notice of each Claim relating to the acceptability of the Goods and Special Services or the interpretation of the requirements of the Contract Documents pertaining to either party's performance shall be delivered by the claimant to Engineer and the other party to the Agreement within 15 days after the occurrence of the event giving rise thereto, and written supporting data shall be submitted to Engineer and the other party within 45 days after such occurrence unless Engineer allows an additional period of time to ascertain more accurate data.
- B. *Engineer's Decision*: Engineer will review each such Claim and render a decision in writing within 30 days after receipt of the last submittal of the claimant or the last submittal of the opposing party, if any.
- C. If Engineer does not render a formal written decision on a Claim within the time stated in Paragraph 9.06.B., Engineer shall be deemed to have issued a decision denying the Claim in its entirety 31 days after receipt of the last submittal of the claimant or the last submittal of the opposing party, if any.
- D. Engineer's written decision on such Claim or a decision denying the Claim in its entirety that is deemed to have been issued pursuant to Paragraph 9.06.C, will be final and binding upon Buyer and Seller 30 days after it is issued unless within 30 days of issuance Buyer or Seller appeals Engineer's decision by initiating the mediation of such Claim in accordance with the dispute resolution procedures set forth in Article 13.
- E. If Article 13 has been amended to delete the mediation requirement, then Buyer or Seller may appeal Engineer's decision within 30 days of issuance by following the alternative dispute resolution process set forth in Article 13, as amended; or if no such alternative dispute resolution process has been set forth, Buyer or Seller may appeal Engineer's decision by 1) delivering to the other party within 30 days of the date of such decision a written notice of intent to submit the Claim to a court of competent jurisdiction, and 2) within 60 days after the date of such decision instituting a formal proceeding in a court of competent jurisdiction.
- F. No Claim for an adjustment in Contract Price or Contract Times will be valid if not submitted in accordance with this Paragraph 9.06.
- G. The parties agree to endeavor to avoid or resolve Claims through direct, good faith discussions and negotiations whenever practicable. Such discussions and negotiations should at the outset address whether the parties mutually agree to suspend the time periods established in this Paragraph 9.06; if so, a written record of such mutual agreement should be made and jointly executed.

### **ARTICLE 10 – PAYMENT**

#### 10.01 Applications for Progress Payments

- A. Seller shall submit to Buyer for Engineer's review Applications for Payment filled out and signed by Seller and accompanied by such supporting documentation as is required by the Contract Documents and also as Buyer or Engineer may reasonably require. The timing and amounts of progress payments shall be as stipulated in the Agreement.
  - 1. The first application for Payment will be submitted after review and approval by Engineer of all Shop Drawings and of all Samples required by the Contract Documents.
  - 2. The second Application for Payment will be submitted after receipt of the Goods has been acknowledged in accordance with Paragraph 8.01.B and will be accompanied by a bill of sale, invoice, or other documentation reasonably satisfactory to Buyer warranting that Buyer has rightfully received good title to the Goods from Seller and that, upon payment, the Goods will be free and clear of all liens. Such documentation will include releases and waivers from all parties with viable lien rights. In the case of multiple deliveries of Goods, additional Applications for Payment accompanied by the required documentation will be submitted as Buyer acknowledges receipt of additional items of the Goods.
- 10.02 Review of Applications for Progress Payments
  - A. Engineer will, within ten days after receipt of each Application for Payment, either indicate in writing a recommendation of payment and present the Application to Buyer, or return the Application to Seller indicating in writing Engineer's reasons for refusing to recommend payment. In the latter case, Seller may make the necessary corrections and resubmit the Application.
    - 1. Engineer's recommendation of payment requested in the first Application for Payment will constitute a representation by Engineer, based on Engineer's review of the Application for Payment and the accompanying data, that the Shop Drawings and Samples have been reviewed and approved as required by the Contract Documents and Seller is entitled to payment of the amount recommended.
    - 2. Engineer's recommendation of payment requested in the Application for Payment submitted upon Buyer's acknowledgment of receipt of the Goods will constitute a representation by Engineer, based on Engineer's review of the Application for Payment and the accompanying data Seller is entitled to payment of the amount recommended. Such recommendation will not constitute a representation that Engineer has made a final inspection of the Goods, that the Goods are free from non-conformities, acceptable or in conformance with the Contract Documents, that Engineer has made any investigation as to Buyer's title to the Goods, that exhaustive or continuous inspections have been made to check the quality or the quantity of the Goods beyond the responsibilities specifically assigned to Engineer in the Contract Documents or that there may not be other matters or issues between the parties that might entitle Seller to additional payments by Buyer or Buyer to withhold payment to Seller.

3. Engineer may refuse to recommend that all or any part of a progress payment be made, or Engineer may nullify all or any part of any payment previously recommended if, in Engineer's opinion, such recommendation would be incorrect or if on the basis of subsequently discovered evidence or subsequent inspections or tests Engineer considers such refusal or nullification necessary to protect Buyer from loss because the Contract Price has been reduced, Goods are found to be non-conforming, or Seller has failed to furnish acceptable Special Services.

# 10.03 Amount and Timing of Progress Payments

A. Subject to Paragraph 10.02.A., the amounts of the progress payments will be as provided in the Agreement. Buyer shall within 30 days after receipt of each Application for Payment with Engineer's recommendation pay Seller the amount recommended; but, in the case of the Application for Payment upon Buyer's acknowledgment of receipt of the Goods, said 30-day period may be extended for so long as is necessary (but in no event more than 60 days) for Buyer to examine the bill of sale and other documentation submitted therewith. Buyer shall notify Seller promptly of any deficiency in the documentation and shall not unreasonably withhold payment.

# 10.04 Suspension of or Reduction in Payment

- A. Buyer may suspend or reduce the amount of progress payments, even though recommended for payment by Engineer, under the following circumstances:
  - 1. Buyer has reasonable grounds to conclude that Seller will not furnish the Goods or the Special Services in accordance with the Contract Documents, and
  - 2. Buyer has requested in writing assurances from Seller that the Goods and Special Services will be delivered or furnished in accordance with the Contract Documents, and Seller has failed to provide adequate assurances within ten days of Buyer's written request.
- B. If Buyer refuses to make payment of the full amount recommended by Engineer, Buyer will provide Seller and Engineer immediate written notice stating the reason for such action and promptly pay Seller any amount remaining after deduction of the amount withheld. Buyer shall promptly pay Seller the amount withheld when Seller corrects the reason for such action to Buyer's satisfaction.

# 10.05 Final Application for Payment

A. After Seller has corrected all non-conformities to the reasonable satisfaction of Buyer and Engineer, furnished all Special Services, and delivered all documents required by the Contract Documents, Engineer will issue to Buyer and Seller a notice of acceptance. Seller may then make application for final payment following the procedure for progress payments. The final Application for Payment will be accompanied by all documentation called for in the Contract Documents, a list of all unsettled Claims, and such other data and information as Buyer or Engineer may reasonably require.
## 10.06 Final Payment

A. If, on the basis of final inspection and the review of the final Application for Payment and accompanying documentation, Engineer is reasonably satisfied that Seller has furnished the Goods and Special Services in accordance with the Contract Documents, and that Seller's has fulfilled all other obligations under the Contract Documents, then Engineer will, within ten days after receipt of the final Application for Payment, recommend in writing final payment subject to the provisions of Paragraph 10.07 and present the Application to Buyer. Otherwise, Engineer will return the Application to Seller, indicating the reasons for refusing to recommend final payment, in which case Seller shall make the necessary corrections and resubmit the Application for payment. If the Application and accompanying documentation are appropriate as to form and substance, Buyer shall, within 30 days after receipt thereof, pay Seller the amount recommended by Engineer, less any sum Buyer is entitled to set off against Engineer's recommendation, including but not limited to liquidated damages to which Buyer is entitled.

## 10.07 Waiver of Claims

- A. The making and acceptance of final payment will constitute:
  - 1. a waiver of all Claims by Buyer against Seller, except Claims arising from unsettled liens from non-conformities in the Goods or Special Services appearing after final payment, from Seller's failure to comply with the Contract Documents or the terms of any special guarantees specified therein, or from Seller's continuing obligations under the Contract Documents; and
  - 2. a waiver of all Claims by Seller against Buyer (other than those previously made in accordance with the requirements herein and listed by Seller as unsettled as required in Paragraph 10.05.A, and not resolved in writing).

## **ARTICLE 11 - CANCELLATION, SUSPENSION, AND TERMINATION**

## 11.01 Cancellation

- A. Buyer has the right to cancel the Contract, without cause, at any time prior to delivery of the Goods by written notice. Cancellation pursuant to the terms of this paragraph shall not constitute a breach of contract by Buyer. Upon cancellation:
  - 1. Buyer shall pay Seller for the direct costs incurred in producing any Goods that Seller has specially manufactured for the Project, plus a fair and reasonable amount for overhead and profit.
  - 2. For Goods that are not specially manufactured for the Project, Seller shall be entitled to a restocking charge of 10 percent of the unpaid Contract Price of such Goods.

## 11.02 Suspension of Performance by Buyer

A. Buyer has the right to suspend performance of the Contract for up to a maximum of ninety days, without cause, by written notice. Upon suspension under this paragraph, Seller shall be entitled

to an increase in the Contract Times and Contract Price caused by the suspension, provided that performance would not have been suspended or delayed for causes attributable to Seller.

### 11.03 Suspension of Performance by Seller

- A. Subject to the provisions of Paragraph 5.07.B, Seller may suspend the furnishing of the Goods and Special Services only under the following circumstance:
  - 1. Seller has reasonable grounds to conclude that Buyer will not perform its future payment obligations under the Contract; and,
  - 2. Seller has requested in writing assurances from Buyer that future payments will be made in accordance with the Contract, and Buyer has failed to provide such assurances within ten days of Seller's written request.

### 11.04 Breach and Termination

- A. Buyer's Breach:
  - 1. Buyer shall be deemed in breach of the Contract if it fails to comply with any material provision of the Contract Documents, including but not limited to:
    - a. wrongful rejection or revocation of Buyer's acceptance of the Goods,
    - b. failure to make payments in accordance with the Contract Documents, or
    - c. wrongful repudiation of the Contract.
  - 2. Seller shall have the right to terminate the Contract for cause by declaring a breach should Buyer fail to comply with any material provisions of the Contract. Upon termination, Seller shall be entitled to all remedies provided by Laws and Regulations.
    - a. In the event Seller believes Buyer is in breach of its obligations under the Contract, Seller shall provide Buyer with reasonably prompt written notice setting forth in sufficient detail the reasons for declaring that it believes a breach has occurred. Buyer shall have seven days from receipt of the written notice declaring the breach (or such longer period of time as Seller may grant in writing) within which to cure or to proceed diligently to cure such alleged breach.
- B. Seller's Breach:
  - 1. Seller shall be deemed in breach of the Contract if it fails to comply with any material provision of the Contract Documents, including, but not limited to:
    - a. failure to deliver the Goods or perform the Special Services in accordance with the Contract Documents,
    - b. wrongful repudiation of the Contract, or

- c. delivery or furnishing of non-conforming Goods and Special Services.
- 2. Buyer may terminate Seller's right to perform the Contract for cause by declaring a breach should Seller fail to comply with any material provision of the Contract Documents. Upon termination, Buyer shall be entitled to all remedies provided by Laws and Regulations.
  - a. In the event Buyer believes Seller is in breach of its obligations under the Contract, and except as provided in Paragraph 11.04.B.2.b, Buyer shall provide Seller with reasonably prompt written notice setting forth in sufficient detail the reasons for declaring that it believes a breach has occurred. Seller shall have seven days from receipt of the written notice declaring the breach (or such longer period of time as Buyer may grant in writing) within which to cure or to proceed diligently to cure such alleged breach.
  - b. If and to the extent that Seller has provided a performance bond under the provisions of Paragraph 4.01, the notice and cure procedures of that bond, if any, shall supersede the notice and cure procedures of Paragraph 11.04.B.2.a.

# **ARTICLE 12 – LICENSES AND FEES**

- 12.01 Intellectual Property and License Fees
  - A. Unless specifically stated elsewhere in the Contract Documents, Seller is not transferring any intellectual property rights, patent rights, or licenses for the Goods delivered. However, in the event the Seller is manufacturing to Buyer's design, Buyer retains all intellectual property rights in such design.
  - B. Seller shall pay all license fees and royalties and assume all costs incident to the use or the furnishing of the Goods, unless specified otherwise by the Contract Documents.
- 12.02 Seller's Infringement
  - A. Subject to Paragraph 12.01.A, Seller shall indemnify and hold harmless Buyer, Engineer and their officers, directors, members, partners, employees, agents, consultants, contractors, and subcontractors from and against all claims, costs, losses, damages, and judgments (including but not limited to all reasonable fees and charges of engineers, architects, attorneys and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to any infringement or alleged infringement of any United States or foreign patent or copyright by any of the Goods as delivered hereunder.
  - B. In the event of suit or threat of suit for intellectual property infringement, Buyer will promptly notify Seller of receiving notice thereof.
  - C. Seller shall promptly defend the claim or suit, including negotiating a settlement. Seller shall have control over such claim or suit, provided that Seller agrees to bear all expenses and to satisfy any adverse judgment thereof.

- 1. If Seller fails to defend such suit or claim after written notice by Buyer, Seller will be bound in any subsequent suit or claim against Seller by Buyer by any factual determination in the prior suit or claim.
- 2. If Buyer fails to provide Seller the opportunity to defend such suit or claim after written notice by Seller, Buyer shall be barred from any remedy against Seller for such suit or claim.
- D. If a determination is made that Seller has infringed upon intellectual property rights of another, Seller may obtain the necessary licenses for Buyer's benefit, or replace the Goods and provide related design and construction as necessary to avoid the infringement at Seller's own expense.

## 12.03 Buyer's Infringement

- A. Buyer shall indemnify and hold harmless Seller, and its officers, directors, partners, employees, agents, consultants, contractors, and subcontractors from and against all claims, costs, losses, damages, and judgments (including but not limited to all reasonable fees and charges of engineers, architects, attorneys and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to any infringement or alleged infringement of any United States or foreign patent or copyright caused by Seller's compliance with Buyer's design of the Goods or Buyer's use of the Goods in combination with other materials or equipment in any process (unless intent of such use was known to Seller and Seller had reason to know such infringement would result).
- B. In the event of suit or threat of suit for intellectual property infringement, Seller must after receiving notice thereof promptly notify Buyer.
- C. Upon written notice from Seller, Buyer shall be given the opportunity to defend the claim or suit, including negotiating a settlement. Buyer shall have control over such claim or suit, provided that Buyer agrees to bear all expenses and to satisfy any adverse judgment thereof.
  - 1. If Buyer fails to defend such suit or claim after written notice by Seller, Buyer will be bound in any subsequent suit or claim against Buyer by Seller by any factual determination in the prior suit or claim.
  - 2. If Seller fails to provide Buyer the opportunity to defend such suit or claim after written notice by Buyer, Seller shall be barred from any remedy against Buyer for such suit or claim.

## 12.04 *Reuse of Documents*

A. Neither Seller nor any other person furnishing any of the Goods and Special Services under a direct or indirect contract with Seller shall: (1) acquire any title to or ownership rights in any of the Drawings, Specifications, or other documents (or copies of any thereof) prepared by or bearing the seal of Engineer or its consultants, including electronic media versions; or (2) reuse any of such Drawings, Specifications, other documents, or copies thereof on any other project without written consent of Buyer and Engineer and specific written verification or adaptation by Engineer. This prohibition will survive termination or completion of the Contract. Nothing

herein shall preclude Seller from retaining copies of the Contract Documents for record purposes.

### 12.05 Electronic Data

- A. Unless otherwise stated in the Supplementary Conditions, copies of data furnished by Buyer or Engineer to Seller, or by Seller to Buyer or Engineer that may be relied upon are limited to the printed copies (also known as hard copies). Files in electronic media format of text, data, graphics, or other types are furnished only for the convenience of the receiving party. Any conclusion or information obtained or derived from such electronic files will be at the user's sole risk. If there is a discrepancy between the electronic files and the hard copies, the hard copies govern.
- B. Because data stored in electronic media format can deteriorate or be modified inadvertently or otherwise without authorization of the data's creator, the party receiving electronic files agrees that it will perform acceptance tests or procedures within 60 days, after which the receiving party shall be deemed to have accepted the data thus transferred. The transferring party will correct any errors detected within the 60-day acceptance period.
- C. When transferring documents in electronic media format, the transferring party makes no representations as to long term compatibility, usability, or readability of documents resulting from the use of software application packages, operating systems, or computer hardware differing from those used by the data's creator.

## **ARTICLE 13 – DISPUTE RESOLUTION**

## 13.01 Dispute Resolution Method

- A. Either Buyer or Seller may initiate the mediation of any Claim decided in writing by Engineer under Paragraph 9.06.B or 9.06.C before such decision becomes final and binding. The mediation will be governed by the Construction Industry Mediation Rules of the American Arbitration Association in effect as of the Effective Date of the Agreement. The request for mediation shall be submitted in writing to the American Arbitration Association and the other party to the Contract. Timely submission of the request shall stay the Engineer's decision from becoming final and binding.
- B. Buyer and Seller shall participate in the mediation process in good faith. The process shall be concluded within 60 days of filing of the request. The date of termination of the mediation shall be determined by application of the mediation rules referenced above.
- C. If the mediation process does not result in resolution of the Claim, then Engineer's written decision under Paragraph 9.06.B or a denial pursuant to Paragraph 9.06.C shall become final and binding 30 days after termination of the mediation unless, within that time period, Buyer or Seller:
  - 1. elects in writing to invoke any dispute resolution process provided for in the Supplementary Conditions, or

- 2. agrees with the other party to submit the Claim to another dispute resolution process, or
- 3. if no dispute resolution process has been provided for in the Supplementary Conditions, delivers to the other party written notice of the intent to submit the Claim to a court of competent jurisdiction, and within 60 days of the termination of the mediation institutes such formal proceeding.

## **ARTICLE 14 – MISCELLANEOUS**

## 14.01 *Giving Notice*

A. Whenever any provision of the Contract Documents requires the giving of written notice, it will be deemed to have been validly given if: 1) delivered in person to the individual or to a member of the firm or to an officer of the corporation for whom it is intended, or 2) if delivered at or sent by registered or certified mail, postage prepaid, to the last business address known to the giver of the notice.

## 14.02 Controlling Law

- A. This Contract is to be governed by the law of the state in which the Point of Destination is located.
- B. In the case of any conflict between the express terms of this Contract and the Uniform Commercial Code, as adopted in the state whose law governs, it is the intent of the parties that the express terms of this Contract shall apply.

### 14.03 *Computation of Time*

A. When any period of time is referred to in the Contract Documents by days, it will be computed to exclude the first and include the last day of such period. If the last day of any such period falls on a Saturday or Sunday or on a day made a legal holiday by the law of the applicable jurisdiction, such day shall be omitted from the computation.

## 14.04 *Cumulative Remedies*

A. The duties and obligations imposed by these General Conditions and the rights and remedies available hereunder to the parties hereto are in addition to, and are not to be construed in any way as a limitation of, any rights and remedies available to any or all of them which are otherwise imposed or available by Laws or Regulations, by special warranty or guarantee, or by other provisions of the Contract Documents, and the provisions of this paragraph will be as effective as if repeated specifically in the Contract Documents in connection with each particular duty, obligation, right, and remedy to which they apply.

## 14.05 Survival of Obligations

A. All representations, indemnifications, warranties and guarantees made in, required by, or given in accordance with the Contract Documents, as well as all continuing obligations indicated in the Contract Documents, will survive final payment, completion, and acceptance of the Goods and Special Services and termination or completion of the Agreement.

- 14.06 Entire Agreement
  - A. Buyer and Seller agree that this Agreement is the complete and final agreement between them, and supersedes all prior negotiations, representations, or agreements, either written or oral. This Agreement may not be altered, modified, or amended except in writing signed by an authorized representative of both parties.

### SECTION P-00800

### PROCUREMENT SUPPLEMENTAL GENERAL CONDITIONS

<u>Article</u>	<u>Title</u>	<u>Page No.</u>
1	Definitions and Terminology	
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4	Bonds and Insurance	
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Exhibit 1	No. List of Exhibits	
1	State Prevailing Wage Rate Determination Federal Wage Rates	
2	List of Debarred Subcontractors and Contractors	
3	Davis Bacon Act – Labor Standard Provisions for Federall USEPA Attachment 6 – Requirements for Subrecipients th	y Assisted at are Government Entities
4	Contract Modification Proposal and Acceptance 4 pages	
5	NJAC 7:22-9 and NJAC 7:22-10.11, 12 15 pages	
6	SED Participation Building Phase Quarterly Report (Form	OEO-002)
7	SED participation Monthly Progress Report (Form OEO-0	03)
8	PVSC SED Utilization Plan	
9	NJAC 7:14.2	
10	NJSA 2A: 44-143, 144	

### SECTION P-00800

### PROCUREMENT SUPPLEMENTAL GENERAL CONDITIONS

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#### SECTION P-00800

### PROCUREMENT SUPPLEMENTAL GENERAL CONDITIONS

These Supplemental General Conditions amend or supplement the Standard General Conditions of the Construction Contract (No. P-00700, 2010 Edition) given as Specification Section 00700 and other provisions of the Contract Documents as indicated below. All provisions that are not so amended or supplemented remain in full force and effect.

#### ARTICLE 1 – DEFINITIONS AND TERMINOLOGY

Add the following Section at the beginning of this Article:

- 1.00 Terms
  - A. The terms used in these Supplemental General Conditions which are defined in the Standard General Conditions of the Construction Contract (No. P-00700, 2010 Edition) given as Specification Section 00700 have the meanings assigned to them in the General Conditions.
- 1.01 Defined Terms

Definition 12. Delete in its entirety and replace with the following:

"Those items so designated in the Agreement. Only printed or hard copies of the items listed in the Agreement are Contract Documents. Files in electronic media format of text, data, graphics, and the like are not Contract Documents, and may not be relied on by Seller. Shop Drawings and other Seller submittals are not Contract Documents, even if accepted or reviewed by Engineer or Buyer."

Definition 16. Omit the word "two".

Definition 17. Delete in its entirety and replace with the following:

"The individual or entity designated as such in the Agreement. The terms Engineer and ENGINEER are interchangeable and shall have the same meaning in the Contract Documents."

Add the following new definitions:

- "37. *Conditions of the Contract* The combined General Conditions and Supplemental General Conditions.
- 38. assignee The terms "assignee" and "Installation Contractor" are interchangeable and shall have the same meaning in the Contract Documents.
- 39. Contractor The individual or entity with whom Buyer has entered into the Agreement. The terms Seller, Contractor, and CONTRACTOR are interchangeable and shall have the same meaning in the Contract Documents.

- 40. Designated System Supplier (DSS) The individual or entity with whom Buyer has entered into the Agreement. The terms Seller, Contractor, CONTRACTOR, and Designated System Supplier are interchangeable and shall have the same meaning in the Contract Documents.
- 41. Installation Contractor The individual or entity with whom Buyer has entered into an agreement to install the Goods.
- 42. Owner The individual or entity with whom Seller has entered into the Agreement and for whom the Goods and Special Services are to be performed. The terms Buyer, Owner and OWNER are interchangeable and shall have the same meaning in the Contract Documents.
- 43. Subcontractor An individual or entity having a direct contract with Seller or with any other Subcontractor for the performance of a part of the Goods and Special Services.
- 44. Submittal All drawings, diagrams, illustrations, schedule, and other data or information which are specifically prepared or assembled by or for Seller and submitted by Seller to illustrate some portion of the Goods and Special Services. The terms Shop Drawing and Submittal are interchangeable and shall have the same meaning in the Contract Documents.
- 45. Typ, (Typ), (TYP) The term "Typ", "(Typ)" or "(TYP)", when used in the Contract Documents is the abbreviation of the word typical: used to label a feature that is to be interpreted as exactly the same as nearby comparable features
- 46. Unit Price Work Work to be paid for on the basis of unit prices.
- 47. without exception The term "without exception", when used in the Contract Documents following the name of a proprietary item of equipment, product, or material, shall mean that the sources of the product are limited to the listed manufacturers or products and that no like, equivalent, or "or-equal" item and no substitution will be permitted.

### ARTICLE 2 – PRELIMINARY MATTERS

Add the following Section to the beginning of this Article:

- "2.00 *Execution of Agreement* 
  - A. At least six counterparts of the Agreement will be executed and delivered by the SELLER to the BUYER within ten (10) working days of the Notice of Award and receipt of Contract Documents by the SELLER for execution; and thereafter BUYER will execute and deliver one counterpart to SELLER."
- 2.04 Commencement of Contract Times; Notice to Proceed

Delete in its entirety and substitute the following:

- "A. Except as otherwise provided in (ii) hereinafter, the Contract Time will commence to run on the day indicated in the Notice to Proceed; but in no event will the Contract Time commence to run later than the sixtieth day after the day of Bid opening or the thirtieth day after the Effective Date of the Agreement. By mutual consent of the parties to the Contract, these time limits may be changed.
- B. Notwithstanding the provisions of subsection (i) above, if award of the Bid is challenged, and the BUYER determines that a hearing is required on the challenge, or a Court or governmental entity having jurisdiction issues a stay of the award or performance of the Contract, the Contract Time and Effective Date of the Agreement shall be stayed for the time necessary for BUYER to conduct a hearing and make a determination on the challenge and/or the time that the Contract award or performance are stayed by a Court or governmental entity having jurisdiction, not to exceed an additional 180 days."

### 2.07 *Preliminary Conference*

Delete in its entirety and substitute the following:

"A. Within ten (10) days after the Contract Times start to run, but before any Work a conference shall be attended by, but without limitations to, the following: SELLER, BUYER, ENGINEER and other as appropriate will be held to establish a working understanding among the parties as to the Goods and Special Services and to discuss the schedule referred to in Paragraph 2.06.A, procedures for handling Shop Drawings and other submittals, processing Applications for Payment, and maintaining required records."

### ARTICLE 3- CONTRACT DOCUMENTS: INTENT, AMENDING AND REUSE

3.01 Intent

Add the following subparts to Part A:

- "1. Each and every provision of law and clause required by law to be inserted in these Contract Documents shall be deemed to be inserted herein, and they shall be read and enforced as though it were included herein, and if through mistake or otherwise, any such provision is not inserted, or if not correctly inserted, then upon the application of either party, the Contract Documents shall forthwith be physically amended to make such insertion.
- 2. The Contract Documents indicate the extent and general arrangement of the work. It is the intent of the Contract Documents to obtain an operable Project. Equipment, components, systems, etc., therein shall be made operable by the SELLER.
- 3. The Contract Drawings may be supplemented from time to time with additional drawings by the ENGINEER as may be required to illustrate the work or, as the work progresses, with additional Drawings, by the SELLER, subject to the approval of the ENGINEER. Supplementary Drawings, when issued by the

ENGINEER or by the SELLER, after approval by the ENGINEER, shall be furnished in sufficient quantity to all those who, in the opinion of the ENGINEER, are affected by such Drawings."

3.03 *Reporting and Resolving Discrepancies.* 

Add the following to subpart A. 3 succeeding "thereof"

"or should have known."

#### ARTICLE 4 – BONDS AND INSURANCE

4.01 *Performance, Payment, and Other Bonds* 

Part A: Add the following after "payment bonds" in the first line:

"within ten (10) working days of Notice of Award".

Delete the second sentence and replace with the following:

"The Performance Bond shall remain in effect until completion and acceptance by the BUYER as specified in paragraph 10.05".

Delete Article 4.02 in its entirety and substitute the following:

- 4.02 *Certificates of Insurance* 
  - A. Seller shall deliver to Buyer, with copies to each additional insured identified in the Procurement Supplementary Conditions, certificates of insurance (and other evidence of insurance requested by Buyer or any other additional insured) which Seller is required to purchase and maintain.
  - B. Failure of Buyer to demand such certificates or other evidence of Seller's full compliance with these insurance requirements or failure of Buyer to identify a deficiency in compliance from the evidence provided shall not be construed as a waiver of Seller's obligation to maintain such insurance.
  - C. Upon assignment of this Contract, Seller shall comply with the written request of assignee to provide certificates of insurance to assignee.
  - D. Buyer does not represent that insurance coverage and limits established in this Contract necessarily will be adequate to protect Seller.
  - E. The insurance and insurance limits required herein shall not be deemed as a limitation on Seller's liability under the indemnities granted to Buyer in the Contract Documents
  - F. Wherever in this Article the terms "The Insured" and BUYER occurs with respect to coverage in a policy, it shall mean the BUYER and its agent and agencies, all municipalities where work is being performed under the contract, the ENGINEER, and any other parties specifically designated below, who shall be named as insured in each policy issued. The insurance policies required herein shall not contain any Third Party Beneficiary Exclusion. The State of New

Jersey and its venues, employees and officers shall be named insured on each certificate of Insurance."

Delete Article 4.03 in its entirety and substitute the following:

- 4.03 License Sureties and Insurers
- A. All Bonds and insurance required by the Contract Documents to be purchased and maintained by Seller shall be obtained from surety or insurance companies that are duly licensed or authorized in the jurisdiction in which the Project is located to issue Bonds or insurance policies for the limits and coverage's so required. Such surety and insurance companies shall also meet such additional requirements and qualifications as may be provided in the Procurement Supplementary Conditions.

Add the following sections to this Article

- 4.04 *Seller's Liability Insurance* 
  - A. The policies of insurance so required by this Paragraph 4.04 to be purchased and maintained shall:
    - 1. Include at least the specific coverage's and be written for not less than the limits of liability specified or required by Laws or Regulations, whichever is greater;
    - 2. Include contractual liability insurance covering Seller's indemnity obligations under Paragraph 5.09;
    - 3. Contain a provision or endorsement that the coverage afforded will not be canceled, materially changed or renewal refused until at least 30 days prior written notice has been given to Buyer and Seller and to each other additional insured to whom a certificate of insurance has been issued (and the certificates of insurance furnished by the Seller pursuant to Paragraph 4.03 shall so provide);
    - 4. Remain in effect at least until final payment and at all times thereafter when Seller may be correcting, removing, or replacing non-conforming Goods and Special Services in accordance with Paragraph 8.02;
    - 5. Contain a cross liability or severability of interest clause or endorsement. Insurance covering the specified additional insureds shall be primary insurance, and all other insurance carried by the additional insured's shall be excess insurance; and
    - 6. With respect to workers' compensation and employers' liability, comprehensive automobile liability, commercial general liability, and umbrella liability insurance, and all other liability insurance specified herein to be provided by Seller, Seller shall require its insurance carriers to waive all rights of subrogation against Buyer, Engineer, and their respective officers, directors, partners, employees, and agents.
  - B. Worker's Compensation and Employer's Liability Insurance. This insurance shall protect Seller against all claims under applicable state workers' compensation laws, including coverage as necessary for the benefits provided under the United States Longshoremen's and Harbor Workers' Act and the Jones Act. Seller shall also be protected against claims for injury, disease, or death of employees which, for any reason, may not fall within the provisions of a workers' compensation law. This policy shall include an "all states" or "other states" endorsement.

The liability limits shall be not less than:

Workers' compensationStatutoryEmployers' liability\$2,000,000 each occurrence

C. Comprehensive Automobile Liability Insurance. This insurance shall be occurrence type, written in comprehensive form, and shall protect Seller, and Buyer and Engineer as additional insureds, against all claims for injuries to members of the public and damage to property of others arising from the use of motor vehicles, either on or off the Project site whether they are owned, non-owned, or hired.

The liability limits shall be not less than:

Bodily Injury:	\$1,000,000 Each Person \$2,000,000 Each Accident
Property Damage:	\$1,000,000 Each Occurrence

D. Commercial General Liability Insurance. This insurance shall be occurrence type, written in comprehensive form, and shall protect Seller, and Buyer and Engineer as additional insureds, against claims arising from injuries, sickness, disease, or death of any person or damage to property arising out of the furnishing of the Goods and Special Services. The policy shall also include a per project aggregate limit endorsement, personal injury liability coverage, contractual liability coverage, completed operations and products liability coverage.

The liability limits shall be not less than:

Bodily Injury:	\$2,000,000 Each Occurrence \$2,000,000 Annual Aggregate
Property Damage*:	\$1,000,000 Each Occurrence \$2,000,000 Annual Aggregate

\*Property Damage shall include Explosion, Collapse and Underground Coverages. Property Damage shall include property in the care, custody and control of the insured.

Personal Injury, with employment \$2,000,000 Annual Aggregate exclusion deleted:

E. Umbrella Liability Insurance. This insurance shall protect Seller, and Buyer and Engineer as additional insureds, against claims in excess of the limits provided under workers' compensation and employers' liability, comprehensive automobile liability, and commercial general liability policies. The umbrella policy shall follow the form of the primary insurance, including the application of the primary limits.

The liability limits shall be not less than:

Bodily injury and property damage:	\$5,000,000 combined single limit for each occurrence
	\$5,000,000 general aggregate

F. Professional Liability Insurance: This insurance shall be required only in cases where the Contract Documents specifically require that Seller provide for design services to be performed by a professional engineer with appropriate expertise in accordance with applicable laws and regulations, licensed or registered in the State of New Jersey, and that the Shop Drawings or other evidence of design bear the seal and signature of that professional engineer. This insurance shall provide protection against claims arising out of performance of professional design services and caused by a negligent error, omission, or act for which the insured party is legally liable; such professional liability insurance shall provide coverage in the amount of \$3,000,000 and shall be maintained throughout the duration of the Project and for one year after final payment. In the event that the professional design services are performed by an independent consultant or Subcontractor engaged by Seller, this insurance shall be furnished and maintained by the independent consultant or Subcontractor. In the event that the professional design services are performed by a member of Seller's organization, this insurance shall be furnished and maintained by Seller.

A certificate of insurance for such professional liability insurance coverage, including the amount, duration, and name of the insured party, shall be delivered to Buyer and Engineer.

G. Transportation Insurance: This insurance shall be of the "all risks" type and shall protect Subcontractor and shall include the Indemnified Parties as insureds from all insurable risks of physical loss or damage to Goods in transit until receipt, off-loaded and placed at the Point of Destination. The coverage amount shall be not less than one-hundred and twenty percent of the commercial invoice value of the Goods shipped. Transportation insurance shall provide for losses to be payable to Subcontractor and Buyer as their interests may appear.

### 4.05 *Acceptance of Bonds and Insurance; Option to Replace.*

A. If Buyer has any objection to the coverage afforded by or other provisions of the Bonds or insurance required to be purchased and maintained by Seller in accordance with Article 4 on the basis of non-conformance with the Contract Documents, the Buyer shall so notify the Seller in writing within 10 days after receipt of the certificates (or other evidence requested) required by Paragraphs 2.01.A and 2.02.A. Seller shall provide to the Buyer such additional information in respect of insurance provided as the Buyer may reasonably request. If Seller does not purchase or maintain all of the Bonds and insurance required of Buyer by the Contract Documents, Buyer shall notify the Seller in writing of such failure to purchase prior to the start of the Contract, or of such failure to maintain prior to any change in the required coverage. Without prejudice to any other right or remedy, the Buyer may elect to obtain equivalent Bonds or insurance to protect Buyer's interests at the expense of the Seller who was required to provide such coverage, and a Change Order shall be issued to adjust the Contract Price accordingly.

### ARTICLE 5 – SELLER'S RESPONSIBILITIES

#### 5.01 Supervision and Superintendence

#### Add the following:

"B. SELLER will be held responsible for the conduct of all personnel on site employed by or through Contract. SELLER shall employ only competent persons to perform the work of this contract. Whenever BUYER shall notify SELLER, in writing, that any person on the work, including superintendents and other Supervisors, appears to be incompetent, disorderly, or who disregards the authority of the ENGINEER and/or BUYER, or is otherwise unsatisfactory, such person shall be removed from the Project within the time frame specified by the BUYER, and shall not again be employed on it except with the consent of BUYER."

#### 5.02 *Labor, Materials and Equipment*

Add the following to subpart B:

"4. Any and all applicable technical bulletins issued by the Original Equipment Manufacturers of the Goods, prior to the delivery of the Goods at the Point of Destination, shall be implemented by the SELLER through the Original Equipment Manufacturer at no additional expense to the BUYER."

#### 5.03 Laws and Regulations

Delete Part B in its entirety and substitute the following:

"B. If SELLER observes that the Specifications or Drawings are at variance with any Laws or Regulations, he shall give ENGINEER prompt written notice thereof. If SELLER performs any work knowing it to be contrary to such Laws or Regulations, and without such notice to ENGINEER, he shall bear all costs arising therefrom. The SELLER shall, at all times, observe and comply with and shall cause all his agents and employees and all his Subcontractors to observe and comply with all such existing Laws or Regulations, and shall protect and indemnify the BUYER and the ENGINEER and the municipalities in which work is being performed, and their officers and agents against any claim or liability arising from or based on the violation of any such Law or Regulation, whether by himself or his employees or any of his Subcontractors."

Add the following paragraph:

"D. The SELLER shall keep itself fully informed of all existing and future state and Federal Laws and Regulations and Municipal Ordinances and Regulations, in any manner affecting the work and the persons engaged or employed in the work, or the materials used in the work, or in any affecting the performance of the work, either with respect to hours of labor or otherwise, and of all such laws, ordinances, regulations, orders and decrees, and shall protect and indemnify BUYER and their officers and agents against any claims or liability arising from or based on the violation of any such law, ordinance, regulation, order or decree, whether by itself, or by its agents or employees." Add the following paragraph:

"E. Funding Agency Requirements. Seller will be required to comply with Title VI of the Civil Rights Act of 1964, the Davis-Bacon Act, the Copeland (Anti-Kickback) Act, and the Contract Work Hours and Safety Standards Act. Seller will be required to comply with the President's Executive Order 11246 of September 24, 1965, as amended."

#### 5.04 Or Equals

Delete Paragraph 5.04.A in its entirety and substitute the following:

- "A. Whenever the Goods, or an item of material or equipment to be incorporated into the Goods is specified or described in the Contract Documents by using the name of a proprietary item or the name of a particular supplier or manufacturer, the specification or description is intended to establish the type, function, appearance, and quality required. Unless the specification or description contains or is followed by words reading without exception or that no like, equivalent, or "or-equal" item is permitted, other items of material or equipment or material or equipment of other manufacturers may be submitted to Buyer for Engineer's review.
  - 1. If in Engineer's sole discretion, such an item of material or equipment proposed by Seller is functionally equal to that named and sufficiently similar so that no change in related work will be required, it may be considered by Engineer as an "or-equal" item.
  - 2. For the purposes of this paragraph, a proposed item of material or equipment may be considered functionally equal to an item so named only if:
    - a. in the exercise of reasonable judgment, Engineer determines that: 1) it is at least equal in quality, durability, appearance, strength, and design characteristics; 2) it will reliably perform at least equally well the function imposed by the design concept of the completed Project as a functioning whole; 3) it has an acceptable record of performance and availability of responsive service; and
    - b. Seller certifies that if accepted: 1) there will be no increase in any cost including capital, installation or operating costs, to Buyer; and 2) the proposed item will conform substantially to the detailed requirements of the item named in the Contract Documents."

Delete Paragraph 5.04.B in its entirety and substitute the following:

"B. Engineer's Evaluation: Engineer will be allowed a reasonable time within which to evaluate each proposal or submittal made pursuant to Paragraph 5.04.A. Engineer will be the sole judge of whether to accept or reject such a proposal or submittal. No "or-equal" will be ordered, manufactured or utilized until Engineer's review is complete, which will be evidenced by an accepted Shop Drawing. Engineer will advise Buyer and Seller in writing of any negative determination. Notwithstanding Engineer's acceptance of an "or-equal" item, Seller shall remain obligated to comply with the requirements of the Contract Documents."

### 5.05 Taxes

Add the following to Part A:

"The materials and supplies to be used in the work of this contract are exempt from Federal sales tax and sales tax of the State of New Jersey. SELLER shall obtain the proper certificates, maintain the necessary records and otherwise comply with the requirements of state law."

5.06 Shop Drawings and Samples

Delete Paragraph 5.06 in its entirety and substitute the following:

"Requirements for Shop Drawings, Samples and submittal procedures shall be as specified in the Technical Supplemental Specifications, Q500 – Shop Drawing and Instruction Manuals."

5.08 Sellers's Warranties and Guarantees

Delete Paragraph 5.08.B in its entirety and substitute the following:

"Seller warrants and guarantees to Buyer that all Goods and Special Services will conform with the Contract Documents, and with the standards established by any Samples accepted by Engineer. Engineer shall be entitled to rely on representation of Seller's warranty and guarantee. If the Contract Documents do not otherwise specify the characteristics or the quality of the Goods, the Goods shall comply with the requirements of Paragraph 5.02.B."

Add the following paragraph:

"G. Seller shall provide a minimum 365 day warranty from the time the Goods achieve Completion or a minimum 1,825 day warranty from the Goods date of shipment, whichever occurs first."

### 5.09 Indemnification

Delete Part A in its entirety and substitute the following:

"A. To the fullest extent permitted by Laws and Regulations, and except for the willful misconduct of BUYER, SELLER shall indemnify and hold harmless BUYER, ENGINEER, ENGINEER's Consultants and the officers, directors, employees, agents consultants, contractors and subcontractors of each and any of them from and against all claims, costs, losses and damages (including but not limited to all fees and charges of engineers, architects, attorneys and other professionals and all court or arbitration of other dispute resolution costs including appeals) caused by, arising out of or relating to the performance of SELLER's obligations under the Contract Documents, provided that any such claim, cost, loss or damage is caused in whole or in part by any negligent act or omission of the SELLER, or any individual or

entity directly or indirectly employed by SELLER or anyone for whose acts SELLER may be liable."

Add the following new Paragraphs as follows:

- "C. The indemnification obligations of Seller under Paragraph 5.09.A shall not extend to the liability of Engineers and Engineer's officers, directors, partners, employees, agents, and consultants arising out of:
  - 1. the preparation or acceptance of, or the failure to prepare or accept, maps, Drawings, opinions, reports, surveys, Change Orders, designs, or Specifications; or
  - 2. giving directions or instructions, or failing to give them, if that is the primary cause of the injury or damage.
- D. Wherever in this Agreement a provision imposes upon the SELLER an obligation of indemnification, that obligation shall be as set forth in the preceding paragraphs of this provision. SELLER acknowledges that it is the intent of the parties that any indemnification obligation imposed upon SELLER pursuant to any provision of this Agreement shall be the broadest called for under this Agreement.
- E. Nothing in the Contract Documents shall create or give to third parties any claim or right of action against the SELLER, the BUYER or the ENGINEER beyond such as may legally exist irrespective of the Contract."
- 5.10 Delegation of Professional Design Services

Delete Paragraph 5.10 in its entirety and substitute the following:

- "5.10 Delegation of Professional Design Services:
  - A. Seller will not be required to provide professional design services unless such services are specifically required by the Contract Documents or unless such services are required to carry out Seller's responsibilities for furnishing the Goods and Special Services. Seller shall not be required to provide professional services in violation of applicable law.
  - B. If professional design services or certifications by a design professional related to the Goods and Special Services are specifically required of Seller by the Contract Documents, Buyer and Engineer will specify all performance and design criteria that such services must satisfy or will provide reports and/or drawings from which design criteria can be derived by the Seller. Seller shall cause such services or certifications to be provided by a properly licensed professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, Shop Drawings and other submittals prepared by such professional. Shop Drawings and other submittals related to the Goods and Special Services designed or certified by such professional, if prepared by others, shall bear such professional's written approval when submitted to Engineer.

- C. Buyer and Engineer shall be entitled to rely upon the adequacy, accuracy and completeness of the services, certifications or approvals performed by such design professionals, provided Buyer and Engineer have specified to Seller all performance and design criteria that such services must satisfy or provided to the Seller sufficient information in reports and/or on drawings to derive the design criteria.
- D. Pursuant to this Paragraph 5.10, Engineer's review and acceptance of signed and sealed certifications of performance and design criteria used when designing systems, materials, or equipment and design calculations and design drawings will be only for the limited purpose of checking for conformance with performance and design criteria and the design concept set forth in the Contract Documents. Where the Seller has derived design criteria from reports and/or drawings, the Engineer's review will be for the limited purpose of checking for conformance with the design concept expressed in the Contract Documents. Engineer's review and acceptance of Shop Drawings and other submittals (except performance and design criteria and design calculations and design drawings) will be only for the purpose stated in the Submittals Procedures section."

Add the following section to this Article

### "5.11 Concerning Subcontractors, Manufacturers and Others

- A. Seller shall not employ any Subcontractor, manufacturer, or other individual or entity, whether initially or as a replacement, against whom Buyer may have reasonable objection. Seller shall not be required to employ any Subcontractor, manufacturer, or other individual or entity to furnish or perform any of the Goods and Special Services against whom Seller has reasonable objection.
- B. Seller shall be fully responsible to Buyer and Engineer for all acts and omissions of the Subcontractors, manufacturers, and other individuals or entities performing or furnishing any of the Goods and Special Services just as Seller is responsible for Seller's own acts and omissions. Nothing in the Contract Documents:
  - 1. shall create for the benefit of any such Subcontractor, manufacturer, or other individual or entity any contractual relationship between Buyer or Engineer and any such Subcontractor, manufacturer, or other individual or entity, nor
  - shall anything in the Contract Documents create any obligation on the part of Buyer or Engineer to pay or to see to the payment of any moneys due any such Subcontractor, manufacturer, or other individual or entity except as may otherwise be required by Laws and Regulations.
  - C. Seller shall be solely responsible for scheduling and coordinating the Goods and Special Services of Subcontractors, manufacturers, and other individuals or entities performing or furnishing any of the Goods and Special Services under a direct or indirect contract with Seller.
  - D. Seller shall require all Subcontractors, manufacturers, and such other individuals or entities performing or furnishing any of the Goods and Special Services to communicate with Buyer and Engineer only through Seller.

- E. The divisions and sections of the Specifications and the identifications of any Drawings shall not control Seller in dividing the Goods and Special Services among Subcontractors or manufacturers or delineating the Goods and Special Services to be performed by any specific trade.
- F. All Goods and Special Services performed for Seller by a Subcontractor or manufacturer will be pursuant to an appropriate agreement between Seller and the Subcontractor or manufacturer which specifically binds the Subcontractor or manufacturer to the applicable terms and conditions of the Contract Documents for the benefit of Buyer and Engineer."

### ARTICLE 6 – SHIPPING AND DELIVERY

6.03 *Risk of Loss* 

Delete Paragraph 6.03.A in its entirety and substitute the following:

"A. Risk of loss and insurable interests transfer from Seller to Buyer upon Buyer's receipt of the Goods at the Point of Destination. In the event Goods are placed into Storage, Seller shall be responsible for Risk of Loss for the duration Goods are in Storage upon Buyer's receipt of Goods at the Point of Destination."

### ARTICLE 7 – CHANGES: SCHEDULE AND DELAY

7.01 *Changes in the Goods and Special Services* 

Add the following paragraphs:

- "D. Where the Contract Documents provide that all or part of the Work is to be Unit Price Work, initially the Contract Price will be deemed to include for all Unit Price Work an amount equal to the sum of the unit price for each separately identified item of Unit Price Work times the estimated quantity of each item as indicated in the Agreement.
- E. The estimated quantities of items of Unit Price Work are not guaranteed and are solely for the purpose of comparison of Bids and determining an initial Contract Price. Determinations of the actual quantities and classifications of Unit Price Work performed by SELLER will be made by ENGINEER.
- F. Each unit price will be deemed to include an amount considered by SELLER to be adequate to cover SELLER's overhead and profit for each separately identified item.
- G. BUYER or SELLER may make a Claim for an adjustment in the Contract Price if:
  - 1. the quantity of any item of Unit Price Work performed by SELLER differs by more than plus or minus twenty percent (20%) from the estimated quantity of such item indicated in the Agreement; and
  - 2. there is no corresponding adjustment with respect to any other item of Work; and

3. SELLER believes that SELLER is entitled to an increase in Contract Price as a result of having incurred additional expense or BUYER believes that BUYER is entitled to a decrease in Contract Price and the parties are unable to agree as to the amount of any such increase or decrease."

#### 7.02 Changing Contract Price or Contract Times

Add the following to the end of Part B:

"SELLER certifies that this claim is made in good faith, that the supporting data are accurate and complete to the best of SELLER's knowledge and belief, and that the amount or time requested accurately reflects the contract adjustment for which SELLER believes BUYER is liable."

#### ARTICLE 8 – BUYER'S RIGHTS

8.03 *Correction Period* 

Add the following paragraph:

"B. Nothing in this Article 8 concerning the correction period shall establish a period of limitation with respect to any other obligation which Seller has under the Contract Documents. The establishment of time periods relates only to the specific obligations of Seller to correct the Goods and Special Services, and has no relationship to the time within which Seller's obligations under the Contract Documents may be sought to be enforced, nor to the time within which proceedings may be commenced to establish Seller's liability with respect to Seller's obligations other than to specifically correct the Goods and Special Services."

### ARTICLE 9 – ROLE OF ENGINEER

#### 9.01 *Duties and Responsibilities*

Add the following sentence to Part A:

"The action of the Engineer in performance of these duties shall not be construed to make the Engineer the Agent for the Buyer with respect to changes in the cost of the Goods and Special Services or changes in the Contract Documents."

9.03 *Authorized Variations* 

Delete Paragraph 9.03.A in its entirety and substitute the following:

"A. Engineer may authorize minor deviations or variations in the Contract Documents by: 1) written acceptance of specific variations set forth in Shop Drawings when Seller has duly noted such variations as required in Paragraph 5.06.C.4, or 2) a Field Order."

9.05 Decisions on Requirements of Contract Documents

Add the following at the end of the first sentence of Paragraph 9.05.A:

"...insofar as the subject matter of any pertinent claim, dispute, or other matter falls within the realm of the technical expertise of Engineer."

Add the following at the end of Paragraph 9.05.A:

"Engineer shall not render any decision on any claims, disputes, or other matters that in the opinion of the Engineer, requires legal, rather than technical, interpretation."

### ARTICLE 10 - PAYMENT

10.01 Application for Progress Payments

Delete Paragraph 10.01in its entirety and substitute the following:

"Seller shall submit to Buyer for Engineer's review Applications for Payment filled out and signed by Seller and accompanied by such supporting documentation as is required by the Contract Documents and also as Buyer or Engineer may reasonably require. The timing and amounts of progress payments shall be as stipulated in the Agreement. Progress payments on account of Allowance and Unit Price Work will be based on the Work and number of units completed, respectively."

10.05 Final Application for Payment

Delete the last sentence of Paragraph 10.05.A in its entirety and substitute the following:

"The final Application for Payment shall be accompanied by all documentation called for in the Contract Documents, a list of all unsettled Claims, consent of the surety, signed by an agent and accompanied by a certified copy of such agent's authority to act for the surety, and such other data and information as Buyer or Engineer my reasonably require."

### ARTICLE 11 – CANCELLATION, SUSPENSION, AND TERMINATION

No modifications.

### ARTICLE 12 – LICENSE AND FEES

12.04 Reuse of Documents

Delete part 2, of Paragraph 12.04.A in its entirety and replace with the following:

"(2) reuse any of such Drawings, Specifications, other documents, or copies thereof on any other project without written consent of Buyer and Engineer and specific written verification or adaptation by entity responsible for those documents. This prohibition will survive termination or completion of the Contract. Nothing herein shall preclude Seller from retaining copies of the Contract Documents for record purposes."

Delete Paragraph 12.05.A in its entirety and replace with the following:

"A. Except as permitted in the Technical Supplemental Specifications, Q500 – Shop Drawing and Instruction Manuals, copies of data furnished by Buyer or Engineer to Seller, or by Seller to Buyer or Engineer that may be relied upon are limited to the printed copies (also known as hard copies). Files in electronic media format of test, data, graphics, or other types are furnished only for the convenience of the receiving party. Any conclusion or information obtained or derived from such electronic files will be at the user's sole risk. If there is a discrepancy between the electronic files and the hard copies, the hard copies govern."

#### ARTICLE 13 – DISPUTE RESOLUTION

No modifications.

#### ARTICLE 14 – MISCELLANEOUS

14.01 *Giving Notice* 

Add the following subpart to Part A:

"1. No oral statement of any person whosoever shall in any manner or degree modify or otherwise affect the terms of this Contract. Any notice to the CONTRACTOR, from OWNER and ENGINEER, relative to any part of this Contract shall be in writing."

Add the following to Paragraph 14.05:

"B. Seller shall obtain from all manufacturers any and all warranties and guarantees of such manufacturers, whether or not specifically required by the Specifications, and shall assign such warranties and guarantees to Buyer. With respect thereto, Seller shall render reasonable assistance to Buyer when requested, in order to enable Buyer to enforce such warranties and guarantees. The assignment of any warranties or guarantees shall not affect the correction period or any other provisions of these Contract Documents."

Add the following additional Article:

#### "ARTICLE 15 - LIQUIDATED DAMAGES

- 15.01 If the SELLER shall fail to complete the work within the Contract Time, or extension of time granted by the BUYER in accordance with Article 7, then the SELLER will pay to the BUYER the amount for damages as specified in the Agreement for each calendar day that the Contract work remains incomplete.
- 15.02 For the purposes of calculating the number of calendar days for damaged assessment, such calculation shall include the day on which date of completion occurs, but shall not include the day of scheduled completion.
- 15.03 *Penalties and Fines* 
  - A. In the event BUYER is penalized by any governmental entity, including but not limited to the NJDEP, due to any act or omission by the SELLER, the SELLER shall be solely responsible for the payment of same. SELLER shall

reimburse BUYER for payment of any such fine and penalty within ten (10) days of receiving notice of payment of such fine or penalty from BUYER. Any monies paid by the SELLER pursuant to this provision shall not relieve the SELLER of liability to BUYER for damages sustained by BUYER by virtue of any other provision of this Agreement."

Add the following additional Article:

#### "ARTICLE 16 - FEDERAL AND STATE GOVERNMENT PROVISIONS

#### 16.01 Affirmative Action Requirements

During the performance of this contract, the SELLER agrees as follows:

- A. The SELLER, where applicable, will not discriminate against any employee or applicant for employment because of age, race, creed, color, national origin, ancestry, marital status, affectional or sexual orientation, gender identity or expression, disability, nationality or sex. Except with respect to affectional or sexual orientation and gender identity or expression, the SELLER will ensure that equal employment opportunity is afforded to such applicants in recruitment and employment, and that employees are treated during employment, without regard to their age, race, creed, color, national origin, ancestry, marital status, affectional or sexual orientation, gender identity or expression, disability, nationality or sex. Such equal employment opportunity shall include, but not be limited to the following: employment, up-grading, demotion, or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The SELLER agrees to post in conspicuous places, available to employees and applicants for employment, notices to be provided by the Public Agency Compliance Officer setting forth provisions of this nondiscrimination clause.
- B. The SELLER, where applicable will, in all solicitations or advertisements for employees placed by or on behalf of the SELLER, state that all qualified applicants will receive consideration for employment without regard to age, race, creed, color, national origin, ancestry, marital status, affectional or sexual orientation, gender identity or expression, disability, nationality or sex.
- C. The SELLER, where applicable, will send to each labor union or representative of workers with which it has a collective bargaining agreement or other contract or understanding, a notice, to be provided by the agency contracting officer advising the labor union or workers' representative of the SELLER 's commitments under this act and shall post copies of the notice in conspicuous places available to employees and applicants for employment.
- D. The SELLER, where applicable, agrees to comply with any regulations promulgated by the Treasurer, pursuant to N.J.S.A. 10:5-31 et seq., as amended and supplemented from time to time and the Americans with Disabilities Act.

#### 16.02 Anti-Discrimination (N.J.S.A. 10:2-1)

- A. Every contract for or on behalf of the State or any county or municipality or other political subdivision of the State, or any agency of or authority created by any of the foregoing, for the construction, alteration or repair of any public building or public work or for the acquisition of materials, equipment, supplies or services shall contain provisions by which the SELLER agrees that:
  - 1. In the hiring of persons for the performance of work under this contract or any subcontract hereunder, or for the procurement, manufacture, assembling or furnishing of any such materials, equipment, supplies or services to be acquired under this Contract, no SELLER, nor any person acting on behalf of such SELLER, shall, by reason of race, creed, color, national origin, ancestry, marital status, sex, affectional or sexual orientation, discriminate against any person who is qualified and available to perform the work to which the employment relates;
  - 2. No SELLER, nor any person on his behalf shall in any manner, discriminate against or intimidate any employee engaged in the performance of work under this contract or any subcontract hereunder, or engaged in the procurement, manufacture, assembling or furnishing of any such materials, equipment, supplies or services to be acquired under such contract, on account of race, creed, color, national origin, ancestry, marital status, sex, affectional or sexual orientation;
  - 3. There may be deducted from the amount payable to the SELLER by the contracting public agency, under this contract, a penalty of \$50.00 for each person for each calendar day during which such person is discriminated against or intimidate in violation of the provisions of the contract; and
  - 4. This Contract may be canceled or terminated by the contracting public agency, and all money due or to become due hereunder may be forfeited, for any violation of this section of the contract occurring after notice to the SELLER from the contracting public agency of any prior violation of this section of the contract.

#### 16.03 Foreign Corporations (N.J.S.A. 14A:13-3)

- A. No foreign corporation shall have the right to transact business in this State until it shall have procured a certificate of authority so to do from the Secretary of State. A foreign corporation may be authorized to do in this State any business which may be done lawfully in this State by a domestic corporation, to the extent that it is authorized to do such business if the jurisdiction of its incorporation, but no other business.
- B. Without excluding other activities which may not constitute transacting business in this State, a foreign corporation shall not be considered to be transacting business in this State, for the purposes of this act, by reason of carrying on in this State any one or more of the following activities;

- 1. maintaining, defining or otherwise participating in any action or proceeding, whether judicial, administrative, arbitrative or otherwise, or effecting the settlement thereof or the settlement of claims or disputes;
- 2. holding meetings of its directors or shareholders;
- 3. maintaining bank accounts or borrowing money, with or without security, even if such borrowings are repeated and continuous transactions and even if such security has a situs in this State;
- 4. maintaining offices or agencies for the transfer, exchange and registration of its securities, or appointing and maintaining trustees or depositories with relation to its securities.
- C. The specification in subsection 14A:13-3(2) does not establish a standard for activities which may subject a foreign corporation to service of process or taxation in this State.

#### 16.04 Statement of Ownership (N.J.S.A. 52:25-24.2)

- A. No corporation, partnership, or limited liability company shall be awarded any contract nor shall any agreement be entered into for the performance of any work or the furnishing of any materials or supplies, the cost of which is to be paid with or out of any public funds, by the State, or any county, municipality or school district, or any subsidiary or agency of the State, or of any county, municipality or school district, or by any authority, board, or commission which exercises governmental functions, unless prior to the receipt of the bid or accompanying the bid, of said corporation, said partnership, or said limited liability company there is submitted a statement setting forth the names and addresses of all stockholders in the corporation who own 10 percent or more of its stock, of any class, or of all individual partners in the partnership who own a 10 percent or greater interest therein, or of all members in the limited liability company who own a 10 percent or greater interest therein, as the case may be. If one or more such stockholder or partner or member is itself a corporation or partnership or limited liability company, the stockholders holding 10 percent or more of that corporation's stock, or the individual partners owning 10 percent or greater interest in that partnership, or the members owning 10 percent or greater interest in that limited liability company, as the case may be, shall also be listed. The disclosure shall be continued until names and addresses of every noncorporate stockholder, and individual partner, and member, exceeding the 10 percent ownership criteria established in this act, has been listed.
- B. To comply with this section, a bidder with any direct or indirect parent entity which is publicly traded may submit the name and address of each publicly traded entity and the name and address of each person that holds a 10 percent or greater beneficial interest in the publicly traded entity as of the last annual filing with the federal Securities and Exchange Commission or the foreign equivalent, and, if there is any person that holds a 10 percent or greater beneficial interest, also shall submit links to the websites containing the last annual filings with the federal Securities and Exchange Commission or the foreign equivalent and the relevant page numbers of the filings that contain

the information on each person that holds a 10 percent or greater beneficial interest.

- 16.05 State Treasurer's List of Debarred, Suspended and Disqualified Bidders (N.J.S.A. 34:11)
  - A. The SELLER, or an officer or partner of the bidder shall not, at the time of the bid, be included on the State Treasurer's List of debarred, suspended, or disqualified bidders. The SELLER shall immediately notify the BUYER whenever it appears that the SELLER is on the State Treasurer's List. The SELLER may be debarred, suspended, or disqualified from contracting with the State and the Department if the SELLER commits any of the acts listed in N.J.A.C. 7:1-5.2. Enclosed with the State Wage Rate Determination is a list of contractors and subcontractors who are debarred from public works pursuant to N.J.S.A. 34:11-56.37 and 38, no contract will be awarded or made to the listed contractors or subcontractors."

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