AMENDMENT TO REQUEST FOR PROPOSALS
Steam Turbine Generator

REQUEST FOR PROPOSALS #14P0012MG
Procurement Officer: Michael Grahek
Issue Date: June 4, 2014

AMENDMENT NO. 1
Effective Date: June 18, 2014

ISSUED TO:
All Prospective Offerors

ISSUED BY:
University of Alaska Fairbanks
Procurement & Contract Services
PO Box 757940
Fairbanks AK 99775-7940

Dear Vendor:

The following clarifications, revisions, and changes have been made to Request for Proposals No. 14P0012MG for a Steam Turbine Generator:

CHANGE: Due to the extent of questions received and changes to the specifications, the Submittal Deadline is hereby changed

FROM: July 1, 2014, 5:00pm AKDT
TO: July 18, 2014, 5:00pm AKDT

NOTE: For the purposes of this solicitation, it will be permissible to submit the required electronic (PDF version) copy only of the proposal by the Submittal Deadline, provided it is a complete proposal, including the Rate Response Form in a separate file, with all required documents, and is received by the Submittal Deadline as outlined in the RFP. A hard copy of the proposal, as required, may then be delivered after the Submittal Deadline, provided it is received no later than 5:00pm AKDT, July 21, 2014, and contains no changes or additions to the electronic version.

CHANGE: Page 80, Paragraph F.2. (Anticipated Schedule – Delivery) as follows:

- All equipment and materials supplied under this contract are to be delivered by July 31, 2015. Preferred Delivery Date for all equipment and materials is March 25, 2016. Winter construction is not planned for this project. The foundations are scheduled to be complete in November, 2015, but the turbine bay enclosure is not scheduled to begin until April, 2016. Early delivery of the steam turbine might result in significant costs for storage and protection. Therefore, the Offeror’s proposal should address its approach to the delivery schedule, including whether storage at the factory site is anticipated, or may be necessary, for this project, and provide analysis or discussion, as much as possible, about how this may impact the Offeror’s price, if at all.
QUESTIONS:
The following questions were received from potential Offerors. They are presented in a Question and Answer format.


A1-A1) This is correct. UAF requires a steam turbine that is capable of producing a minimum of 17 MW given the throttle and extraction steam flows and conditions in the guarantee case. It is possible that, given these conditions, the equipment may actually produce more than the minimum required output. If this is the case, Offerors shall ensure that the exhaust flow reported in the performance table reflects the minimum continuous flow required for cooling of the back end of the turbine, also known as "minimum condensing flow."

In general, when reporting the turbine performance information on the datasheets in Section 00 43 33, Offerors shall treat the throttle and extraction flows and conditions as fixed. Offerors shall vary the exhaust flow (at 2 in. Hg.) and generator output to satisfy their turbine energy balance. This statement applies to all performance cases presented in the data sheets.

A1-Q2) Can we please reconfirm that Axial Exhaust is preferred?

A1-A2) Confirmed. Offerors shall provide an axial exhaust in their proposal.

A1-Q3) Should we offer the lower cost Down Exhaust as an option?

A1-A3) Optional pricing for other exhaust configurations is not required at this time.

A1-Q4) Is a general drawing of the layout, which shows the TG set, ductwork, and the condenser available for review?

A1-A4) Please refer to the preliminary general arrangements GG03, GG04 & GG07 in Attachment 2.

Note: Other questions regarding the basis for evaluation of efficiency have been received, but UAF has not completed formulating answers for these issues. This information will be provided to all interested parties via written amendment as soon as it is available. It is anticipated that the next amendment will be issued within the next few days.

CLARIFICATIONS:

A1-C1) Revised specification Section 48 11 19, 2.12 in its entirety to limit Offeror’s scope of supply for turbine controls to providing turbine governor, overspeed trip unit, vibration monitoring system, generator excitation system, generator protective relaying, and generator auto-synchronization components. The remaining turbine control functions are to be performed in the plant DCS system including auxiliary equipment control, process monitoring and alarm functions and process trips and permissive interlocks. Also added requirements for Offeror to provide logic diagrams and control narrative to provide basis for development of turbine control programming within DCS and to review DCS logic configuration and the Offeror shall attend the DCS FAT testing. (See Attachment 1)

A1-C2) Revised specification language in Section 48 11 19, 2.12E (previously Section 48 11 19, 2.12A) to read as follows, “Control system shall be fed from redundant 120 volts ac UPS power circuits. Internal power supplies shall be 100% redundant 24 volt dc or other voltages as required by SELLER’s design.” Section 48 11 19 has been updated and the changes have been highlighted. (See Attachment 1)

A1-C3) Revised specification language in Section 48 11 19, 2.12M 1.a (previously Section 48 11 19, 2.12J 1.a) to read as follows, “a. 2 radial position proximity probes installed 90° apart per bearing on steam turbine, generator, and exciter (if applicable).” Section 48 11 19 has been updated and the changes have been highlighted. (See Attachment 1)
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A1-C4) Revised specification language in Section 48 11 19, 2.12M 1.b (previously Section 48 11 19, 2.12J 1.b) to read as follows, "2 axial position probes for thrust bearing." Section 48 11 19 has been updated and the changes have been highlighted. (See Attachment 1)

A1-C5) Deleted language in Section 48 11 19, 2.12M 1.f (previously Section 48 11 19, 2.12J 1.f) as it is now redundant to the requirements of item 1.a above. Section 48 11 19 has been updated and the changes have been highlighted. (See Attachment 1)

A1-C6) Revised Section 00 43 33 to change the revenue meter from a Siemens unit to a Square D/Schneider Electric ION8650C unit. Section 00 43 33 has been updated and changes have been highlighted. (See Attachment 1)

A1-C7) Revised Section 00 43 33 to change the protection unit from a Beckwith unit to a Schweitzer 700G unit. Section 00 43 33 and Section 01 63 00 has been updated and changes have been highlighted. (See Attachment 1)

A1-C8) Revised Section 01 63 00 to remove the VFD manufacturers Reliance and Siemens and replace them with Yaskawa and Allen-Bradley. Section 01 63 00 has been updated and changes have been highlighted. (See Attachment 1)

A1-C9) Added specification language in Section 48 11 19, 2.07b 1.m to read as follows, "Provide instrumentation, piping, valves, etc. to allow the dc motor driven emergency system to be test run periodically while the turbine generator is running." Section 48 11 19 has been updated and the changes have been highlighted. (See Attachment 1)

A1-C10) Added acceptable generator manufacturers in Section 01 63 00. The acceptable manufacturers are Brush, Siemens, Hyundai Ideal, and Electric Machinery. Section 01 63 00 has been updated and changes have been highlighted. (See Attachment 1)

A1-C11) Added specification language in Section 26 05 00, 2.16F to read as follows, "Starters shall be furnished with motor circuit protectors (MCP) rated 600-volt or Bussman type RK1 current limiting fuses." Section 26 05 00 has been updated and the changes have been highlighted. (See Attachment 1)

A1-C12) Added acceptable gearbox manufacturers in Section 01 63 00. The acceptable manufacturers are Rexnord/Falk, Siemens/Flender, GE/Lufkin, Voith, Allen Gears, and Renk-Maag. Other gearboxes manufactured directly by the Offeror, or by a wholly owned subsidiary of the Offeror, may also be acceptable. However, Offerors are requested to follow the substitution request procedure to obtain approval. Section 01 63 00 has been updated and changes have been highlighted. (See Attachment 1)

ATTACHMENTS: The following Attachments are provided and incorporated into the RFP:

- Attachment 1 – Updated Technical Specifications
  - 00 43 33 Proposed Product Form (Datasheets)
  - 01 63 00 Approved Subcontractors and Suppliers List
  - 26 05 00 Common Work Results for Electrical
  - 48 11 19 Steam Turbine Generator Unit

- Attachment 2 – Preliminary General Arrangements

All other terms and conditions remain the same.

Sincerely,

UNIVERSITY OF ALASKA FAIRBANKS

Michael Grahek, C.P.M.
Sr. Contracting Officer
**STEAM TURBINE GENERATOR DATASHEET**

**Equipment Name:** Steam Turbine Generator  
**Tag No.:**

<table>
<thead>
<tr>
<th>DESCRIPTION</th>
<th>Units</th>
<th>SPEC DATA</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>DESIGN OPERATING CONDITIONS</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>GUARANTEE CASE</strong></td>
<td>CASE 2</td>
<td>CASE 3</td>
</tr>
<tr>
<td>Ambient Temp (F)/ Load(%) / Extraction(%)</td>
<td>-40/100/100</td>
<td>-40/100/100</td>
</tr>
<tr>
<td>Coal Fired Boiler</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Number Operating</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>HP Steam Turbine</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Temperature Inlet</td>
<td>°F</td>
<td>750</td>
</tr>
<tr>
<td>2. Pressure Inlet</td>
<td>psia</td>
<td>625</td>
</tr>
<tr>
<td>3. Throttle Inlet Flow</td>
<td>lbs/hr</td>
<td>280,000</td>
</tr>
<tr>
<td>4. Temperature Extraction-1 (IP)</td>
<td>°F</td>
<td>410</td>
</tr>
<tr>
<td>5. Pressure Extraction-2 (IP)</td>
<td>psia</td>
<td>140</td>
</tr>
<tr>
<td>7. Pressure Extraction-2 (LP)</td>
<td>psia</td>
<td>45</td>
</tr>
<tr>
<td>Condenser</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Pressure Outlet (Condenser)</td>
<td>inHg (abs)</td>
<td>2</td>
</tr>
<tr>
<td>2. Turbo Exhaust Energy</td>
<td>MMBTU/hr</td>
<td></td>
</tr>
<tr>
<td>General Turbine Performance</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Guaranteed turbine heat rate</td>
<td>Btu/kWh</td>
<td></td>
</tr>
<tr>
<td>2. Guaranteed gross generator output</td>
<td>MW</td>
<td></td>
</tr>
<tr>
<td>4. Guaranteed aux power</td>
<td>kW</td>
<td></td>
</tr>
<tr>
<td>5. Guaranteed flow extraction-1 (IP)</td>
<td>lbs/hr</td>
<td>53,000</td>
</tr>
<tr>
<td>6. Guaranteed flow extraction-2 (LP)</td>
<td>lbs/hr</td>
<td>182,200</td>
</tr>
</tbody>
</table>

*Guaranteed at pressure, temperature, and flow conditions; other data is predicted or estimated. Guaranteed unit output and turbine generator unit heat rate shall include all manufacturers’ performance tolerances.*
### STEAM TURBINE GENERATOR DATASHEET

**Equipment Name:** Steam Turbine Generator  
**Tag No.:**

<table>
<thead>
<tr>
<th>DESCRIPTION</th>
<th>Units</th>
<th>SPEC DATA</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>OFF DESIGN OPERATING CONDITIONS</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>CASE 1</strong></td>
<td><strong>CASE 2</strong></td>
<td><strong>CASE 3</strong></td>
</tr>
<tr>
<td>Ambient Temp (F) / Load(%) / Extraction(%)</td>
<td>40/100/75</td>
<td>40/100/50</td>
</tr>
<tr>
<td>Coal Fired Boiler</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Number Operating</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>HP Steam Turbine</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Temperature Inlet °F</td>
<td>750</td>
<td>750</td>
</tr>
<tr>
<td>2. Pressure Inlet psia</td>
<td>625</td>
<td>625</td>
</tr>
<tr>
<td>3. Throttle Inlet Flow lbs/hr</td>
<td>280,000</td>
<td>273,000</td>
</tr>
<tr>
<td>4. Temperature Extraction-1 (IP) °F</td>
<td>434</td>
<td>434</td>
</tr>
<tr>
<td>5. Pressure Extraction-2 (IP) psia</td>
<td>125 - 140</td>
<td>125 - 140</td>
</tr>
<tr>
<td>6. Temperature Extraction-2 (LP) °F</td>
<td>274</td>
<td>274</td>
</tr>
<tr>
<td>7. Pressure Extraction-2 (LP) psia</td>
<td>30 - 45</td>
<td>30 - 45</td>
</tr>
<tr>
<td>Condenser</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Pressure Outlet (Condenser) inHg (abs)</td>
<td>1.43</td>
<td>1.37</td>
</tr>
<tr>
<td>General Turbine Performance</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Turbine heat rate Btu/kWh</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Gross generator output MW</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Aux power kW</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Flow extraction-1 (IP) lbs/hr</td>
<td>20,390</td>
<td>19,520</td>
</tr>
<tr>
<td>6. Flow extraction-2 (LP) lbs/hr</td>
<td>172,340</td>
<td>126,010</td>
</tr>
</tbody>
</table>
### Condensing Steam Turbine Generator

#### A Turbine, generator, reduction gear package dimensions:

1. Overall length, ft
2. Overall width, ft
3. Overall height, ft
4. Shipping weight, lb:
   - a. Turbine
   - b. Generator
   - c. Reduction gearbox
5. Weight of heaviest piece handled for erection, lb
6. Weight of heaviest piece handled for normal maintenance, lb
7. Total effective rotating inertia at generator, kg m²

#### B Steam turbine:

1. Manufacturer
2. Model No.
3. Type
4. Speed, rpm

#### C Governor:

1. Manufacturer
2. Model

#### D Reduction gear:

1. Manufacturer
2. Model

#### E Lube oil system:

1. Coolers:
   - a. Number of coolers
   - b. Type
   - c. Cooler length, ft
   - d. Cooler diameter, ft
   - e. Inlet cooling water temperature, °F
   - f. Discharge cooling water temperature at full load, °F
   - g. Total cooling water flow rate at full load, gpm
2. Reservoir capacity, gal
3. Lube oil skid:
<table>
<thead>
<tr>
<th><strong>Condensing Steam Turbine Generator</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>a  Overall length, ft</td>
</tr>
<tr>
<td>b  Overall width, ft</td>
</tr>
<tr>
<td>c  Overall height, ft</td>
</tr>
<tr>
<td>d  Assembled weight, lb</td>
</tr>
<tr>
<td>e  Operating weight, lb</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>F  Hydraulic oil system:</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Type of fluid:</td>
</tr>
<tr>
<td>2 Reservoir, capacity, gal</td>
</tr>
<tr>
<td>3 Coolers:</td>
</tr>
<tr>
<td>a Number of coolers</td>
</tr>
<tr>
<td>b Type</td>
</tr>
<tr>
<td>4 Hydraulic oil skid:</td>
</tr>
<tr>
<td>a Overall length, ft</td>
</tr>
<tr>
<td>b Overall width, ft</td>
</tr>
<tr>
<td>c Overall height, ft</td>
</tr>
<tr>
<td>d Assembled weight, lb</td>
</tr>
<tr>
<td>e Operating weight, lb</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>G  Gland seal system:</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Condenser:</td>
</tr>
<tr>
<td>a Type</td>
</tr>
<tr>
<td>b Length, ft</td>
</tr>
<tr>
<td>c Diameter, ft</td>
</tr>
<tr>
<td>d Inlet cooling water temperature, °F</td>
</tr>
<tr>
<td>e Discharge cooling water temperature at full load, °F</td>
</tr>
<tr>
<td>f Cooling water flow rate at full load, gpm</td>
</tr>
<tr>
<td>2 Gland seal system skid:</td>
</tr>
<tr>
<td>a Overall length, ft</td>
</tr>
<tr>
<td>b Overall width, ft</td>
</tr>
<tr>
<td>c Overall height, ft</td>
</tr>
<tr>
<td>d Assembled weight, lb</td>
</tr>
<tr>
<td>e Operating weight, lb</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>H  Startup data:</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Starting time to full load for cold start:</td>
</tr>
<tr>
<td>a Normal, minutes</td>
</tr>
<tr>
<td>b Emergency, minutes</td>
</tr>
</tbody>
</table>
## Condensing Steam Turbine Generator

### 2 Starting time to full load for hot restart:
- a Normal, minutes
- b Emergency, minutes

### I Auxiliary power requirements:

#### 1 480-volt ac:

<table>
<thead>
<tr>
<th>Function</th>
<th>Hp or kW, each</th>
</tr>
</thead>
<tbody>
<tr>
<td>a Lube oil heater</td>
<td></td>
</tr>
<tr>
<td>b Auxiliary lube oil pump</td>
<td></td>
</tr>
<tr>
<td>c Oil vapor fan</td>
<td></td>
</tr>
<tr>
<td>d Gland steam packing exhauster fan</td>
<td></td>
</tr>
<tr>
<td>e Hydraulic oil pump</td>
<td></td>
</tr>
<tr>
<td>f Hydraulic oil cooler fan</td>
<td></td>
</tr>
<tr>
<td>g Other 480-volt, ac loads (list):</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
</tr>
</tbody>
</table>

#### 2 24-volt dc:
- a
- b
- c

#### 3 120-volt ac loads (list):
- a
- b
- c
<table>
<thead>
<tr>
<th>DESCRIPTION</th>
<th>UNITS/OPTIONS</th>
<th>SPEC DATA</th>
<th>VENDOR DATA</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>General Data</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Manufacturer</td>
<td>---</td>
<td>By manufacturer</td>
<td></td>
</tr>
<tr>
<td>Catalog/Serial No.</td>
<td>---</td>
<td>By manufacturer</td>
<td></td>
</tr>
<tr>
<td>Location of Manufacturing Facility</td>
<td>---</td>
<td>By manufacturer</td>
<td></td>
</tr>
<tr>
<td>Location of Nearest OEM Service Center</td>
<td>---</td>
<td>By manufacturer</td>
<td></td>
</tr>
<tr>
<td><strong>Operating Conditions</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Turbine Output – Rated Maximum Capability</td>
<td>MW</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>Conditions at Rated Maximum Capability</td>
<td>---</td>
<td>By manufacturer</td>
<td></td>
</tr>
<tr>
<td>Turbine Rated Output – Design Conditions</td>
<td>MW</td>
<td>By manufacturer</td>
<td></td>
</tr>
<tr>
<td>Design Conditions at Rated Output</td>
<td>---</td>
<td>By manufacturer</td>
<td></td>
</tr>
<tr>
<td>Site Maximum Ambient Temperature</td>
<td>°F</td>
<td>95</td>
<td></td>
</tr>
<tr>
<td>Site Minimum Ambient Temperature</td>
<td>°F</td>
<td>-50</td>
<td></td>
</tr>
<tr>
<td>Elevation Above Sea Level</td>
<td>Ft</td>
<td>1,262</td>
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<tr>
<td>Operating Environment Maximum Ambient Temperature</td>
<td>°F</td>
<td>130</td>
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<tr>
<td>Operating Environment Minimum Ambient Temperature</td>
<td>°F</td>
<td>40</td>
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<tr>
<td><strong>Cooling Water</strong></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Maximum Ambient Temperature</td>
<td>°F</td>
<td>105</td>
<td></td>
</tr>
<tr>
<td>Minimum Ambient Temperature</td>
<td>°F</td>
<td>50</td>
<td></td>
</tr>
<tr>
<td>Maximum Pressure</td>
<td>Psig</td>
<td>150</td>
<td></td>
</tr>
<tr>
<td>Minimum Pressure</td>
<td>Psig</td>
<td>150</td>
<td></td>
</tr>
<tr>
<td>Plant dc voltage</td>
<td>V</td>
<td>125</td>
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<tr>
<td><strong>Cooling System</strong></td>
<td></td>
<td>TEWAC</td>
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<tr>
<td>Generator Terminal Conductor System</td>
<td>---</td>
<td>Cable</td>
<td></td>
</tr>
<tr>
<td><strong>Ratings and Physical Data</strong></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Nameplate MVA Rating</td>
<td>MVA</td>
<td>By manufacturer to match turbine guarantee rating as a minimum</td>
<td></td>
</tr>
<tr>
<td>At Cooling Medium Cold Temperature</td>
<td>°C</td>
<td>By manufacturer</td>
<td></td>
</tr>
<tr>
<td>Rated Minimum Continuous Capability</td>
<td>MVA</td>
<td>By manufacturer</td>
<td></td>
</tr>
<tr>
<td>At Cooling Medium Cold Temperature</td>
<td>°C</td>
<td>By manufacturer</td>
<td></td>
</tr>
<tr>
<td>Rated Maximum Continuous Capability</td>
<td>MVA</td>
<td>By manufacturer</td>
<td></td>
</tr>
<tr>
<td>At Cooling Medium Cold Temperature</td>
<td>°C</td>
<td>By manufacturer</td>
<td></td>
</tr>
<tr>
<td>Rated Terminal Voltage</td>
<td>kV</td>
<td>12.47kV</td>
<td></td>
</tr>
<tr>
<td>Continuous Voltage Operation Range (% of from Rated Terminal Voltage)</td>
<td>%</td>
<td>95%-105%</td>
<td></td>
</tr>
<tr>
<td>Rated Frequency</td>
<td>Hz</td>
<td>60</td>
<td></td>
</tr>
<tr>
<td>DESCRIPTION</td>
<td>UNITS/OPTIONS</td>
<td>SPEC DATA</td>
<td>VENDOR DATA</td>
</tr>
<tr>
<td>----------------------------------------------------------------------------</td>
<td>---------------</td>
<td>---------------------------------------------------------------------------</td>
<td>-------------</td>
</tr>
<tr>
<td>Frequency and Voltage Variation Capability From Rated Frequency</td>
<td>+ % / - %</td>
<td>In Accordance with Standards and Reliability Council Requirements</td>
<td></td>
</tr>
<tr>
<td>Generator Synchronous Rated Speed</td>
<td>rpm</td>
<td>By manufacturer</td>
<td></td>
</tr>
<tr>
<td>Generator Connection to Prime Mover</td>
<td>Direct/Gearbox</td>
<td>By manufacturer</td>
<td></td>
</tr>
<tr>
<td>Maximum Overspeed Capability Above Rated Without Damage</td>
<td>%</td>
<td>Per Standards</td>
<td></td>
</tr>
<tr>
<td>Rated Power Factor:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lagging</td>
<td>pu</td>
<td>0.85</td>
<td></td>
</tr>
<tr>
<td>Leading</td>
<td>pu</td>
<td>0.90</td>
<td></td>
</tr>
<tr>
<td>Minimum Stator Insulation Class</td>
<td>Class</td>
<td>F</td>
<td></td>
</tr>
<tr>
<td>Minimum Rotor Insulation Class</td>
<td>Class</td>
<td>F</td>
<td></td>
</tr>
<tr>
<td>Maximum Temperature Rise at Rated Load</td>
<td>Class</td>
<td>By manufacturer</td>
<td></td>
</tr>
<tr>
<td>Maximum Hot Spot Temperature at Rated Load and Maximum Cooling Medium Temp</td>
<td>°C</td>
<td>By manufacturer</td>
<td></td>
</tr>
<tr>
<td>Maximum Temperature at Rated Load and Maximum Cooling Medium Temp</td>
<td>°C</td>
<td>By manufacturer</td>
<td></td>
</tr>
<tr>
<td>Location of Generator Terminals</td>
<td>Top/Bottom</td>
<td>Bottom</td>
<td></td>
</tr>
<tr>
<td>Maximum Allowable Overall Far-Field A-Weighted Sound Pressure Level</td>
<td>dBA</td>
<td>85</td>
<td></td>
</tr>
<tr>
<td>Maximum Allowable Overall Near-Field A-Weighted sound Pressure Level</td>
<td>dBA</td>
<td>90</td>
<td></td>
</tr>
<tr>
<td>Total Weight</td>
<td>lbs</td>
<td>By manufacturer</td>
<td></td>
</tr>
<tr>
<td>Total Weight Shipped</td>
<td>lbs</td>
<td>By manufacturer</td>
<td></td>
</tr>
<tr>
<td>Space Required in Front of Generator for Rotor Pull-out</td>
<td>ft</td>
<td>By manufacturer</td>
<td></td>
</tr>
<tr>
<td>Phase Rotation Order in Which Phases Reach Positive Maximum</td>
<td></td>
<td>A, B, C</td>
<td></td>
</tr>
<tr>
<td>Phase Connection</td>
<td>Delta or Wye</td>
<td>Wye</td>
<td></td>
</tr>
<tr>
<td>Winding Material</td>
<td>Cu</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum Core iron loss factor at 1 Tesla</td>
<td>W/kg</td>
<td>1.1</td>
<td></td>
</tr>
<tr>
<td>Number of Synchronizing Breaker(s)</td>
<td>One or Two</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Location of Synchronizing Breaker(s)</td>
<td>---</td>
<td>12.47 kV SWGR</td>
<td></td>
</tr>
<tr>
<td>Color</td>
<td>ANSI Standard</td>
<td>By manufacturer</td>
<td></td>
</tr>
</tbody>
</table>

**Efficiency**

@ rated lagging PF:

<table>
<thead>
<tr>
<th>Load Level</th>
<th>Efficiency</th>
<th>VENDOR DATA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full Load</td>
<td>%</td>
<td>By manufacturer</td>
</tr>
<tr>
<td>3/4 Load</td>
<td>%</td>
<td>By manufacturer</td>
</tr>
<tr>
<td>1/2 Load</td>
<td>%</td>
<td>By manufacturer</td>
</tr>
<tr>
<td>1/4 Load</td>
<td>%</td>
<td>By manufacturer</td>
</tr>
<tr>
<td>@ PF = 1.0</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## DATA SHEETS
### SYNCHRONOUS CYLINDRICAL-ROTOR GENERATOR

<table>
<thead>
<tr>
<th>DESCRIPTION</th>
<th>UNITS/OPTIONS</th>
<th>SPEC DATA</th>
<th>VENDOR DATA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full Load</td>
<td>%</td>
<td>By manufacturer</td>
<td></td>
</tr>
<tr>
<td>3/4 Load</td>
<td>%</td>
<td>By manufacturer</td>
<td></td>
</tr>
<tr>
<td>1/2 Load</td>
<td>%</td>
<td>By manufacturer</td>
<td></td>
</tr>
<tr>
<td>1/4 Load</td>
<td>%</td>
<td>By manufacturer</td>
<td></td>
</tr>
</tbody>
</table>

**Excitation System**

- **Type**
  - Brushless
- **Manufacturer**
  - By manufacturer
- **Field winding dc resistance**
  - Ω
  - By manufacturer
- **Excitation System Nominal Response**
  - ---
  - By manufacturer
- **Ceiling Voltage**
  - V
  - By manufacturer
- **High Initial Response?**
  - Y/N
  - Y
- **IEEE Excitation System Model Type**
  - ---
  - By manufacturer
- **Excitation System Redundancy?**
  - Y/N
  - Y
- **Input Power**
  - kVA
  - By manufacturer
- **Input Voltage and Number of Phases**
  - V / Ph
  - By manufacturer
- **Input Current**
  - A
  - By manufacturer

**Rated Output Under No-Load:**

- **Power**
  - kW
  - By manufacturer
- **Voltage**
  - V
  - By manufacturer
- **Current**
  - A
  - By manufacturer

**Rated Output Under Full Load:**

- **Power**
  - kW
  - By manufacturer
- **Voltage**
  - V
  - By manufacturer
- **Current**
  - A
  - By manufacturer

- **Available Field Flashing Voltage (If Required)**
  - V
  - 480
- **Var Controller?**
  - Y/N
  - Y
- **Power Factor Controller?**
  - Y/N
  - Y
- **Power System Stabilizer?**
  - Y/N
  - Y
- **IEEE PSS Model Type**
  - ---
  - PSS2A
- **Provide Calculations, Initial Settings for PSS?**
  - Y/N
  - Y
- **Provide Tuning and Commissioning of PSS?**
  - Y/N
  - Y
- **Var/Power Factor Control**
  - Y/N
  - Y
- **Tie-Line MW/Var Control**
  - Y/N
  - N
- **Voltage Regulator Manufacturer**
  - ---
  - By manufacturer
- **Voltage Regulator Type**
  - ---
  - By manufacturer
- **Power Potential Transformer (PPT)**
  - **Installed Location**
    - Indoor or Outdoor
    - Indoor
- **Cable Entrance Location (Top, Bottom, or Side)**
  - ---
  - By manufacturer
- **Total Weight**
  - lbs
  - By manufacturer
<table>
<thead>
<tr>
<th>DESCRIPTION</th>
<th>UNITS/OPTIONS</th>
<th>SPEC DATA</th>
<th>VENDOR DATA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neutral Grounding</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Method</td>
<td>---</td>
<td>Low Resistance</td>
<td></td>
</tr>
<tr>
<td>Impedance</td>
<td>Ω</td>
<td>By manufacturer</td>
<td></td>
</tr>
<tr>
<td>Voltage Rating</td>
<td>VAC</td>
<td>By manufacturer</td>
<td></td>
</tr>
<tr>
<td>Current Rating</td>
<td>A</td>
<td>By manufacturer</td>
<td></td>
</tr>
<tr>
<td>Time Rating</td>
<td>sec</td>
<td>60</td>
<td></td>
</tr>
<tr>
<td>Ground Transformer (for High-Impedance System):</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Manufacturer</td>
<td>---</td>
<td>By manufacturer</td>
<td></td>
</tr>
<tr>
<td>Type</td>
<td>OIL/DRY</td>
<td>Dry</td>
<td></td>
</tr>
<tr>
<td>Enclosure Type</td>
<td>NEMA</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>kVA Rating</td>
<td>kVA</td>
<td>By manufacturer</td>
<td></td>
</tr>
<tr>
<td>BIL Rating</td>
<td>kV</td>
<td>By manufacturer</td>
<td></td>
</tr>
<tr>
<td>High Voltage Terminals</td>
<td>kV</td>
<td>By manufacturer</td>
<td></td>
</tr>
<tr>
<td>Low Voltage Terminals</td>
<td>VAC</td>
<td>240</td>
<td></td>
</tr>
<tr>
<td>Neutral Isolation Switch</td>
<td>Y/N</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cable Entrance Location (Top, Bottom, or Side)</td>
<td>---</td>
<td>By manufacturer</td>
<td></td>
</tr>
</tbody>
</table>

### Line Side Bushing Current Transformers

<table>
<thead>
<tr>
<th>Metering and Relaying Accuracy Class and Burden Requirement</th>
<th>ANSI C57.13</th>
<th>0.3B1.8 and C800</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quantity On Each Phase</td>
<td>EA</td>
<td>4</td>
</tr>
<tr>
<td>CT Ratio</td>
<td>Pri / Sec</td>
<td>1200/5MR</td>
</tr>
<tr>
<td>Configuration</td>
<td>Delta / Wye</td>
<td>Wye – Grounded</td>
</tr>
<tr>
<td>Quantity per Phase Requiring Laboratory Calibration Certificates</td>
<td>Qty</td>
<td>One</td>
</tr>
</tbody>
</table>

### Neutral Side Bushing Current Transformers

<table>
<thead>
<tr>
<th>Metering and Relaying Accuracy Class and Burden Requirement</th>
<th>ANSI C57.13</th>
<th>0.3B1.8 and C800</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quantity On Each Phase</td>
<td>EA</td>
<td>3</td>
</tr>
<tr>
<td>CT Ratio</td>
<td>Pri / Sec</td>
<td>1200/5</td>
</tr>
<tr>
<td>Configuration</td>
<td>Delta / Wye</td>
<td>Wye – Grounded</td>
</tr>
<tr>
<td>Quantity per Phase Requiring Laboratory Calibration Certificates</td>
<td>Qty</td>
<td>None</td>
</tr>
</tbody>
</table>

### Voltage Transformers

<table>
<thead>
<tr>
<th>Voltage Transformer Set #1:</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Accuracy and Burden Requirement</td>
<td>ANSI C57.13</td>
<td>0.3, Z,</td>
<td></td>
</tr>
<tr>
<td>Voltage Rating</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High Voltage (Line – Line)</td>
<td>kV</td>
<td>By manufacturer</td>
<td></td>
</tr>
<tr>
<td>Low Voltage (Line – Line)</td>
<td>V</td>
<td>120</td>
<td></td>
</tr>
<tr>
<td>Voltage Transformer Ratio (VTR)</td>
<td>HV:LV</td>
<td>By manufacturer</td>
<td></td>
</tr>
<tr>
<td>Quantity</td>
<td>EA</td>
<td>3</td>
<td></td>
</tr>
</tbody>
</table>
### DATA SHEETS
**SYNCHRONOUS CYLINDRICAL-ROTOR GENERATOR**

**Equipment Name:** Steam Turbine Generator  
**Tag No.:** STG-4  
**Rev.:** A

#### DESCRIPTION

<table>
<thead>
<tr>
<th>Configuration</th>
<th>UNITS/OPTIONS</th>
<th>SPEC DATA</th>
<th>VENDOR DATA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Draw-out Construction?</td>
<td>Y/N</td>
<td>N</td>
<td></td>
</tr>
<tr>
<td>Primary Fuses?</td>
<td>Y/N</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>Provide Laboratory Calibration Certificate?</td>
<td>Y/N</td>
<td>Y</td>
<td></td>
</tr>
</tbody>
</table>

**Voltage Transformer Set #2**

<table>
<thead>
<tr>
<th>Accuracy and Burden Requirement</th>
<th>ANSI C57.13</th>
<th>0.3, Z, and ZZ</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Voltage Rating</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High Voltage (Line – Line)</td>
<td>kV</td>
<td>By manufacturer</td>
<td></td>
</tr>
<tr>
<td>Low Voltage (Line – Line)</td>
<td>V</td>
<td>120</td>
<td></td>
</tr>
<tr>
<td>Voltage Transformer Ratio (VTR)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HV:LV</td>
<td>By manufacturer</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Quantity</td>
<td>EA</td>
<td>3</td>
<td></td>
</tr>
</tbody>
</table>

**Surge Arresters**

<table>
<thead>
<tr>
<th>Provide Surge Arresters?</th>
<th>Y/N</th>
<th>Y</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Voltage Rating</td>
<td>kV</td>
<td>By manufacturer</td>
<td></td>
</tr>
<tr>
<td>MCOV Rating</td>
<td>kV</td>
<td>By manufacturer</td>
<td></td>
</tr>
</tbody>
</table>

**Surge Capacitors**

<table>
<thead>
<tr>
<th>Provide Surge Capacitors?</th>
<th>Y/N</th>
<th>Y</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Capacitance</td>
<td>µF</td>
<td>By manufacturer</td>
<td></td>
</tr>
<tr>
<td>Voltage Rating</td>
<td>kV</td>
<td>By manufacturer</td>
<td></td>
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</tbody>
</table>

**Cooling Water And Generator Coolers**

<table>
<thead>
<tr>
<th>Cooling Water Supply Loop</th>
<th>Open/Closed</th>
<th>Closed</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature, Hot Day (Dry Bulb ≥ 80°F)</td>
<td>°F</td>
<td>XX</td>
<td></td>
</tr>
<tr>
<td>Temperature, Normal Day (80°F &lt; Dry Bulb &lt; 60°F)</td>
<td>°F</td>
<td>XX</td>
<td></td>
</tr>
<tr>
<td>Temperature, Cold Day (Dry Bulb ≤ 60°F)</td>
<td>°F</td>
<td>XX</td>
<td></td>
</tr>
<tr>
<td>Propylene Glycol Percentage</td>
<td>%</td>
<td>XX%</td>
<td></td>
</tr>
<tr>
<td>Fouling Factor</td>
<td>XX</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Design Water-side Pressure</td>
<td>psi</td>
<td>XX</td>
<td></td>
</tr>
<tr>
<td>Maximum Permissible Water-side Friction Loss</td>
<td>psi</td>
<td>XX</td>
<td></td>
</tr>
<tr>
<td>Generator Heat Exchanger Type</td>
<td>---</td>
<td>Shell and Tube</td>
<td></td>
</tr>
<tr>
<td>Generator Cooler Tubesheet Material</td>
<td>---</td>
<td>Muntz Metal or Naval Brass</td>
<td></td>
</tr>
<tr>
<td>Generator Cooler Tube Material</td>
<td>---</td>
<td>90/10 Cu-Ni</td>
<td></td>
</tr>
<tr>
<td>Cooler Tube Velocity Range</td>
<td>ft/sec</td>
<td>By manufacturer</td>
<td></td>
</tr>
<tr>
<td>DESCRIPTION</td>
<td>UNITS/OPTIONS</td>
<td>SPEC DATA</td>
<td>VENDOR DATA</td>
</tr>
<tr>
<td>----------------------------------------------------------------------------</td>
<td>---------------</td>
<td>-----------</td>
<td>----------------------</td>
</tr>
<tr>
<td>Required Cooling Water Flow Rate Requirements</td>
<td>GPM (m³/hr)</td>
<td>By manufacturer</td>
<td></td>
</tr>
<tr>
<td>Pressure Drop at Required Flow Rate</td>
<td>psi</td>
<td>By manufacturer</td>
<td></td>
</tr>
<tr>
<td>Water Temperature Rise</td>
<td>°C</td>
<td>By manufacturer</td>
<td></td>
</tr>
<tr>
<td>Number of Coolers</td>
<td>---</td>
<td>By manufacturer</td>
<td></td>
</tr>
<tr>
<td>Generator Load Capability with One Cooler Out of Service</td>
<td>% of Rated</td>
<td>100%</td>
<td></td>
</tr>
</tbody>
</table>

**Air Cooled**

| Oil Flow to Shaft Seals @ Inlet Oil Temperature                            | ---           | By manufacturer |
| Total at 1/2 psi air pressure                                             | gpm           | By manufacturer |
| Total at 45 psi air pressure                                              | gpm           | By manufacturer |
| Gas Side Oil Flow at 1/2 psi                                              | gpm           | By manufacturer |
| 1" difference in oil level of lower sight glass of seal oil vacuum tank  | gal           | By manufacturer |
| Differential between seal oil and air pressure                            | psi           | By manufacturer |
| Amount of Gas Space in Generator Casing                                   | cu ft         | By manufacturer |
| Amount of carbon dioxide required for removing air from casing (Generator at standstill) | cu ft | By manufacturer |
| Amount of air required for filling casing to 90% purity at 1/2 psi (Generator at standstill) | cu ft | By manufacturer |
| Rated Air Pressure                                                        | psi           | By manufacturer |
| Amount of air required for increasing pressure in casing                  | cu ft         | By manufacturer |
| 0.5 to 15 psi                                                            | cu ft         | By manufacturer |
| 0.5 to 30 psi                                                            | cu ft         | By manufacturer |
| 0.5 to 45 psi                                                            | cu ft         | By manufacturer |
| Minimum purity of cylinder air                                            | %             | By manufacturer |
| Air purity in generator casing in normal operation.                      | %             | By manufacturer |
| Maximum air requirement of generator in normal operation                  | cu ft/day     | By manufacturer |
| 0.5 psi                                                                 | cu ft/day     | By manufacturer |
| 15 psi                                                                   | cu ft/day     | By manufacturer |
| 30 psi                                                                   | cu ft/day     | By manufacturer |
| 45 psi                                                                   | cu ft/day     | By manufacturer |

Main Seal Oil Pump:

| Capacity                                                                 | gpm           | By manufacturer |
| Pump Motor Rating                                                        | hp            | By manufacturer |
| Pump Motor Terminal Voltage and Phases                                    | VAC / Ph      | By manufacturer |
| Duration of Operation on Shutdown Without Damage                          | min.          | By manufacturer |
| VAC Starter Provided                                                      | Y/N           | N               |

Emergency Seal Oil Pump:

| Capacity                                                                 | gpm           | By manufacturer |
| Pump Motor Rating                                                        | hp            | By manufacturer |
# Data Sheets

**Synchronous Cylindrical-Rotor Generator**

<table>
<thead>
<tr>
<th>DESCRIPTION</th>
<th>UNITS/ OPTIONS</th>
<th>SPEC DATA</th>
<th>VENDOR DATA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pump Motor Terminal Voltage</td>
<td>VDC</td>
<td>125</td>
<td></td>
</tr>
<tr>
<td>Duration of Operation on Shutdown Without Damage</td>
<td>min.</td>
<td></td>
<td>By manufacturer</td>
</tr>
<tr>
<td>VDC Starter Provided</td>
<td>Y/N</td>
<td></td>
<td>Y</td>
</tr>
<tr>
<td>Vacuum Pump:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Capacity</td>
<td>cfm</td>
<td></td>
<td>By manufacturer</td>
</tr>
<tr>
<td>Pump Motor Rating</td>
<td>hp</td>
<td></td>
<td>By manufacturer</td>
</tr>
<tr>
<td>Pump Motor Terminal Voltage</td>
<td>VAC</td>
<td></td>
<td>By manufacturer</td>
</tr>
<tr>
<td>Duration of Operation on Shutdown Without Damage</td>
<td>min.</td>
<td></td>
<td>By manufacturer</td>
</tr>
<tr>
<td>VAC Starter Provided</td>
<td>Y/N</td>
<td></td>
<td>N</td>
</tr>
</tbody>
</table>

**Space Heaters**

| Quantity                                         | ea             |           |             |
| Locations                                        | ---            |           |             |
| Power Rating                                     | kW             |           | By manufacturer |
| Voltage Rating and Phases                        | VAC / ph       |           | By manufacturer |

**Vibration Monitoring**

| Vibration Probes (X & Y)                         | Y/N            |           | Y           |
| Maximum Vibration                                | mils           |           | By manufacturer |

**Other Equipment**

| Generator Bearings Insulated                     | MΩ             | 10 M ohm  |             |
| Provide Slot Couplers for Partial Discharge      | Y/N            |           | Y           |
| Provide Generator Condition Monitoring           | Y/N            |           | N           |
| Provide Terminal Box and Flex Braids for IPB Connection | Y/N     |           | Y           |
| Provide Neutral Terminal Box with Neutral Connections | Y/N         |           | Y           |
| Provide Surge/VT Enclosure                       | Y/N            |           | Y           |
| Provide Provisions for Connecting Beckwith M-3921 | Y/N            |           | N           |
| Field Ground/Brush Lift-Off Field Ground Coupler |                 |           |             |
| Generator Control Panel                          | Y/N            |           | Y           |

**Control Panel Main Components:**

- Synchroscope: By manufacturer
- Indicating Lights: By manufacturer
- “Raise/Lower” Control Switch: By manufacturer

**Revenue Quality Meter**

| MAXSYS/ Siemens 2510-DNP-L2 (Level 2) Square D/Schneider Electric ION 8650C | 1 |

| 15kV Breaker Trip Only Control Switch | Each | 1 |

| Beckwith M3425A Schweitzer Extended 700G Generator Protection Relay | Each | 2 |
**DATA SHEETS**  
**SYNCHRONOUS CYLINDRICAL-ROTOR GENERATOR**

<table>
<thead>
<tr>
<th>DESCRIPTION</th>
<th>UNITS/OPTIONS</th>
<th>SPEC DATA</th>
<th>VENDOR DATA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lockout switches to match control and protection scheme</td>
<td>Each</td>
<td>By manufacturer</td>
<td></td>
</tr>
<tr>
<td>Accidental Energization Relay (C60 or approved equal)</td>
<td>Each</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Test switches for all CT, VT, and Trip circuits</td>
<td>Each</td>
<td>By manufacturer</td>
<td></td>
</tr>
<tr>
<td>Control voltage</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Electrical Characteristics:**

**Impedance:**

- MVA Base for Impedances: MVA
- Minimum Short Circuit Ratio: SCR
- Direct-axis unsaturated synchronous reactance ($X_{d}$): pu
- Direct-axis unsaturated transient reactance ($X'_{d}$): pu
- Direct-axis unsaturated subtransient reactance ($X''_{d}$): pu
- Quadrature-axis unsaturated synchronous reactance ($X_{q}$): pu
- Quadrature-axis unsaturated transient reactance ($X'_{q}$): pu
- Quadrature-axis unsaturated subtransient reactance ($X''_{q}$): pu
- Direct-axis saturated synchronous reactance ($X_{ds}$): pu
- Direct-axis saturated transient reactance ($X'_{ds}$): pu
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- Quadrature-axis saturated synchronous reactance ($X_{qs}$): pu
- Quadrature-axis saturated transient reactance ($X'_{qs}$): pu
- Quadrature-axis saturated subtransient reactance ($X''_{qs}$): pu
- Negative sequence unsaturated reactance ($X_{d}$): pu
- Negative sequence saturated reactance ($X'_{ds}$): pu
- Negative sequence saturated reactance ($X''_{ds}$): pu
- Zero sequence unsaturated reactance ($X_{0}$): pu
- Zero sequence saturated reactance ($X'_{0}$): pu
- Stator leakage reactance (unsaturated) ($X_{li}$): pu
- Stator resistance per phase ($R_{a}$): Ω
- Rotor resistance ($R_{f}$): Ω

**Time Constants:**

- Direct-axis transient open-circuit time constant ($T'_{do}$): sec
- Direct-axis transient 3 phase short-circuit time constant ($T'_{d}$): sec
- Direct-axis transient 2 phase short-circuit time constant ($T'_{d2}$): sec
- Direct-axis transient 1 phase short-circuit time constant ($T'_{d1}$): sec
- Direct-axis subtransient open-circuit time constant ($T''_{do}$): sec
- Direct-axis subtransient short-circuit time constant ($T''_{d}$): sec
- Quadrature-axis transient open-circuit time constant ($T'_{qo}$): sec

---

*Equipment Name: Steam Turbine Generator*  
*Tag No.: STG-4  Rev. A*
## DATA SHEETS
### SYNCHRONOUS CYLINDRICAL-ROTOR GENERATOR

**Equipment Name:** Steam Turbine Generator  
**Tag No.:** STG-4  
**Rev.:** A

<table>
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<tr>
<th>DESCRIPTION</th>
<th>UNITS/OPTIONS</th>
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<th>VENDOR DATA</th>
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### Armature Resistance Data
- Positive Sequence, R_1  
- Negative Sequence, R_2  
- Zero Sequence, R_0

### Miscellaneous Generator Characteristic Data
- Continuous Unbalanced Load (Max), I_2^∞  
- Short Time Capability Unbalanced Fault, (I_2)^2t  
- Saturation Factor at 100% Terminal Voltage (S100)  
- Saturation Factor at 100% Terminal Voltage (S120)  
- Generator Inertia Constant (H)  
- Combined Turbine-Generator Inertia (H)  
- Shaft Damping Factor (D)  
- 3-phase stator winding capacitance  
- 3-phase armature winding capacitance  
- Armature winding resistance per phase

### Special Tools

### Spare Parts

### Special Requirements
K  Estimated maximum sound pressure levels from condensing steam turbine unit when measured 3' in horizontal and 5' from ground floor or platform, free-field conditions:

<table>
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<th>Band No.</th>
<th>Center Band Frequency, Hz</th>
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L  Estimated maximum sound pressure levels from backpressure steam turbine generator when measured 3' in horizontal and 5' from ground floor or platform, free-field conditions:

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M  Submit the following additional data with Bid:

1  Drawings and data as listed in the Submittals Schedule included in the contract documents.

*****
Note: Buyer approval of supplier/subcontractor required for any component not specifically called out on this list

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1.01 SECTION INCLUDES

A. General electrical requirements for equipment and services including, but not limited to:
   1. Factory wiring.
   2. Low voltage field wiring.
   3. Low voltage splices and terminations.
   4. Low voltage cabinets and electrical enclosures.
   5. Equipment safety grounding.
   6. Low voltage fuses and fuse blocks.
   7. Electrical meters.
   8. Control relays and switches.
   10. Indicating lights.
   11. Alarm and trip contacts.
   12. Low voltage starters.
   13. Low voltage circuit breakers and disconnect switches.
   15. Power factor correction capacitors.
   16. Outlet, pull, and junction boxes.
   17. Plates and covers.
   18. Wiring devices.
   20. Panelboards.
   21. Welding.
   22. Shop finish.
   23. Rust-inhibiting compounds.
   25. Packaging, identification, and tagging.
   27. Trip setting coordination.
   28. Grounding and bonding.
   29. Fireproofing and fire ratings.

B. Section is generic in nature and may contain technical requirements for equipment that is not included in the scope of this contract. Seller shall rely on Sections 01 10 00 – Summary, 01 11 00 – Division of Responsibility, and 01 18 00 – Terminal Points for direction as to the scope of supply.

C. Content of this section is not intended to define Seller's scope of supply.

1.02 INFORMATIONAL SUBMITTALS

A. Product Data:
   1. List of proposed material identifying manufacturer, type and model number for equipment to be provided for complete job.
   2. Manufacturer’s catalog sheets marked to indicate specific type, model or catalog number of equipment to be provided.
   3. Equipment drawings, elementary diagrams, schematics, wiring, performance curves, instruction manuals, and all other documentation necessary for complete description of material being supplied and as required to support installation, commissioning and maintenance of equipment. Manufacturer’s standard connection diagram or schematic showing more than one scheme of connection will not be accepted.
   4. Manufacturer’s technical descriptions, product data sheets, and applicable manuals for use in protective device system coordination including:
      a. Fuse manufacturer, type, ratings, and protection curves.
      b. Circuit breaker manufacturer, type, trip setting ranges, and protection curves.
      c. Relay trip device ranges, curves, and setting manuals.
d. Transformer damage curves.
e. CT ratios and saturation curves.
f. VT ratings.
5. List of recommended spare parts required for equipment start-up, commissioning and operation.
6. List of special maintenance tools required for installation and operation of equipment.
7. If necessary, provide additional data to clearly demonstrate that proposed alternate equipment meets or exceeds equipment as specified.
8. When requested by Engineer, submit system information, including but not limited to, utility feeders, existing relays, circuit breakers, fuses, and transformers.

1.03 CLOSEOUT SUBMITTALS

A. Operation and maintenance manuals. Provide at minimum:
   1. Itemized equipment list.
   2. General description and technical data.
   3. Receiving, storage, installation, and testing instructions.
   4. Operating and maintenance procedures.
   5. Complete set of final drawings requiring no further action.
   6. Complete documentation of inspections and tests performed, including logs, curves, and certificates. Documentation shall note any replacement of equipment or components that failed during testing.
   7. Spare parts list.
   8. Lubrication recommendations.

B. Reference Section 01 78 23 – Operating and Maintenance Data for additional requirements.

1.04 MAINTENANCE MATERIALS

A. Extra materials: Provide touchup paint in same type and color to repair at least 25% of finish-painted equipment surface. Paint shall be sufficient to perform touch-up painting in accordance with shop-applied material instructions for repair painting.

B. Each piece of equipment shall be furnished with special tools as required for installation, maintenance, and dismantling of equipment.
   1. Furnish in quantities as necessary to complete work on schedule.
   2. Tools shall be new and shall become property of Buyer.
   3. Tools and intended use shall be identified in assembly instructions. Tools shall only be used for their intended purpose.

1.05 QUALITY ASSURANCE

A. Manufacturer qualifications:
   1. Manufacturer of equipment specified shall be recognized in industry for normally supplying this type of equipment.
   2. Manufacturer shall be ISO certified.
   3. When requested by Engineer, provide list of similar equipment installations that have employed identical equipment from manufacturer.

B. Materials and equipment furnished for permanent installation shall be new, unused, and undamaged.

C. Asbestos not allowed.

D. Parts shall be manufactured to American industry standard sizes and gages to facilitate maintenance and interchangeability. Metric sized components not allowed unless specifically requested by the Seller and approved by the Buyer.

1.06 DELIVERY, STORAGE, AND HANDLING
A. Pack, ship, handle, and store in accordance with manufacturer’s requirements.

B. Ship equipment completely factory assembled unless physical size, arrangement, configuration, or shipping and handling limitations make this impracticable. Shipping splits and required field assembly shall be identified with equipment submittals.

C. Costs associated with sections, accessories, or appurtenances requiring field assembly shall be Seller’s responsibility.

D. Separately packaged parts and accessories shall be consolidated and shipped together with equipment. Mark each container clearly to identify contents and as belonging with main equipment.
   1. Provide individual weatherproof itemized packing slips attached to outside of each container for contents included. Provide duplicate inside each container.
   2. Attach master packing list, covering accessory items for equipment, to main piece of equipment.
   3. Mark each container with project identification number for equipment and container number followed by total number of containers.

E. Equipment shall be suitably protected during shipment, handling, and storage. Damage incurred during shipment shall be repaired at no cost to Buyer.

F. Equipment packaging shall be suitable for transport via oceangoing vessel.

G. Protect coated surfaces against impact, abrasion, and discoloration.

H. Electrical equipment and insulation systems shall be protected against ingress of moisture, including saltwater. Use space heaters if necessary to protect against moisture.

I. Exposed threads shall be greased and protected.

J. Pipe, tube, and conduit connections shall be closed with rough usage plugs. Seal and tape open ends of piping, tubing, and conduit.

K. Equipment openings shall have covers, to seal equipment.

L. Store materials in clean, dry place. Protect from weather, dirt, water, construction debris, and physical damage in accordance with manufacturer’s instructions.

1.07 SCHEDULING

A. Coordinate with Buyer early and late shipping and delivery schedules for items requiring storage and handling at Site.

1.08 WARRANTY

A. Electrical equipment shall be provided with manufacturer’s standard warranty, but not less than 1 year.

PART 2 PRODUCTS

2.01 DESIGN CRITERIA

A. Service conditions: Provide equipment and material suitable for intended service and installation at location indicated.

B. Low-voltage auxiliary and control power.
   1. Electrical power for ac control and instrumentation equipment:
      a. Provide devices necessary for proper operation and protection of equipment during electrical power supply and ambient temperature fluctuations specified.
b. Design for continuous operation at any voltage from 85% to 110% of nominal voltage. Dropout voltage shall be 60% of nominal for relays and 75% for contactors and starters.

2. Electrical power for dc devices:
   a. Design for continuous operation on ungrounded station battery system, capable of maintaining operation at any voltage from 80% to 112% of nominal voltage.
   b. Electrical devices served shall not impose ground connection on supply.

C. Auxiliary power: Design auxiliary equipment for low voltage service, with electrical power designed to operate from one of nominal electrical power sources as follows and as indicated on Drawings:

<table>
<thead>
<tr>
<th>Volts</th>
<th>Phase</th>
<th>Frequency</th>
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</thead>
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<tr>
<td>480Y/277</td>
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<td>60</td>
</tr>
<tr>
<td>208Y/120</td>
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<tr>
<td>120/240</td>
<td>1</td>
<td>60</td>
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<tr>
<td>125</td>
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</table>

D. Design equipment in accordance with seismic requirements listed in most recent local building codes, Section 01 83 00 – Structural Performance Requirements and Data Sheets.

2.02 MECHANICAL CONSTRUCTION

A. Provide recommendation for attachment of equipment to foundation or structural supports with design drawings, as applicable. Method of attachment will take into account seismic requirements of job site as indicated on Data Sheets and in Section 01 83 00 – Structural Performance requirements.

2.03 FACTORY WIRING

A. Select cable for electrical and environmental conditions of installation, and suitable for unusual service conditions where encountered.
   1. Proper temperature application cable shall be used throughout, but shall be not less than 90°C rated.
   2. Conductors routed over hinges shall use extra-flexible stranding.
   3. Cable insulation shall be rated for maximum service voltage used, but not less than 600 volts.
   4. Splices not allowed.

B. Panel, control cabinet, switchboard, motor control center, and switchgear wiring shall use flame retardant cross-linked polyethylene (XLPE) or flame retardant ethylene-propylene rubber (EPR) insulation that meet or exceed requirements of UL 44 for Types SIS, and XHHW.
   1. Minimum size: No. 14 AWG (1.5 mm²).
   2. Conductors: Annealed bare copper with fine stranding passing IEEE 1202 and UL VW-1 flame test.

C. Instrumentation, thermocouple, and thermocouple extension wire shall use twisted shielded pairs/triads having flame retardant cross-linked polyethylene (XLPE) insulation, and chlorinated polyethylene (CPE) jacket.
   1. Minimum size: No. 16 AWG (1.0 mm²).
   2. Conductor type:
   3. Provide each pair/triad with shield.
   4. Shielding shall consist of aluminum-polyester tape and flexible strand tin-coated No.18 AWG (0.75 mm²) copper drain wire.
   5. Drain wire for each instrument cable shall be insulated with spaghetti sleeve. One end of shield wire shall be terminated on grounded terminal.
   6. Cables shall pass IEEE 1202 and ICEA 70,000 Btu/hr vertical tray flame test, and each conductor shall pass UL VW-1 flame test.

D. Terminations:
1. Conductor terminal connectors shall be insulated, ring tongue, compression type connectors properly sized for conductor and terminal.
   a. Connectors shall be constructed of copper and shall be tin-plated.
   b. Interior surface of connector wire barrel shall be serrated; exterior surface of connector wire barrel shall be furnished with crimp guides.
2. Uninsulated terminal connectors shall be used for conductors terminated on devices equipped with individual fitted covers, such as, but not limited to, control switches and lockout relays.
3. Connections requiring disconnect plug and receptacle type devices shall be provided with factory-terminated conductors on each plug and receptacle.
   a. Plugs and receptacles shall be factory wired into junction boxes containing terminal blocks for external connections.
   b. Conductors on disconnect portion of plug-receptacle assemblies shall be in common jacket.
4. Prior to shipment of equipment, remove temporary wiring installed in factory for equipment testing.
5. Current transformers shall terminate on shorting type terminal blocks. Ship with shorting jumpers installed.

E. Identification and labeling:
1. Provide conductor identification sleeve on each end of each internal conductor. Mark each sleeve with opposite end destination identification with non-smudging, permanent black ink. Sleeves shall be UV-resistant self-adhesive type or PVC, not less than 1/2” long.
2. Permanently label each terminal block, terminal, conductor, relay, breaker, fuse block, and other auxiliary devices to coincide with identification indicated on manufacturer’s drawings.

2.04 SPLICES AND TERMINATIONS

A. Splices, except as in lighting and general-purpose power circuits specified below, not allowed unless specifically indicated on Drawings or required for connection to equipment.

B. Temperature rating of splices and terminations: No less than 75°C.

C. Splices allowed in lighting and general-purpose power circuits.
   1. Provide wire and cable connectors of high-conductivity, corrosion-resistant material with contact area equal to at least current carrying capacity of wire or cable.
   2. General lighting and general-purpose building power circuits:
      a. Twist-type, insulated spring connectors for splices on solid or stranded conductors smaller than No. 6 AWG.
      b. Use indent, hex screw, or bolt clamp-type connectors, with or without tongue for splices on solid or stranded conductors No. 6 AWG and larger.
      c. Apply insulating 600-volt tape.

D. Insulating tapes and compounds for terminations and splices: UL-listed for intended use, location, and voltage by manufacturer.

E. Termination of conductors to equipment with bolted connections:
   1. Use compression type lugs:
   2. Compression lugs for cables 250 kcmil and larger shall have at least 2 clamping elements of compression indents, and provision for at least 2 bolts for joining to apparatus terminals.
   3. Crimping hand tools used for securing conductors in compression type connectors or terminal lugs shall be made for purpose and conductor sizes involved.
   4. Crimping tools shall be ratchet-type preventing tool from opening until crimp action is completed.
   5. Tools shall be product approved by connector manufacturer.

F. Terminals:
   1. Conductors No. 10 AWG and smaller: Marathon 1500 Series.
   2. Conductors larger than No. 4/0 AWG: Terminate to tinned copper bus bar drilled and tapped with standard NEMA sized and spaced holes.
G. Coordinate sizes and types of conductor terminals for 600-volt power cable terminations in equipment with furnished conductor and terminal connector data.

H. Provide 600-volt rated terminal blocks for instrumentation and control conductors for connection to circuits external to specified equipment, and for internal circuits crossing shipping splits.
1. Use crimp-on terminals matching termination point terminations in manufacturer-furnished panels. Splices not allowed.
2. Terminal blocks for thermocouple extension wire: Buchanan “Medium Duty” with thermocouple contacts or Marathon 200 Series with Omega Engineering, Inc. Type TL terminal lugs.
3. Furnish with white marking strips.
5. Fuses may be mounted on terminal blocks.
6. Maximum 2 conductors in accordance with termination point.

I. Terminal blocks for external connections shall leave from centrally mounted location, not from individual devices in enclosure.
1. Group-in instrument and control compartment for easy accessibility.
2. Provide sufficient space on each side of each terminal block to allow orderly arrangement of leads to be terminated on block.
3. Locate auxiliary equipment in compartments, enclosures, or junction boxes so service personnel will have direct access without interference from structural members and instruments without removal of barriers, cover plates, or wiring.
4. Do not mount terminal blocks in compartments containing cables or buses operating at voltages above 600 volts.
5. Size for wire sizes of incoming conductors as necessary.

J. Circuit identification number listed on either circuit schedule or panel schedule shall be used to identify circuit, positioned as near as possible to end of each conductor on multiple single wire circuits and on cable jacket for multiconductor cables.

K. Cable designations shall be visible after installation without requiring physical movement of cable.

2.05 ELECTRICAL ENCLOSURES

A. Size junction boxes, pull boxes, and enclosures in accordance with requirements of NEC.

B. Junction boxes and pull boxes 4” (100 mm) trade size or smaller in any dimension shall be galvanized malleable iron, or cast ferrous metal NEMA rated for installed location. Do not use concentric knockouts.

C. Junction boxes, pull boxes, and electrical enclosures larger than 4” (100 mm) trade size in any dimension shall be as follows, unless required otherwise.
1. NEMA rating for electrical enclosures installed in nonhazardous locations:
   a. Indoor:
      1) Dry environmentally controlled area: NEMA 12.
      2) Noncorrosive wet or hose-down area: NEMA 4.
      3) Corrosive wet or hose-down area: NEMA 4X
   b. Outdoor:
      1) Corrosive area: NEMA 4X.
      2) Noncorrosive area hose-down or spray area: NEMA 4.
      3) Noncorrosive area nonhose-down area NEMA 3R.
2. Construct noncast-metal electrical enclosures from reinforced steel plate capable of supporting devices mounted on or within enclosure without deflection. Steel plate thickness shall conform to UL requirements.
3. Enclosures shall be of adequate strength to support mounted components during shipment and installation.
5. Electrical enclosures located in outdoor, wet, or hose down areas shall be provided with space heaters. Provide space heaters completely wired within enclosure. Provide following:
   a. Space heater.
   b. Adjustable thermostat with set point temperature indicator.
   c. One miniature circuit breaker protective device.
   d. Space heaters, thermostat, and protection shall not interfere with cable into or out of enclosure, or with maintenance or replacement of devices within enclosure.
   e. Use of space heaters shall not change or discolor any painted surface.
   f. Space heater capacity shall maintain enclosure internal temperature above dew point under service conditions for Fairbanks, Alaska.
   g. Space heaters: Rate for 240 volts ac minimum, and size for operation on applied voltage of 120 volts ac.

D. Outdoor electrical enclosures with ventilating openings:
   1. Louver on outdoor electrical equipment and protect in accordance with NEMA type.
   2. Equip openings on outdoor electrical equipment with fine mesh filters and stainless steel bug screens.

2.06 OUTLET BOXES

A. Outlet boxes for concealed wiring systems: Sheet metal, galvanized or cadmium plated.

B. Minimum 4” (100 mm) square, 1-1/2” (38 mm) deep, sized to accommodate devices and number of conductors in accordance with NEC. Equip with plaster ring or cover as necessary for flush finish.

C. Exposed conduit systems shall have surface-mounted boxes unless specified otherwise. Boxes for exposed wiring in nonhazardous, noncorrosive, and nonweatherproof locations shall be malleable iron, cadmium finish or cast aluminum alloy, minimum 4” (100 mm) square, 1-1/2” (38 mm) deep.

D. Enclosures shall be as required for areas in which they are installed and as specified.
   1. Boxes: Install flush in masonry construction and design for intended use.
   2. Recessed boxes:
      a. Where fixture is mounted, boxes shall be minimum 4” (100 mm) and octagonal in shape or 4” (100 mm) square by 1-1/2” (38 mm) deep with round plaster ring.
      b. Where used as junction box, boxes shall be minimum 4” (100 mm) square by 2-1/8” (53 mm) deep.
   3. Outlet boxes for wall concealed telephone and signaling systems: 4” (100 mm) square by 1-1/2”(38 mm) deep, minimum. Furnish with plaster ring and cover plate.
   4. Floor boxes for floor outlets:
      a. Cast-metal with threaded conduit entrances, brass flange ring and brass duplex flap cover plate.
      b. Watertight with leveling and adjustment screws for adjusting cover plate to finished floor.
      c. Minimum 4” (100 mm) diameter and 3-1/2” (88 mm) deep with approved gasket or seal between adjusting ring and box.
   5. Floor outlets for combination signaling, data, and power outlets: Construct of steel base, PVC housing, and steel bracket to allow feed through wiring and activation load-bearing support. Box construction shall meet UL 514A requirements.
      a. Entire housing shall be removable for unrestricted access.
      b. Once assembled, PVC housing shall be capable of carrying 6,000 lb (2722 kg) load.
      c. Coordinate outlet requirements with communication system requirements.
   6. Floor boxes in 2-hour rated floors shall be secured in cored hole and shall be UL classified and listed for 2-hour rated floors.

2.07 PULL AND JUNCTION BOXES

A. Furnish junction boxes and pull boxes were shown on Drawings, and where necessary to facilitate pulling wires and cables without damage.
B. Above ground boxes shall be formed from sheet steel, with corners folded in and securely welded with inward flange on each of 4 edges.

C. Drill box for mounting and attachment of cover; galvanize after fabrication.

D. Cover: Construct of one-piece galvanized steel and provide with stainless steel round head machine screws.

E. Box and cover shall be made of code gage steel, or heavier if shown on Drawings.

F. Size: Minimum 4-1/2" (113 mm) deep and in accordance with NEC. Use next larger standard size when necessary in accordance with manufacturer standard sizes.

G. Furnish pull and junction boxes without knockouts for field drilling.

H. Enclosures shall be as required for areas in which installed and in accordance with requirements specified.

I. Underground boxes: Specifically design and construct for intended installed location, and be either pre-formed concrete or PVC. Covers shall be capable of withstanding, without failure, type of traffic in general area.

J. If pull and junction boxes are exposed in and around architecturally finished surfaces, paint box to match finish of nearby surfaces, unless indicated otherwise.

K. Bolt-on junction box covers 3'-0" (900 mm) square or larger, or heavier than 25 lb. (11 kg) shall have permanent rigid handles. Covers larger than 3'-0" x 4'-0" (900 mm x 1200 mm) shall be split.

2.08 EQUIPMENT SAFETY GROUNDING

A. Exposed raceway shall be electrically continuous. Conduit and tray shall not be considered to be only ground conductor.

B. Furnish equipment that is part of integral shipping unit or assembly with bare copper ground conductor extending to central ground connection lug. Lug shall be suitable for field connection to local ground. Electrical equipment shall be considered any device that is energized.

C. Single-point ground connections required for proper operation of electronic equipment shall be insulated from equipment safety ground. Such connections shall be extended, using insulated cable, to single insulated termination point suitable for field connection to appropriate ground system.

D. Conduits containing power circuits shall have ground conductor installed inside conduit. Ground conductor shall be bonded to equipment or tray or duct ground at both ends.

E. Provide ground bushing on each conduit containing power circuit. Connect ground bushings together inside enclosure and to enclosure ground lug or ground bus.
   1. Use No. 8 AWG conductor for ground bushings trade size 1-1/2" (38 mm) and smaller.
   2. Ground bushings larger than 1-1/2" (38 mm) shall be sized in accordance with requirements of NEC, but in no case shall bushings be smaller than No. 8 AWG.

F. Ground conductor: Uninsulated, Class B standard, round soft drawn uncoated copper as defined in ICEA S-19-81, unless specified otherwise.

G. Hardware: Clamps, bolts, washers, nuts, and other hardware used with grounding conductor shall be copper, copper alloy, high copper alloy, or silicon bronze.

2.09 PIN AND SOCKET CONNECTORS
A. Unless shown on Drawings, not allowed.

2.10 FUSES AND FUSE BLOCKS

A. Modular-type, Class H screw terminal fuse blocks with Bakelite frame and reinforced retaining clips. Blocks shall be similar in construction and by same manufacturer.

B. Slow blow fuses: Bussmann Type MDL or Gould Shawmut Type GDL with ampere ratings of 1/4, 1/2, 1, or 2.

C. Fast acting fuses: Bussmann Type NON or Gould Shawmut Type OT with ampere ratings of 1, 3, 6, 10, 15, 20, or 30.

D. Extremely fast acting fuses: Bussmann Type KAB with ampere ratings of 1, 3, 6, 10, 15, 20, or 30.

2.11 CONTROL RELAYS

A. General service, industrial grade auxiliary relays rated 600-volt.

B. Contacts: Reversible from N.O. to N.C. in field.

C. Timing relays for critical service: Agastat Series 7000.

2.12 CONTROL SWITCHES

A. Multistage, rotary-type rated 120 volts ac or 125 volts dc, 3 amperes, as required.

B. Handles: Black, fixed, modern, pistol grip type. Provide engraved black plastic escutcheon plates with targets.

C. Provide with colored LED lamps and nameplates as required.

2.13 PUSHBUTTONS

A. Standard pushbuttons: Heavy, industrial-type rated 120 volts ac or 125 volts dc, 3 amperes, as required.

B. Provide with colored LED lamps and nameplates as required.

2.14 INDICATING LIGHTS

A. Status indicating lights: High-intensity, cluster, LED-type for panel mounting.

B. Coordinate indicating light colors with indicated conditions as follows. Indicating lights shall be energized when condition exists and shall be de-energized when condition does not exist:
   1. Red: Equipment energized: such as motor running, valve open, or breaker closed.
   2. Green: Equipment de-energized: such as motor stopped, valve closed, or breaker open.
   3. Amber: Equipment abnormality: such as motor trip, breaker trip, or relay trip.
   4. White: Monitoring of control power or trip coil: such as lockout relay trip coil monitor or breaker trip coil monitor. Light is on during normal circuit operation and off during loss of power or loss of coil.
   5. Blue: Loss of control power.

2.15 ALARM AND TRIP CONTACTS

A. Alarm contacts for remote annunciation: Suitable for operation at 120 volts ac and 125 volts dc. Contacts shall be rated at least 0.5-ampere make and break, minimum.
B. Alarm contacts: Normally closed contacts that open to alarm condition.

C. Trip contacts for remote trip: Suitable for operation at 125 volts dc and rated 5 amperes make or break, minimum.

2.16 SEPARATELY MOUNTED COMBINATION MOTOR STARTERS

A. Enclosed, 3-phase, full-voltage, nonreversing, unless indicated otherwise.

B. Complete combination starter shall have minimum interrupting rating of 65 kA or greater if specified elsewhere or indicated on Drawings.

C. Starter enclosures shall have enclosure NEMA rating specified herein.

D. Provide combination starter with microprocessor-based contactor and integral electronic overload protection; minimum size shall be NEMA 1.

E. Each phase shall have microprocessor-monitored current sensor for motor running overload, phase loss and phase unbalance protection.
   1. Provide Class II ground fault protection; set to 20% of maximum continuous ampere rating and have delay of 20 seconds and run delay of 1 second to prevent nuisance trip on start.
   2. Single-speed starters shall be furnished with 3 current sensors. 2-speed starters shall be furnished with 6 current sensors.

F. Starters shall be furnished with motor circuit protectors (MCP) rated 600-volt or Bussman type RK1 or Bussman type RK1 current limiting fuses.
   1. Each breaker shall be manually operated with quick-make, quick-break, trip-free toggle mechanism.
   2. Starters shall have external manual breaker-operating handle with provisions for up to 3 padlocks.
   3. Access door shall be interlocked with motor circuit protector, so door cannot be opened while breaker is closed except by interlock override.
   4. Starter contactor shall mechanically operate auxiliary contacts. Each starter shall include auxiliary contacts required for application, plus 2 spare NO and 1 spare NC contacts.
   5. Provide membrane-style pushbutton control module and LED lights, if indicated on schematics, to control starter functions and indication. Pushbuttons and LEDs shall be clearly identified.
   6. Verify and match control power transformers, overload protection, and sizes of starters to actual equipment furnished.
   7. Size control power transformers (CPT) to supply control circuit and any additional loading simultaneously. Minimum CPT size shall be 100 volts-amperes for Size 1 starters and 150 volts-amperes for Size 2 and larger starters.
   8. CPTs shall have primary leads protected, and one secondary lead protected and one secondary lead grounded. Provide DIN rail-mounted, miniature circuit breakers for protection. Fuses not allowed.
   9. Starters for systems with system voltage of 120 volts or less shall not require CPT.
10. Two-speed starters and reversing starters shall be mechanically and electrically interlocked so only one set of contacts can be closed at any one time.

2.17 LOCAL SEPARATE CIRCUIT BREAKERS

A. Provide 3-pole, molded-case, separately enclosed circuit breakers of not less than interrupting rating shown on Drawings at rated voltage.
   1. Provide with thermal and instantaneous trip elements.
   2. Breakers shall use high-conductivity copper for current carrying parts. Breaker enclosures shall have NEMA type enclosure as specified.

B. Each breaker shall be manually operated with quick-make, quick-break, and trip-free toggle mechanism. Thermal elements shall withstand sustained overloads and short-circuit currents without injury and without affecting calibration.
C. Circuit breakers shall have "On," "Off," and "Tripped" indication and shall be pad-lockable with 3 padlocks in "On" and "Off" position.
   1. Breakers rated over 70 amperes shall be rated 100% and have adjustable electronic trip units.
   2. Breakers shall be capable of adding alarm, lockout, shunt trip, and under-voltage as options.

2.18 LOCAL SEPARATE DISCONNECT SWITCHES

A. Three-pole, nonfusible, heavy-duty, rated 600-volt with continuous current rating as shown on Drawings and as required by load.
   1. Type: Either molded-case or blade.
   2. Switches shall use high-conductivity copper for current carrying parts.

B. Switches shall be positive, quick-make, and quick-break mechanisms.
   1. Switch assembly plus operating handle shall be integral part of enclosure base.
   2. Each switch shall have handle whose position is easily recognizable and which can be locked in "On" and "Off" position with 3 padlocks. "On" and "Off" positions shall be clearly marked.

C. Switches shall be UL-listed and horsepower rated. Where applicable, switches shall have defeatable door interlocks that prevent door from being opened while operating handle is in "On" position.

2.19 DC MOTOR STARTERS

A. Magnetic starters for dc service shall be suitable for starting 125 volts dc rated motors unless stated otherwise.

B. Starters shall have same features and capabilities, where applicable, as ac combination and manual starters.

C. Size starters for motor served. Coordinate system requirements with equipment manufacturer’s requirements.

D. Manufacturer: General Electric.

2.20 PLATES AND COVERS

A. Provide finish plates and covers of appropriate type and size for wiring and control devices, signal, and communication outlets.

B. Mark each plate and cover to show circuit and panel designation. Unless indicated to be engraved plate, use self-sticking, clear membrane, UV-resistant labels with typed black letters. Handwritten labels not allowed.

C. Coordinate color with adjacent surfaces.

D. Raised cover galvanized steel plates shall be acceptable for use on surface-mounted outlet boxes in unfinished areas where weatherproof plates are not required.

E. For weatherproof installations, cover plates shall be gasketed and rated for NEMA Type 4 installation.

F. Device plate mounting hardware shall be countersunk and finished to match plate.

2.21 WIRING DEVICES

A. Where more than one flush device is indicated in same location, mount devices in gangs under common plate.
B. Switches for control of ac lighting panel load circuits, single-pole, 3-way, and 4-way, shall be premium, heavy-duty specification-grade, and meet FS W-S-896E. Switches shall be rated for use at 120 or 277 volts and 20 amperes minimum.

C. Device color, if not shown on Drawings, shall be coordinated to match adjacent finishes.

D. Wall switches requiring pilot light indication shall have red LED pilot light when toggled "On."

E. Pulse control of lighting contactors shall be 20 amperes, 120/277 volts, momentary, double-throw, and center "Off."

F. Standard convenience outlets: Premium, heavy-duty, specification-grade, duplex, 3-wire, grounding, 20-ampere, 125-volt for 120-volt circuits, and rated 250-volts for 240 or 208-volt circuits.

G. Ground fault circuit interrupter (GFI) receptacles: Duplex, 20-ampere, and 125 volts, feed-through type.

H. Isolated ground (IG) outlets: Duplex, 3-wire, with isolated grounding terminal, 20-ampere, and 125 volts. Outlets shall be orange in color, unless specified otherwise.

2.22 WELDING

A. If special welding requirements are required for any piece of equipment during installation, requirements shall be stated on manufacturer’s shop drawing of affected part.

B. Furnish detailed welding requirements with equipment shipment.

2.23 PANELBOARDS

A. Dead-front, circuit breaker type, rated for voltage, phase, with main lugs or main breaker as indicated on panel schedules.

B. Enclosure shall be NEMA-rated for installation location and capable of flush or surface mounting.

C. Enclosure cover and access door shall be hinged with breaker operating handles accessible through latchable and lockable door.

D. Typed panel directory located inside door shall have panel and circuits function clearly identified. Handwritten panel schedules not allowed.

E. Provide main and neutral buses insulated from cabinet with separate ground bus. Bus material shall be copper. Ground bus shall be similar to neutral bus in size and number of conductor terminating positions.
   1. Bond ground bus to panelboard enclosure by copper ground strap or copper conductor of appropriate size. Bond neutral bus to ground bus in accordance with requirements of NEC.
   2. Grounding bus connection to enclosure by removable screws not allowed.
   3. Bus shall be capable of terminating clamp type lugs for neutral cable in each supply conduit, and connections for neutral cable in each load circuit.
   4. Neutral bus shall be fully rated, unless specified otherwise.
   5. Isolated ground panelboards: As specified above, except isolated ground bus shall be bonded, by insulated ground conductor, back to source of separately derived system. Do not bond isolated ground bus to panelboard enclosure unless this is first point of grounding for separately derived system.

2.24 CIRCUIT BREAKERS

B. Branch circuit breakers used for lighting circuits shall be switch duty rated, “SWD.”

C. Breakers having multiple poles shall be manufactured as common trip type.

D. Interrupting rating shall be not less than interrupting rating of panelboards, and not series rated to achieve required short circuit interrupting rating.

E. Provide handle clips for 10%, or minimum of 2 whichever is greater, for breakers to prevent casual operation. If no breakers are indicated for installation, then provide on breakers labeled as spare.

F. Breakers, and provisions for future breakers, shall be provided in quantities, poles, and ampere ratings shown on Drawings.

G. Molded-case circuit breakers used in ac and dc panelboards and ac load centers shall be bolt-on type, G-frame size.

2.25 FINISHES

A. Manufacturer’s standard coating systems shall be factory-applied. Coating systems shall provide resistance to corrosion caused by weather and industrial environments.
   1. Surfaces inaccessible after factory or field assembly shall be protected for life of equipment.
   2. Painted surfaces shall be filled to provide smooth, uniform base for painting.
   3. Surfaces requiring field welds shall not be coated within 3” (75 mm) of field weld.

B. Coating material and application techniques shall conform to regulations of air quality management agency having jurisdiction.

C. Exterior surfaces of control and electrical equipment, including panels, cabinets, switchgear, transformers, and motors shall be manufacturer’s standard colors unless specified otherwise.

D. Apply high-temperature coating systems to uninsulated equipment operating at temperatures at or above 200°F (93°C).

2.26 RUST-INHIBITOR COMPOUNDS

A. Uncoated machined and ferrous surfaces subject to corrosion shall be protected with rust-inhibitor compounds.

B. Rust-inhibitor compounds used to protect surfaces of equipment and piping exposed to feedwater or steam shall be completely water-soluble.

C. Surfaces to be field welded shall be coated with consumable rust-inhibitor compounds that will not affect quality of weld.

D. External gasket surfaces, flange faces, couplings, rotating equipment shafts and bearings shall be thoroughly cleaned and coated with rust-inhibitor compounds.

2.27 IDENTIFICATION AND TAGGING

A. Conduits inside manholes, hand holes, building entrance pull boxes, and junction boxes shall be provided with 19-gage (1 mm) stainless steel identification tags, with 1/2” (13 mm) stamped letters and numbers.
   1. Attach conduit Identification tags with stainless steel banding. Tag position shall be readily visible for inspection.
   2. Tags shall provide, as minimum:
      a. Circuit origination and destination.
      b. Voltage.
      c. Number of conductors in accordance with phase.
d. Number of phase conductors.

B. Cables passing through or terminating in manholes, hand holes, and pull boxes shall have 19-gage (1 mm) stainless steel identification tags with stamped lettering that provides circuit identification information.

C. Provide power, control, and instrumentation cables with permanent type identification markers with typed cable numbers and from/to information at each point of termination. Cable numbers and from/to information will be provided for circuits not associated with low-voltage panelboards.
   1. Position cable markers to be readily visible for inspection.
   2. Cable numbers shall match those as shown on Drawings.
   3. Provide wire tags at each termination point for each conductor. Tags shall be permanent, wrap around, heat-shrinkable type with typewritten information.

D. Color-code power conductors with electrical tape or provide with colored jacket.
   1. Source voltage of 208Y/120 volts:
      a. Phase A: Black.
      b. Phase B: Red.
      c. Phase C: Blue.
   2. Source voltage of 120/240 volts:
      a. Phase A: Black.
      b. Phase B: Red.
   3. Source voltage of 480Y/277 volts:
      b. Phase B: Orange.
      c. Phase C: Yellow.
      d. Neutral: Gray.
   4. Source voltage of 240/120-volt delta: High-leg systems shall not be used without Engineer approval.
   5. Service entrance and equipment ground conductors shall be bare copper or green insulated conductor. Equipment bonding conductors shall be bare copper.
   6. Isolated ground conductors shall be insulated; green in color with integral yellow stripe. No substitutions.

E. Signage:
   1. Provide proper signage, plaque, directory and warning labels for electrical equipment and raceway in accordance with NEC requirements.
   2. One-line diagram: Display unfolded and behind clear plastic so diagram is clearly visible.
   3. Mount diagram to permanent structure or wall and located within sight of each feeder, branch-circuit disconnect, each service disconnect, and switchgear. Place permanent legible warning sign in conspicuous location with wording “Danger – High Voltage” required for following areas over 600 volts:
      a. A “Danger – High Voltage” warning sign lettering shall be a minimum of 1” (25 mm) high and remaining lettering a minimum of 1/4” (6 mm) high.
      b. Locations:
         1) At entrances to electrical equipment vaults and electrical equipment rooms, areas, or enclosures, and manholes and handholes, unless words are cast into access cover.
         2) At points of access to conductors on high-voltage conduit systems and cable systems.
         3) On cable trays and cable trench containing high-voltage conductors with maximum spacing of warning notices not to exceed 10’ (3 m).
         4) On metal-clad and metal-enclosed switchgear panels or doors providing access to live parts over 600 volts [a], [Article 225.70].
         5) On isolated phase and nonsegregated phase bus duct, at access openings unless Buyer has a differing standard.

2.28 EQUIPMENT NAMEPLATES
A. Laminated white-over-black plastic such that face is white with black letters, with 1/8” (3 mm)
engraved letters securely fastened with minimum of 2 self-tapping, stainless steel screws.

B. Motor starters, either separately mounted or contained in motor control centers, shall have
nameplates identifying related equipment. Where separate control and indicating lights are used,
starters shall have engraved or etched legends ("start", "stop", etc.) as shown on Drawings.

C. Provide control stations with nameplates identifying related equipment. Control and indicating lights
shall have engraved or etched legends as shown on Drawings.

D. Circuit breakers within main switchboards and distribution switchboards shall be provided with
nameplates identifying related equipment being served.

E. Fused and nonfused switches shall have 2 front cover-mounted nameplates.
   1. Nameplate containing permanent record indicating switch type, manufacturer’s name, catalog
      number, and appropriate rating for equipment served.
   2. Provide additional nameplate to identify associated equipment.

F. Panelboards shall have front cover-mounted nameplates identifying panelboard, matching information
shown on Drawings and associated panel schedule. Nameplate shall have at least 4 lines of text
consisting of:
   1. Line 1: Panel equipment identification number.
   3. Line 3: Appropriate description from which power is derived, (i.e. fed from HP1 through XFMR-
      LP1).
   4. Line 4: Location of power source, (i.e. PP-1, NW wing).

G. Lighting and auxiliary power transformers shall have front cover-mounted nameplates identifying
transformer, matching information shown on Drawings. Nameplate shall have at least 2 lines of text
that consist of:
   1. Line 1: Transformer equipment identification number.
   2. Line 2: Location of derived power source (i.e. fed from MDB, Elec Rm Basement).

H. Nameplates shall meet requirements of NFPA 70E

2.29 HARDWARE

A. Provide hardware including, but not limited to, anchor bolts, nuts, washers, expansion anchors, wire
nuts needed for installation.

B. Hardware smaller than 3/4” (19 mm) shall match NEMA standard size bolt holes on motors and
electrical equipment.

2.30 LOGIC SYSTEMS FACTORY TESTING

A. Prior to shipment, test electrical equipment containing solid-state logic systems in accordance with
manufacturer’s standard tests for minimum of 120 hours under power.
   1. Components tested shall include electronic devices; power supplies, input-output devices,
      operator interface devices, and interconnecting cables provided with system.
   2. System shall be tested as complete assembly. Testing of individual components or modules not
      allowed as system tests.

B. System test shall include:
   1. Means of confirming logic or mathematical design response of system by simulating changes in
      system input.
   2. Test shall repeatedly cycle system through operations system will be expected to perform in
      service with loads on various components equivalent to those which will be experienced in actual
      service.
3. Adjustment of power source voltages to high and low limits. Verify correct operation of system at both high and low power source voltage limits.

C. System shall be tested and verified capable of providing surge withstand capability in accordance with requirements of ANSI C37.90.1.

D. Perform tests with solid-state logic system exposed to ambient temperature appropriate to service for which associated electrical equipment is designed.

PART 3 EXECUTION

3.01 EXAMINATION OF SITE

A. Seller shall be responsible for familiarity with Project Site conditions. Equipment furnished and installed shall be capable of withstanding most severe conditions that will be encountered.

3.02 PROTECTION OF WORK

A. Protect installed Work and provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.

B. Damage occurring to building or equipment during installation shall be repaired or replaced to conditions existing prior to damage at no additional cost or delay to project or Buyer.

3.03 TRIP SETTING COORDINATION

A. Motor overload protection shall be selected and set by Seller based on final motor nameplate information. Size motor circuit protectors to coordinate with motor starting characteristics and overload protection. Submit summary of settings to Buyer, list:
   1. Equipment project identification number.
   2. Nameplate information.
   3. Overload device trip range.
   4. Overload device setting.
   5. Trip device rating.
   6. Trip device setting if different from rated value.

B. Set trip devices and verify devices are operating within manufacturer’s tolerances. Make changes to settings not complying with requirements furnished by Engineer. Device settings will be furnished for following equipment:
   1. Medium-voltage system.
   2. Low-voltage switchgear.
   3. Secondary unit substations.

3.04 WIRING DEVICES, BOXES, AND FITTINGS

A. Install galvanized or cadmium plated, threaded, malleable iron boxes and fittings in:
   1. Embedded in concrete walls, ceiling, and floors.
   2. Outdoor exposed faces of masonry walls.
   3. Locations where weatherproof cover is required by code or this specification.

B. Install galvanized or cadmium plated sheet steel boxes in:
   1. Indoor exposed faces of masonry walls.
   2. Interior partition walls.
   3. Joist supported ceilings.

C. Rigid PVC device boxes shall be installed in exposed nonmetallic conduit systems.

D. Telephone and communication conduit systems shall have separate junction boxes and pull fittings.
E. Install fire system wiring in dedicated conduit system.

F. Finish openings so standard sized cover plates can be used. Oversized plates not allowed.

G. Mount wall switches 3'-6" (1050 mm) above finished floor or grade unless specified otherwise. After circuits are energized, test wall switches for proper operation.

H. Outlets:
   1. Standard mounting height: 18" (450 mm) above finished floor, unless specified otherwise.
   2. Outlets outdoors, garages, basements, shops, storerooms, and other rooms where equipment may be hosed down: 4'-0" (1200 mm) above finished floor or grade.
   3. Surface-mount welding receptacles 4'-0" (1200 mm) above finished floor or grade.
   4. After circuits are energized, test each receptacle for correct polarity.
   5. Test GFCI receptacles for proper operation.
   6. Mount wall thermostats 5'-6" (1650 mm) above finished floor unless noted otherwise. Thermostats mounted shall be suitably insulated from wall temperatures.

I. Communication outlets:
   1. 18" (450 mm) above finished floor unless required otherwise.
   2. Outlets outdoors, garages, basements, shops, storerooms, and rooms where equipment may be hosed down: 4'-0" (1200 mm) above floor.

J. Clock outlets: Locate 7'-0" (2.13 m) above finished floor or grade.

3.05 GROUNDING AND BONDING

A. Electrical system and equipment grounding shall be installed in accordance with NEC and shall conform to following, where applicable:
   1. Ground conductors shall be bare or green-insulated in accordance with NEC.
   2. Cable shall be soft-drawn copper or copper bar, sized in accordance with drawings and NEC, but not smaller than No. 12 AWG.
   3. Ground cable splices and joints inaccessible upon completion of construction shall meet requirements of IEEE 837 and shall be exothermic weld or compression system type.
   4. Ground cable through exterior building walls not in conduit shall enter within 3' (1 m) below finished grade and shall be provided with water stop.
   5. Ground cable near base of structure shall be in undisturbed earth and as far from structure as excavation permits, but not closer than 6" (150 mm).
   6. Copper ground conductor in addition to conduit connection shall ground each piece of electrical equipment.
   7. Copper or high-conductivity copper alloy ground lugs or clamps shall make ground connections to equipment and ground buses. Connections to enclosures not provided with ground buses or ground terminals shall be made by clamp-type lugs added under permanent assembly bolts or under new bolts drilled and added through enclosures other than explosionproof, or by grounding locknuts or bushings. Ground cable connections to anchor bolts; against gaskets, paint, or varnish; or on bolts holding removable access covers not permitted.
   8. Bond grounding system to water piping by connection to first flange inside building from main that will form good ground connection. Make connection with copper bar or strap by drilling and tapping flange and providing bolted connection.
   9. Ground conductors on equipment shall be formed to contour of equipment and firmly supported.
   10. Ground rods not described elsewhere shall be minimum 5/8" (16 mm) diameter by 10' (3.0 m) long, with copper jacket bonded to steel core.
   11. Make connections to ground grid where shown on Drawings.
   12. Verify connections by performing continuity checks.

3.06 FIREPROOFING AND FIRE RATINGS

A. Maintain fire-resistive integrity during construction.
B. Penetrations through fire-resistive structures shall be sealed with fire-resistive material compatible with construction penetration.

C. Where required by codes, local building officials, or fire marshal, furnish UL fire sealing systems and install in accordance with manufacturer’s recommendations.

D. Coordinate specific testing requirements with each project.

END OF SECTION

1) Dan Akselrod
2) Stanley Worcester
PART 1  GENERAL

1.01  RELATED SECTIONS

A. Section 00 43 33 – Proposed Product Form (Datasheets)
B. Section 01 40 00 – Quality Requirements.
C. Section 01 43 33 – Manufacturer’s Field Services and Performance Testing.
D. Section 01 78 23 – Operating and Maintenance Data.
E. Section 26 05 00 – Common Work Results for Electrical.
F. Section 26 05 03 – Small and Medium 3-Phase Motors.
G. Section 48 10 01 – Cylindrical-Rotor Synchronous Generators.

1.02  SYSTEM DESCRIPTION

A. The condensing steam turbine shall be single-cylinder non-reheat type unit with reduction gearing. The turbine will have two extractions. The Low Pressure (LP) extraction shall be an auto-extraction. The Intermediate Pressure (IP) extraction will be uncontrolled. Refer to Section 00 43 33 for design and guarantee operating conditions and minimum pressure requirements.

B. Units will be installed indoors in power plant room environment and be used for generation of electricity and to supply steam for export to external users. Turbine shall be supplied with main steam from a new coal boiler (by others). Steam turbine will be connected to a hybrid condensing system consisting of a surface condenser and wet cooling tower in conjunction with an air cooled condenser.

1.03  SUBMITTALS

A. Shop drawing submittals shall conform to and the requirements of Section 01 33 00 and shall be submitted in accordance with the submittal schedule provided in the contract documents.

1.04  QUALITY ASSURANCE

A. See Section 01 42 19 – Reference Standards and 01 40 00 – Quality Requirements.

1.05  DESIGN AND OPERATING CONDITIONS

A. Steam will be supplied to the turbine from two (2) coal fired boilers. Extractions shall be used for process heating and in-plant loads.

B. Existing boiler water conditions:
   1. Concentration, ppm maximum:
      a. Suspended Solids:  < 3 ppm
      b. Specific Conductivity (µS/cm):  < 600 max; Typically 475 – 500. Silica (SiO₂):  < 2 ppm; max; Typically 0.4 - 0.6 ppm.
      c. Alkalinity: 75 – 100 ppm
      d. pH: 10 - 12
2. Supplemental chemicals, including sodium hydroxide, sodium sulfite, phosphates, neutralizing amines, and organic dispersants will be added to feedwater as required at points external and internal to existing boilers and new steam generating units.

C. Design criteria:
1. Equipment shall be designed to operate without damage up to trip speed and exhaust relief valve set pressure.
2. Design extraction flow shall be rated steam flow minus cooling flow required through back end of turbine.

D. Safety:
1. Exposed rotating components shall have suitable guard covers designed to prevent accidental contact.
2. Guard covers: Substantially constructed, securely fastened in place, and able to be easily removed for maintenance purposes.
3. Cover high-temperature surfaces with insulating material for personnel protection.

1.06 CONDITIONS OF SERVICE

A. Operation
1. The turbine-generators shall be designed and equipped for commercial operation as follows:
   a. To be capable of operating with steam supplied from a coal fired boiler with an integrated control system.
   b. To be capable of withstanding a 100 percent load rejection to auxiliary power without turbine overspeed trip.
   c. To be capable of coming to rest without bearing damage on loss of cooling water providing the turbine is tripped immediately after loss.
   d. To be capable of initiating the rapid closure of governor control valves followed by immediate reopening to achieve a rapid reduction in turbine driving power as a means of maintaining unit stability (remaining in synchronism), during severe generator load loss transients due to external system disturbances.

B. Hydrostatic Test of Main Steam Piping System
1. The main steam piping will be hydrostatically tested at 1 ½ times design pressure. It is intended that the turbine main steam stop valves be used to close off the pipe at the turbine end during hydrostatic test of the main steam system and, therefore, shall be designed accordingly. Hydrostatic test water temperature and valve body temperature will be close to ambient during the test.

1.07 GUARANTEE

A. Guarantee performance data included in Section 00 43 33.

B. Minimum gross output of 17 MW for guarantee case.

C. If requested, submit data obtained from tests and operating experience on similar units to substantiate guarantees made.

1.08 SPECIAL TOOLS

A. Provide special tools, jigs, fixtures, and lifting tackle, including slings and associated rigging devices, necessary for assembly, erection, operation, maintenance, and repair of equipment. Special tools shall become property of Buyer.

B. Special tools and devices are of design, purpose, and use of which are peculiar to equipment furnished and which are not available from normal wholesale or retail outlets. Standard, general-purpose tools are not included in this requirement.
C. Provide neat and substantial metal toolbox with hinged cover and lifting handles or metal cabinet with hinged door and prominently mark box or cabinet “TOOLS FOR STEAM TURBINE GENERATOR.”

D. Coordinate lifting tackle with bridge crane lifting height limitations. Bridge crane will be provided by others. Bridge crane hook maximum lift height will be provided at later date. Lifting tackle shall allow for lifting of turbine casing and other major components above turbine generator units.

1.09 SPARE PARTS

A. Submit list with prices of recommended spare parts as specified in article “Submittals.”

B. Provide spare parts consisting of parts required for scheduled maintenance during first year of operation, as well as consumable spares for first year of operation.

PART 2 PRODUCTS

2.01 STEAM TURBINE

A. Condensing turbine:
   1. Quantity: 1.
   2. Type: Single-cylinder, condensing, multivalve, extraction.
   3. Number of extraction points: 2.
   4. Orientation of extraction nozzles: To be determined after award of contract.
   5. Orientation of inlet nozzle: To be determined after award of contract.

B. Casing: Cast alloy steel. Provide boroscopic inspection openings.

C. Exhaust flange: Suitable for connecting to flanged condenser duct.

D. Design turbine to accept steam piping forces and moments equal to those specified in Section 40 01 50.

E. Provide stainless steel steam strainer for steam inlet.

F. Radial bearings: Journal- or pad-type, horizontally split with minimum B-10 life of 50,000 hours.

G. Thrust bearing: Multiple-segment type, tilting shoe, or tapered land type with minimum B-10 life of 50,000 hours.

H. Mount turbine and reduction gears on common baseplate.

I. Provide speed reduction gear to reduce shaft speed of turbine to required synchronous speed of generator. Gear shall be of proven design type offered as standard by turbine manufacturer, shall be designed with minimum service factor 1.10, and shall be in accordance with requirements of AGMA 6011. Gear rating shall be based on maximum expected steam turbine output at conditions stated in Section 00 43 33. Provide dual-element temperature detectors.

2.02 PROTECTIVE VALVES

A. Main steam stop valve:
   1. Type: Hydraulic operated. Provide piping, valves, and accessories necessary for hydraulic actuation.
   2. Equip stop valve with corrosion-resistant, fine mesh metal strainers in accordance with equipment requirements.
3. Design valves to withstand hydrostatic test pressure of 1.5 times design pressure.
4. Provide means of manual and automatic tripping in response to turbine protection system. Valve shall allow testing and test reset with turbine in operation.
5. Provide 2 normally open and 2 normally closed contacts at each end of stop valve travel for Buyer's use in addition to standard complement of limit switches used by turbine control system.
6. Inlet connection: Butt-welded, suitable for welding to piping or flanged, suitable for design pressure and temperature conditions.
7. Provide temporary connection kit and internals to facilitate main steam line steam blow through stop valve.

B. Nonreturn valves:
1. Type: Hydraulic- or pneumatic-operated check valves.
2. Design to meet requirements of ASME TDP-1.

2.03 CONTROL VALVES

A. Furnish multiple control valves with overload valve as applicable, to allow optimized operation at guarantee conditions.

B. Type: Hydraulic operated. Provide piping, valves, and accessories necessary for hydraulic actuation.

C. Provide means of manual and automatic tripping in response to turbine protection system. Valves shall allow testing and test reset with turbine in operation.

2.04 EXTRACTION VALVE(S)

A. Furnish extraction valve(s) external to the unit so the valve(s) can be accessible/repairable without the need to lift the turbine case.

B. Extraction valves shall be throttle or globe valves. Disk type valves are NOT acceptable.

2.05 TURNING GEAR

A. Type: ac motor-driven, with self-operating overrunning clutch.

B. Operation:
1. Local-remote manual.
2. Clutch shall automatically couple motor to turbine shaft or speed reduction gear when motor is turned on.
3. Clutch shall automatically disengage when shaft speed exceeds turning gear on startup.

C. Provide OSHA-approved guards and housings for moving parts of turning gear.

D. Controls: Furnish accessories for control of operation, including but not limited to, pressure switches or other interlocks to prevent operation of turning gear if lubricating oil pressure drops below safe level.

2.06 GLAND STEAM SEAL SYSTEM

A. Type: Steam.

B. Seals: Labyrinth or carbon ring type.

C. Design gland seal system to automatically seal turbine throughout entire operating range.
D. Provide manufacturer’s standard shaft packing vent system modified as necessary to include following:
      a. Type: Shell and tube.
      b. Quantity: 1, per unit.
      c. Tubes: Stainless steel.
      d. Tube sheet: Carbon steel.
      e. Channel and cover material: Carbon steel.
      f. Cooling water source: Hybrid cooling tower/ACC water.
         1) Maximum supply temperature: 105°F.
         2) Pressure: Up to 50 psig. Provide pressure regulating valve(s) and safety valve(s) as required for lower pressures.
      g. Fouling factor on water side: 0.002 hr-ft²-°F/Btu.
      h. Construct shell-and-tube type heat exchangers in accordance with TEMA Class C and ASME Code requirements. Exchangers shall have Code stamp.
      i. Alternative materials may be proposed, provided materials are equal or exceed strength and corrosion-erosion characteristics of specified materials.
   2. Gland seal exhauster fan or steam jet air ejector.
   3. Floor-mounted equipment skid for gland steam equipment.
   4. Pipe supports and piping within turbine and external skid limits.

2.07 LUBRICATION SYSTEM

A. Furnish to provide lubrication requirements of turbine, generator, and reduction gear.

B. Provide manufacturer’s standard system modified as necessary to include, but not be limited to, following:
   1. Main oil reservoir shipped fully assembled and wired on separate skid, or on turbine skid, including:
      a. Two full-capacity (main and auxiliary pumps) lubricating oil pumps and one dc motor driven emergency oil pump. Main lube oil shall be turbine or gear shaft driven, auxiliary lube oil pump shall be ac motor driven. If separate lube oil system skid is furnished that precludes use of shaft-driven main lube oil pump, provide ac drive main lube oil pump instead of turbine or gear shaft driven pump. Provide turning gear oil pump as required by systems design.
      b. Ac motor-driven vapor extractor.
      c. Oil separator on vapor extractor suction with return piping to reservoir.
      d. Connections for oil conditioning equipment.
      e. Oil return tray, as required.
      f. Suction strainer.
      g. Connections and access openings for draining and cleaning.
      h. Electrical enclosure with terminal strips for customer connections.
      i. Lube oil level indicator.
      j. Provide 480-volt, 3-phase, 60 Hz electric immersion tank heater thermostatically controlled to maintain minimum lube oil temperature during shutdown and automatic shut-off due to low lube oil level alarm.
      k. Provide reservoir with sufficient capacity to contain oil flow-back occurring on shut down without overflowing. Reservoir shall allow minimum 700 hours of continuous normal operation without addition of make-up oil.
      l. Provide relief valve for each pump.
      m. Provide instrumentation, piping, valves, etc. to allow the dc motor driven emergency system to be test run periodically while the turbine generator is running.
   2. Lube oil coolers:
      a. Type: Shell-and-tube.
      b. Quantity: 2. Water-to-oil type capable of maintaining required cooling rate up to 110% rated full load as determined by turbine manufacturer.
      c. Tubes: 18 BWG, minimum, 90-10 copper-nickel.
      d. Tube sheets: 90-10 copper-nickel.
      e. Channel and cover material: Carbon steel.
f. Water source: Cooling tower water.
   1) Maximum supply temperature: 105°F.
g. Fouling factor on water side: 0.002 hr-ft²·°F/Btu.
h. Construct shell and tube type heat exchangers in accordance with TEMA Class C and ASME Code requirements. Exchangers shall have Code stamp.
i. Provide noninterrupting valve arrangement to switch oil from one cooler to other without turbine generator shutdown.
j. Pressure drop across waterside shall not exceed 10 psi.
k. Maximum water differential temperature across unit shall be 15°F at maximum cooling water temperature conditions specified.
l. Thermal control valve: Provided to allow lube oil to bypass cooler until oil temperature reaches design operating level.
m. Alternative materials may be proposed, provided materials are equal or exceed strength and corrosion-erosion characteristics of specified materials.

3. Piping:
a. Bearing supply and drain system piping and pipe supports within skid limits.
b. Guarded supply piping or protection shields in hot turbine part areas.
c. Bearing pressure regulator as required.
d. Provide stainless steel piping for piping downstream of oil filters.
e. Provide isolation valves as necessary to allow isolation and removal of one pump filter or cooler with unit in operation.

4. Oil filters:
a. Type: Replaceable cartridge.
b. Quantity: 2, per unit, 100% capacity.
c. Provide maximum 20-micron absolute filtration, 10-micron nominal.
d. Furnish suitable device to indicate contaminated filter.
e. Provide non-interrupting valve arrangement to switch oil from one filter to other without turbine generator shutdown.

5. Instrumentation, integral with main oil reservoir, including, but not limited to:
a. Pump test system for pump.
b. Test valves.
c. Individual pump outlet pressure gages.
d. Pressure gage shutoff valves.
e. Pressure switches for automatic sequential starting of motor-driven pump.
f. Bearing oil pressure transmitter.
g. Bearing oil temperature RTDs.

6. Indicators:
a. Level indicator (float-type) with alarm switches for high and low oil level in oil reservoir.
b. Thermometer: Oil out of cooler.
c. Thermometer: Oil into cooler.
d. Thermometer: Oil reservoir.

7. Protective devices:
a. Low bearing oil pressure warning alarm switch.
b. Low bearing oil pressure trip switch with separate contact for indication.
c. Low oil level device with trip switch and separate contact for indication.
d. High temperature alarm switch for oil reservoir.
8. High differential pressure alarm switch for oil filters.
9. Additional devices (pressure regulators, pressure indicators, pressure transmitters, temperature RTDs, and duplex accumulators, etc.) for combined lubrication and hydraulic system, if combined system is provided.

2.08 HYDRAULIC SYSTEM

A. Furnish system to provide hydraulic requirements of turbine stop and control valves. System may be integral with lubrication system, or it may be separate system in accordance with following.
B. System components shall be mounted and piped on single skid requiring only interconnection with turbine and valves.

C. Hydraulic system shall be furnished with phosphate ester, fire-resistant fluid if separate from turbine lube oil system.

D. Provide manufacturer’s standard system modified as necessary to include, but not be limited to, following:
   1. Main hydraulic system stainless steel fluid reservoir fully assembled and wired, including:
      a. Cleanout and drain provisions.
      b. Fluid level sight glass.
   2. Pumps:
      a. Type: Variable displacement, pressure compensated, piston, ac motor-driven.
      b. Quantity: 2, per unit, each 100% capacity.
      c. Provide inlet strainers for each pump, and duplex filters located in discharge of pumps.
         Furnish 3-way, non-interrupting valve arrangement to switch oil from one filter to other without turbine shutdown.
      d. Provide relief valve for each pump and pressure switch for startup of standby pump on low hydraulic pressure.
   3. Accumulators: Provide 2, per unit, fluid accumulators and accessories sized to allow operation of turbine unit when one accumulator is out of service.
   4. Hydraulic oil cooler (if required):
      a. Type: Fan-cooled.
      b. Quantity: 1, per unit. Size to provide 100% of maximum cooling required at maximum ambient conditions as specified in Section 00 31 00.
      c. Construction: Stainless steel.
      d. Fan shall be AC motor-driven with thermostatic controls.
   5. Piping: Stainless steel.
   6. Provide isolation valves as necessary to allow isolation and removal of one pump or filter with unit in operation.
   7. Instrumentation mounted on hydraulic system fluid reservoir, including, but not be limited to:
      a. Pump test system for hydraulic pumps.
      b. Individual pump outlet pressure gages.
      c. Pressure gage valve manifolds.
      d. Differential pressure switches for duplex filters and fluid filtration unit differential pressure alarms.
      e. Low hydraulic system pressure alarm switch.
      f. High and low level alarm switches for fluid reservoir.
      g. Low hydraulic pressure protection-shutdown in event of low hydraulic system pressure.
      h. Hydraulic system pressure transmitter
      i. Hydraulic system temperature RTD.
   8. Indicators:
      a. Thermometer into oil cooler (if cooler is required).
      b. Thermometer out of oil cooler (if cooler is required).
      c. Thermometer for reservoir fluid temperature.

2.09 DRAINS

A. Provide manual means of draining condensate from turbine casing, steam seal system, steam chest drains, and control and stop valves.

B. Furnish continuous orifices, external manual drain valves, limit switches, and controls for operation throughout entire turbine operating cycle in accordance with manufacturer’s requirements and requirements of ASME Standard TDP-1 “Recommended Practices for the Prevention of Water Damage to Steam Turbines Used for Electrical Power Generation.”

2.10 REMOVABLE INSULATION COVERS
A. Provide reusable insulation covers for turbine casing, associated trip and throttle valve, and main steam chest.

B. Inner jacket: Refractory silica based fiber 18 oz/sq yd minimum, nonasbestos, suitable for continuous operation at 760ºF.

C. Outer jacket: Silicon impregnated fiberglass cloth, 16 oz/sq yd minimum.

D. Cover inner jacket with Inconel knitted wire mesh, or equal.

E. Insulation: 4" thick minimum, ceramic fiber blanket, suitable for temperatures up to 800ºF. Maximum outer surface temperature limit shall be 150ºF.

F. Edges: Staple with stainless steel staples.

G. Seam fasteners: Stainless steel wire twists with mating lacing pins.

H. Covers: Custom tailored to completely cover turbine casing, associated trip and throttle valve, and main steam valve chest. Provide in multiple sections, as required.

2.11 MISCELLANEOUS PIPING AND VALVES

A. Provide complete system of piping integral to equipment specified herein for turbine generator unit. Piping provided shall include, but not be limited to, steam piping between main steam stop and control valves and turbine; skid-mounted oil piping; skid-mounted hydraulic fluid piping for governing and control system provided with turbine generator; skid-mounted gland seal system piping; and all other miscellaneous piping required within confines of factory-assembled skids. Furnish and install piping for listed systems on turbine skids as well as external equipment skids provided by Seller/Offerer.

B. Piping shall conform to ANSI B31.1.

C. Drawings indicating routing of piping furnished with turbine generator unit shall be prepared and submitted in accordance with submittal schedule.

D. Piping support: Furnish supports, hangers, and accessories necessary to support piping and valves provided.

E. Connections:
   1. Terminal points of piping for Buyer’s connections shall be arranged for ANSI flange connection where possible.

2.12 CONTROL SYSTEMS

A. Provide turbine and generator controls to include the following functions:
   1. Turbine governor and sequence controller
   2. Turbine overspeed protection and trip system
   3. Vibration monitoring and trip system
   4. Generator excitation system
   5. Generator protective relaying
   6. Generator auto-synchronization system

B. The control, supervisory monitoring and protection functions of the turbine, generator and auxiliary equipment not covered in the above listed functions shall be performed within the OWNER’s plant DCS system. The OFFERER shall provide control logic diagrams and operational control narrative to the OWNER to provide a basis for the DCS control implementation. These should include all permissivities, turbine protection and tripping logic.
other functions necessary for coordinated operation between the DCS and turbine controls. In addition, the OFFERER shall provide logic review and approval of the configured DCS logic/graphics and shall also attend the DCS FAT testing to verify proper operation. Failure to comply with this requirement for the base bid may result in rejection of the bid in accordance with Section 9 of the Instructions to Bidders.

C. The OFFERER, at their discretion, may submit an alternate bid that includes a complete turbine generator control system, including all control, protection and monitoring functions, if they feel that it would provide operational or cost benefits to the OWNER. This offer should include an explanation of the perceived benefits.

D. The OFFERER shall provide a control overview diagram with their bid to clarify the proposed field signal routing and connections as well as both hardwired and digital signal interfaces between the OWNER’s and OFFERER’s control systems.

E. Control system shall be fed from redundant 120 volts ac UPS power circuits. Internal power supplies shall be 100% redundant 24 volt dc or other voltages as required by OFFERER’s design.

F. Equipment shall be factory-installed and wired in local control cabinet including input/output modules, signal conditioning equipment, controllers, and power supplies.

G. Characteristics:
   1. Frequency shall not vary by more than 0.25% of rated frequency from initially preset frequency after application of load and after transients have decayed.
   2. Transient frequency deviation shall not exceed 5% of rated frequency from stabilized initial condition upon application of rated full load. Frequency shall recover to within 0.5% of rated frequency within 6 seconds for application of load.
   3. Change in frequency from initially regulated frequency shall not exceed 0.25% of rated frequency for constant load to rated full load.
   4. Frequency variation: Random nature.
   5. Provide real load sharing capability for multiple turbine generators operating in parallel. Capable of automatically sharing load within 5% while maintaining isochronous speed.

H. Control system:
   1. Turbine generator operation:
      a. Startup: Manufacturer’s standard startup sequence from standstill condition with auxiliaries off, through initial loading of generator. Startup shall be performed from the OWNER’s DCS consoles located in the plant control room. Remote start capabilities are not required.
      b. Operation:
         1) Turbine speed control and generator voltage regulation shall be automatic during normal operation.
         2) Provisions for manual adjustment of speed and voltage setpoints shall be provided locally as well as remotely via OWNER’s facility control system.
      c. Malfunction/trip:
         1) Turbine generator malfunction shall result in a trip of the power circuit breaker and removal of generator field.
         2) Turbine generator shall be prohibited from restarting until malfunction/trip condition has been corrected.
         3) Trip signals shall be wired through lockouts that shall be reset locally at unit or cogeneration switchgear to enable units to be restarted.

I. Control system cabinet requirements:
   1. Cabinet construction:
      a. Manufacturer’s standard, skid-mounted
      b. Freestanding or wall-mounted NEMA 12 cabinet shall be furnished to house input/output modules, termination equipment, signal conditioning equipment, controllers, power supplies, and other components for control system.
c. Cabinet shall be of ample size to conveniently terminate external wiring.
d. Completely assembled and wired to terminal strips with washer-head binding screws. Identify
terminals by letter number and wire number, respectfully.
e. Provide fuses and fuse blocks in control cabinet for various devices, including but not limited to:
   1) Auxiliary relays.
   2) Miscellaneous dc and ac devices.
   3) Provide nameplates for identification of each device.
f. Provide adequate cooling by means of air conditioning, pneumatic vortex coolers, blowers or
   exhaust fans, as necessary, for panel in which internal cabinet operating temperatures
   exceed rating of any component mounted within enclosure. Thermostat shall be used to
   control internal temperature.
g. No water or process piping permitted in control system cabinet or permitted to be installed
   directly over control panels.
h. Required system dc power supplies will be furnished as part of system.
i. Special cabinet or panel grounding provisions that may be required shall be furnished as part
   of system.
j. Wherever possible, signals from local instrumentation and control devices shall be wired
   directly back to the turbine control or plant DCS cabinets with a minimum of intermediate
   terminations.

2. Control cabinet for turbine generator in combination with the plant DCS shall contain
   instrumentation, metering, control relaying, control devices, and annunciation as required for
   startup, continuous operation, testing, normal shutdown, and emergency shutdown.

3. Two operator HMI stations shall be provided. One shall be located in the turbine control
   cabinet and the other shall be supplied loose for locating in the OWNER’s facility control room.

4. Annunciation:
   a. Provide alarm annunciation screen, alarm annunciation light, and horn with test, acknowledge,
      and reset features.
   b. Alarm sequence: First in alarm shall flash until acknowledged, alarm will remain highlighted
      until fault condition is cleared and reset switch is pressed.
   c. Provide manufacturer's standard alarms including alarms for trip functions and instrumented
      machine variables.

5. Turbine controls shall include, but not limited to, the following:
   a. Main steam stop valve operation.
   b. Turning gear operation.
   c. Lubrication system operation.
   d. Hydraulic system operation.
   e. Provide runbacks which OFFERER considers necessary to protect turbine or generator.
   f. Other controls necessary for proper operation of turbine generator.

6. Tests: Control system shall be checked out at factory as complete system. OWNER shall
   have option of observing tests and checkout.

J. Supervisory system:
1. Supervisory system and instrumentation shall provide OWNER’s facility control system (DCS)
   with turbine generator operational parameters including, but not limited to, the following
   parameters as required for remote monitoring:
   a. Main steam stop valve position.
   b. Control valve position.
   c. Turning gear status.
   d. Control and lubricating oil levels, pressures, and temperatures.
   e. Oil filter differential pressures.
   f. Lube oil heater status.
   g. Oil pump status.
   h. Shaft speed.
   i. Shaft vibration at turbine, gearbox, generator, and exciter bearings.
   j. Shell, differential, and rotor expansion.
   k. Shell and valve chest temperatures.
   l. Shaft position.
m. Bearing metal temperatures, including thrust bearing.

n. Generator stator winding temperatures.

o. Generator coolers air inlet and outlet.

p. Exciter temperatures.

q. First stage steam pressure.

r. Condenser backpressure (instrument by others).

s. Hotwell level (instrument by others).

t. Cause of turbine trip.

u. Turbine status (tripped, reset, stopped, etc.).

v. Gland sealing system pressures and status.

w. Vapor extractor status.

x. Alarm conditions.

y. Other machine variables as required for proper operation of turbine generator.

K. Turbine generator protection system:

1. Provide protective devices to initiate turbine generator trip including following:
   a. Trips required for generator protection.
   b. Turbine overspeed.
   c. Thrust bearing failure.
   d. Low lubricating oil or hydraulic fluid pressure.
   e. Manual trip by operator.
   f. Trips required for turbine or governing system protection.
   g. High exhaust temperature trip.
   h. High backpressure (device provided by others).
   i. High hotwell level (device provided by others).
   j. High vibration.
   k. High lube oil temperature.


L. Overspeed protection system:

1. Furnish digital speed-sensing overspeed protection system, separate from main governing system.

2. System shall cause main steam stop valve closure on overspeed condition.

3. System shall utilize two-of-three voting scheme.

4. System shall allow adjustable overspeed setpoint and shall be set to function at 10% above synchronous speed.

5. System shall allow on-line testing without tripping turbine generator.

6. Trip method: De-energize relay to trip.

7. System shall have alarm output interfaced with supervisory PLC.


M. Vibration monitor system: Provide protection against unacceptable vibration levels in turbine, main reduction gear, and generator. Monitoring, level display, alarm, and trip functions shall be provided through steam turbine control cabinet.

1. Provide complete Bently Nevada 3500 vibration monitoring package for turbine and generator including, but not limited to:
   a. 2 radial position proximity probes installed 90° apart per bearing on steam turbine, generator, and exciter (if applicable).
   b. 2 axial position probes for thrust bearing
   c. 1 eccentricity probe for turbine (if applicable)
   d. 2 key phaser probes, one for each shaft
   e. Main reduction gear: 1 accelerometer mounted on gearbox casing
   f. Rack with vibration monitors, redundant power supplies, alarm relay modules for warning and trip, integrated touch screen display and ethernet interface module

2. Vibration monitor system with alarm summary, shutdown contacts, and vibration readouts interfaced with OWNER’s DCS system.

N. Governing system:
1. Turbine generator shall be equipped with NEMA Class D, electro hydraulic control system including microprocessor-based governor. System speed, pressure, and load control performance shall meet or exceed NEMA standards.

2. Functions of governing system shall include, but not necessarily be limited to:
   a. Speed control functions:
      1) Overspeed protection by sensing actual shaft speed.
      2) Multiple (minimum 2) channel speed sensing including redundant transducers, high signal auctioneering for control and failure alarms.
      3) Speed and acceleration controls required for turbine roll-up. System shall not permit holding at critical speeds.
      4) Line speed matching.
      5) System shall be capable of limiting overspeed to prevent overspeed trip when load is suddenly reduced from full load to zero.
   b. Control modes with provisions for remote setpoints from OWNER’s facility control system to governor:
      1) Condensing turbines.
         a) Extraction pressure control.
         b) Load control.
   c. Load control function: Maximum load limiter.
   d. Other hardwired signals from OWNER’s facility control system to governor:
      1) Initiate turbine start
      2) Raise load setpoint
      3) Lower load setpoint
      4) Extraction pressure setpoint
      5) Automatic synchronize initiate.
      6) kW load share

3. "Fail-safe" features such that loss of signal shall initiate shutdown.

4. Capable of both isochronous and droop speed control.

5. Utilize redundant and independent backup overspeed device that will protect turbine from governor failure.

6. System shall have alarm output interfaced with OWNER’s DCS system.

Manufacturer: Woodward 505E.

2.13 ELECTRICAL WIRING

A. Electrical requirements shall be in accordance with Section 26 05 00.

2.14 INSTRUMENTATION

A. Furnish generator and associated systems under provisions of Section 40 91 00 – Primary Process Measuring Devices.

2.15 GENERATOR AND ASSOCIATED SYSTEMS

A. Furnish generator and associated systems under provisions of Section 48 10 01.

2.16 SHOP PAINTING

A. Shop painting shall be in accordance with Section 09 92 00 – Industrial Painting and Coating.

PART 3 EXECUTION

3.01 MANUFACTURER’S FIELD SERVICES

A. Furnish services of qualified service engineer under provisions of Section 01 43 33 – Manufacturer’s Field Services.
3.02 FIELD PERFORMANCE TESTS

A. Furnish services for field performance test under provisions of Section 01 43 33 – Manufacturer’s Field Services.

END OF SECTION

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2) T. Dille
3) J. Solan
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