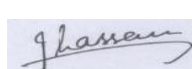






TD-201 Rev No. 00 Form No.	 HYDERABAD	<b>PRODUCT STANDARD</b> <b>PROJECT ENGINEERING &amp; SYSTEMS DIVISION</b> <b>HYDERABAD-32</b>		<b>PY51235</b>										
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<b>COPYRIGHT AND CONFIDENTIAL</b> The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED . It must not be used directly or indirectly in any way detrimental to the interest of the company.	<p><b><u>DOCUMENTS TO BE SUBMITTED ALONG WITH BID:</u></b></p> <p><b>Bidder must submit the following documents along with their bid so as to enable BHEL to evaluate their offer.</b></p> <p><b>Bidder to note that in case following documents are not submitted along with offer, the offer may be liable for Technical Rejection.</b></p> <ul style="list-style-type: none"><li>- Checklist for the offer (Annexure-10)</li><li>- Documents mentioned in checklist.</li><li>- Unpriced “price-bid format” (Annexure-9)</li></ul>			

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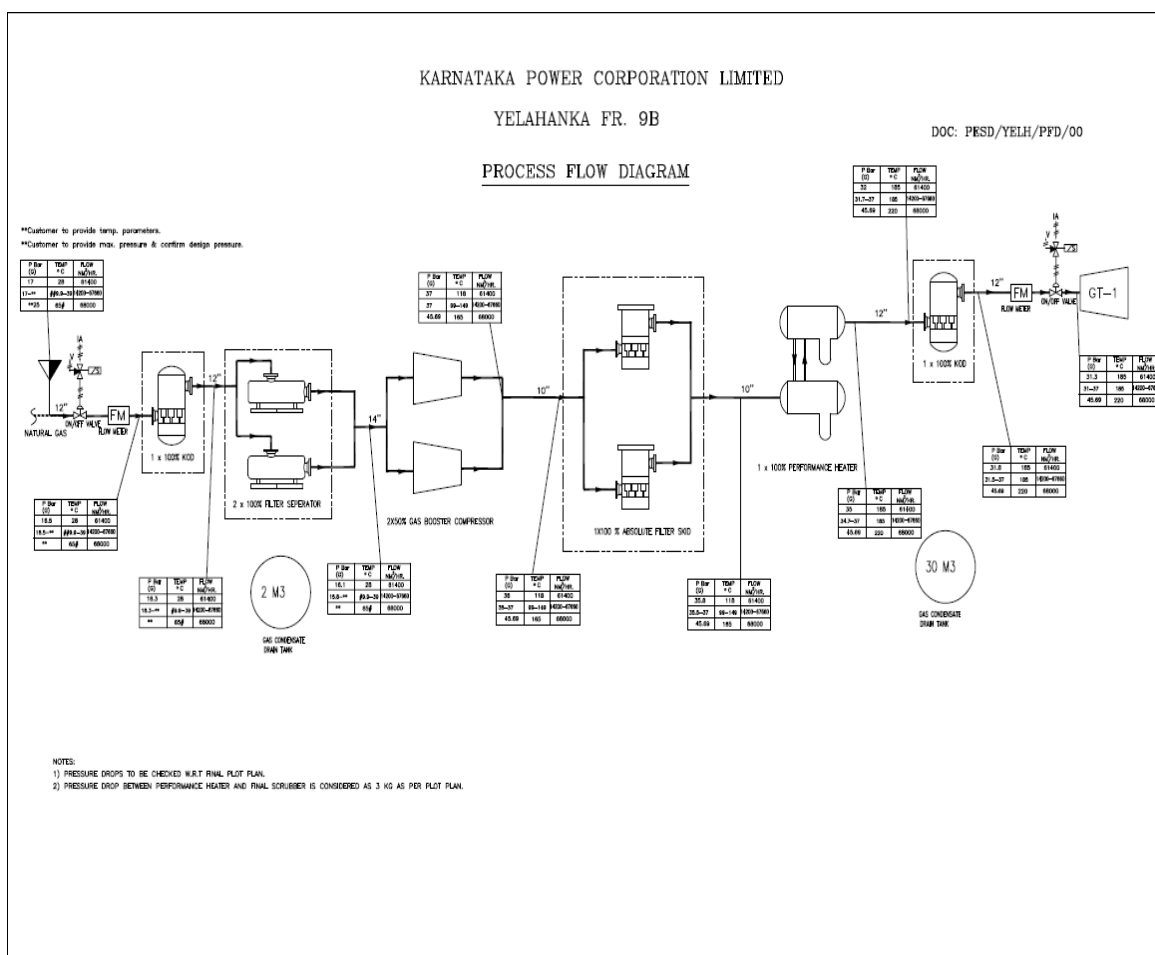
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The fuel gas is made available by KPCL at the battery limit for operation of 1 No. of Gas Turbine. The off-base fuel gas conditioning system is designed for providing fuel gas in clean, dry conditions as acceptable to the Gas Turbine's fuel gas quality requirements and at a pressure range as required by gas turbine.

The fuel gas made available by KPCL at the battery limit is routed through Gas Conditioning system includes Scrubber, filter separator, Gas Booster Compressor, Coalescent filter, performance heater and final scrubber. Clean gas outlet of this gas conditioning systems is routed to the gas turbine.


**PFD FOR PROJECT:**




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<p align="center"><b>COPYRIGHT AND CONFIDENTIAL</b></p> <p>The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED . It must not be used directly or indirectly in any way detrimental to the interest of the company.</p>			<p>information included in this specification as required and submit a comprehensive bid.</p> <p>2.13 The intending tenderers shall be deemed to have visited the site and have studied the conditions before submitting the Bids. Non-familiarity with the site conditions will not be considered a reason either for extra claims or for not carrying out the work in strict conformity with the drawings and specifications.</p> <p>2.14 The successful bidder shall furnish design calculations(in native/original format) to BHEL during detailed engineering stage for approval along with the relevant pages of authentic supporting literature e.g. Code, Hand book, National / international Standards etc. All steps including formulas and abbreviations shall be clearly shown in the calculation. All inputs / assumptions shall be indicated in the first sheet of the calculation. Calculation shall be necessarily done in SI UNITS only for the followings: -</p> <p>2.15 Civil works will be done by BHEL based on civil inputs furnished by the bidder during detail engineering. In case of any changes in the civil input drawing after civil work is completed, necessary prices on account of modification of the civil work shall be deducted from bidder's account.</p> <p><b>3.0 <u>JOB SPECIFICATION:</u></b></p> <p>This job specification gives details specific to the project, which have to be integrated with the general requirements indicated in <b>General Specification</b>.</p> <p><b>3.1 SCOPE OF SUPPLY:</b></p> <p><b>A) No. of systems required</b></p> <p>a) <i>Low Pressure Fuel Gas Scrubber (1X100%) skid: 1 no.</i></p> <p>b) <i>Low Pressure Fuel Gas Filter Separator (2X100%) skid:- 1 no</i></p> <p>c) <i>High Pressure Fuel Gas Coalescent Filter (2X100%) skid:- 1 no</i></p> <p>d) <i>High Pressure Fuel Gas final scrubber (1X100%) skid:- 1 no</i></p> <p><b>B) Scope of supply for each system:</b></p> <p><b>MAIN OFFER:</b></p> <ul style="list-style-type: none"> <li>The scope of supply of each system shall be strictly as per <b>P &amp; ID</b> enclosed as <b>Annexure-1</b> wherein, Gas Conditioning System boundaries are clearly marked. The system shall be provided as per <b>P&amp; ID</b> taking into all other corresponding specific/standard</li> </ul>	
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Ref. Doc	<p>requirements as specified in this <b>Job specification</b> as well as specified elsewhere in this specification.</p> <ul style="list-style-type: none"> <li>• <b>Counter flanges:</b> Counter flanges at all terminal points along with bolts, nuts and gaskets are in the scope of bidder.</li> <li>• <b>Foundation bolts:</b> Foundation bolts for skids along with shims (if required), are in the scope of bidder.</li> <li>• <b>Commissioning spares:</b> Commissioning Spares shall be provided as per <b>Annexure-9</b>.</li> <li>• <b>Mandatory Spares:</b> <b>Unit rates for Mandatory Spares</b> shall be quoted for the items as per the list furnished in <b>Annexure-14</b>.</li> </ul> <p><b>OPTIONAL ITEMS:</b></p> <ul style="list-style-type: none"> <li>• <b>2-years operational spares:</b> <b>Unit rates for 2 years operational spares</b> shall be quoted for the items as per the list furnished in <b>Annexure-13</b>.</li> <li>• <del>Per Diem Rates for “Supervision of Erection and commissioning” to be quoted for the following:</del></li> </ul> <p style="text-align: center;"> <del>Fuel Gas System</del> <input checked="" type="checkbox"/> </p> <p><b>3.2 TECHNICAL DETAILS:</b></p> <p><b>3.2.1. Location of Gas Conditioning System:</b></p> <ul style="list-style-type: none"> <li>• Outdoor with shed, sides open <input checked="" type="checkbox"/></li> <li>• Outdoor without shed <input type="checkbox"/></li> </ul> <p><b>3.2.2. Fuel Gas Properties:</b></p> <p>Fuel Gas Specification: Enclosed as <b>Annexure – 4</b>.</p> <p><b>3.2.3. System Operating- Design parameters:</b></p> <p>The minimum, normal, maximum, mechanical design parameters of pressure, temperature and flow at various stages of system are indicated in the <b>P&amp;ID</b> enclosed as <b>Annexure –1</b> for consideration of the same in the selection /design of the equipment.</p> <p><b>3.2.4. Main equipment isolation valves:</b></p> <p>Main equipment isolation valves shall be full bore trunnion mounted ball valves as indicated in the P&amp;ID for Scrubber skid and main equipment isolation valves shall be gate valves as indicated in the P&amp;ID for filter separator skids.</p> <p><b>3.2.5. Corrosion Allowance:</b></p>		

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<div><p><b>COPYRIGHT AND CONFIDENTIAL</b></p><p>The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED . It must not be used directly or indirectly in any way detrimental to the interest of the company.</p></div>			<ul style="list-style-type: none"><li>As indicated in General Spec or elsewhere <input checked="" type="checkbox"/></li><li>Any other <input type="checkbox"/></li></ul>		
			<b>3.2.6. Non Destructive Testing for Pressure Vessels:</b> As indicated in General Spec or elsewhere <input checked="" type="checkbox"/> Any other <input type="checkbox"/>		
			<b>3.2.7. NACE Material:</b>  Applicable <input type="checkbox"/>  Not Applicable <input checked="" type="checkbox"/>		
			<b>3.2.8. Type of Valves:</b>  a) Emergency shut-down valve, Blow Down valves/ Level Control Valve on Scrubber/ <del>Filter Separator/Fine Filter</del> skid in line with P&ID (Enclosure-I):  Ball Type <input checked="" type="checkbox"/>  Globe Type <input type="checkbox"/>  Not applicable <input type="checkbox"/>  b) <del>Emergency shut down valve, Blow Down valves/ Level Control Valve on Scrubber/</del> on Filter Separator/ <del>Fine Filter</del> skid in line with P&ID (Enclosure-I):  Ball Type <input checked="" type="checkbox"/>  Globe Type <input type="checkbox"/>  Not applicable <input type="checkbox"/>  c) <del>Emergency shut down valve, Blow Down valves/ Level Control Valve on Scrubber/</del> Filter Separator/ <del>Fine Filter</del> skid in line with P&ID (Enclosure-I):  Ball Type <input type="checkbox"/>  Globe Type <input checked="" type="checkbox"/>  Not applicable <input type="checkbox"/>		

**3.2.9. Type of pressure reduction station in line with P&ID (Enclosure-II):**

Conventional pressure reduction station ☐Active monitoring control system ☐Not applicable ☒

### 3.2.10. CV calculation for Pressure Control Station:

Typical Calculation:

Process Fluid : Natural Gas			
	Max. Cv	Normal Cv	Min. Cv
Gas flow in NM3/Hr			
Gas flow in SM3/Hr			
MW			
SP GRAVITY (AIR=1)			
Gas temp, Deg C			
P1,Kg/Cm <sup>2</sup> (abs)			
P2,Kg/Cm <sup>2</sup> (abs)			
DP(P1-P2)			
<b>Cv</b>			
Shut off pressure , Kg/Cm2 (g)			

The Pressure control station shall be selected such that the same will cater to the min. to max. CV requirements as given above.

### 3.2.11. CV value to be considered for Level Control Valves:

0.63 (LCV on Filter Separator)

~~3.2.12. CV value to be considered for on/off solenoid operated Valves (1''):~~


~~0.63 (On/off valve on Scrubber skid, filter separator skid)~~

**3.2.13. Insulation cleats as required, to be provided for the following equipment to support insulation:**

Scrubber skid ☐Filter Separator Skid ☐


Caulescent Filter skid ☒




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Ref. Doc	<div> <div> <p><b>3.2.17. Mounting arrangement of Filter Separator/Fine Filter</b></p> <p>Horizontal <input checked="" type="checkbox"/></p> <p>Vertical <input type="checkbox"/></p> <p><b>3.2.18. Mounting arrangement of Coalescent Filter</b></p> <p>Horizontal <input type="checkbox"/></p> <p>Vertical <input checked="" type="checkbox"/></p> <p><b>3.2.19. Performance of Scrubber:</b></p> <p>Liquid removal efficiency:</p> <p>10 microns &amp; larger: 100%</p> <p>Solids Removal efficiency:</p> <p>8 microns &amp; larger: 100%</p> <p>6 - 8 microns: 99%</p> <p>4 - 6 microns: 90%</p> <p>2-4 microns: 85%</p> <p>Turn Down: 4:1</p> <p><b>3.2.20. Performance of Filter Separator:</b></p> <p>Liquid removal efficiency</p> <p>8 microns and larger – 100%</p> <p>0.5 to 8 microns – 99.5%</p> <p>Solid removal efficiency</p> <p>3 microns and larger - 100%</p> <p>0.5 - 3 microns - 99.5%</p> <p>Turndown - 100%</p> <p><b>3.2.21. Performance of Coalescent filter:</b></p> <p>Liquid removal efficiency</p> <p>0.3 microns and larger – 100%</p> <p>Solid removal efficiency</p> <p>0.3 microns and larger – 100%</p> </div> </div>		

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**3.2.30. Power Supply for Transmitters:**  
As per Annexure-7C

**3.2.31. ~~Bidders to note that PO on GCS skid vendor will be placed subjected to approval of customer based on the credentials of vendor. Hence, all the GCS vendors to submit the credentials/references of Gas Conditioning skids for Gas Turbine applications for customer review along with technical offer.~~**

**d) Project Specific Sub vendors to be followed by bidder**

As per list enclosed as Annexure16 - any item not specifically covered in the approved list of vendors shall be sourced from the current approved vendors of BHEL.

**e) Price bid format:**

As per Annexure-9 ☒

**f) Inspection Agency:**

BHEL/ Third party appointed by BHEL ☒

**g) Instrument Air:**

Availability of Instrument air at skid terminal point:

Normal	:	6 Kg/cm2 (g)
Minimum	:	4.5 Kg/cm2 (g)
Maximum	:	** Kg/cm2 (g)
Mech. Design	:	10.5 kg/cm2 (g).

**h) Back pressure of safety valves:**

Atmospheric ☒


As indicated in the P&ID ☐

Any other details listed below: ☐

~~Maximum Flare backpressure shall be considered for sizing of pressure relief valves:~~

Flare system	Superimposed back pressure (kg/cm2g)	Built up pressure at PSV Outlet (kg/cm2)
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+	Low pressure flare ( $<70\text{kg/cm}^2$ )	0.00	

**i) Project Specific Piping Material Specification to be followed by bidder:**

As per list enclosed as **Annexure-3**.

**j) Type of Level Transmitters:**

Guided Wave Radar type for all skids ☒

Displacement type for all skids ☐

Torque tube type ☐

**k) Type of Canopy for all electrical/electronic instruments:**

FRP canopy for electrical/electronic instruments ☒

~~[Canopy for transmitters shall cover top and all four sides with transparent door on the front. Canopy shall have Acrylic window & mounting bracket plate material shall be SS304. Colour of canopy shall be light grey].~~

~~The typical characteristics of FRP canopy shall be following:~~

~~High Mechanical strength,~~

~~Weather resistant(resistant to most of the acids, alkalies, vapours & fumes),~~

~~UV resistant~~

~~Anti-static~~

~~Special rubber grommets for cable/tube entry.~~

~~Canopy to be provided for all gauges and field instruments(except electrical/electronic instruments)~~

Conventional Mechanical type ☐


  


**l) Tube and tube fittings**


Swagelok/Parker tube fittings ☐


Swagelok/Parker/ Sandvik make tube ☐


Swagelok/Parker type ☒


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<div style="display: flex; justify-content: space-between;"> <div style="width: 20%;"> <p style="writing-mode: vertical-rl; transform: rotate(180deg);"> <b>COPYRIGHT AND CONFIDENTIAL</b>            The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED .            It must not be used directly or indirectly in any way detrimental to the interest of the company.         </p> </div> <div style="width: 80%;"> <p style="text-align: center;"><b>m) Instrument hook up(for PG, DPG &amp; DPT)</b></p> <p style="text-align: center;"><b><u>For DPT</u></b></p> <p>           Prefabricated hook up <input checked="" type="checkbox"/> </p> <p>(For details refer clause 5.3 of Annexure VII.</p> <p> <del>The make of prefabricated hook up shall be Cameron (Singapore) Pte Ltd.,Singapore,Emerson Process Management, India,Parkar Hannfin, India,Schenider Close Couplings, Germany)</del> </p> <p> <del>Bidder to ensure that DPT shall be provided with 5 way manifold as a part of Prefabricated Hook up ( Refer Doc: A307-000-16-15-IS16 of Annexure VII(PEIC 03944 ) which is applicable for DPT.</del> </p> <p><b><u>For PG, DPG, LG &amp; LT</u></b></p> <p> <del>Prefabricated Hook up is not applicable. However, the first isolation valve shall be Quarter Turn metal seated Ball Valve.</del> </p> <p style="text-align: center;"><b>n) Rating of Level control valves/Blow Down valves/Thermowells</b></p> <p>           Rating of minimum #300 class or as per PMS whichever is higher <input checked="" type="checkbox"/> </p> <p>           As per PMS <input type="checkbox"/> </p> <p style="text-align: center;"><b>o) Check list to be furnished along with the offer:</b></p> <p>           Bidders are requested to fill and furnish the check list for the offer, Enclosed as <b>Annexure-10</b>.         </p> <p><b>4.0 GENERAL SPECIFICATION:</b></p> <p>           This specification is intended to cover the Design, Manufacture, Assembly, Testing at manufacturer's works, Delivery at site with appropriate painting and packing, complete with accessories in all respects for efficient and trouble free operation of the equipment to be installed at site.         </p> <p><b>4.1 APPLICATION:</b></p> <p>           Gas conditioning system is provided to condition the fuel gas suitable for using as a fuel in the gas turbine. For reliable operation of Gas Turbine, it is essential that the fuel gas is to be supplied at required pressure, superheat and cleanliness.         </p> </div> </div>			
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<p style="text-align: center;"><b>COPYRIGHT AND CONFIDENTIAL</b></p> <p>The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED . It must not be used directly or indirectly in any way detrimental to the interest of the company.</p>		<p><b>4.2 SCOPE OF SUPPLY:</b></p> <p>Scope of supply of the system shall be as indicated in the job specification.</p> <p><b>4.3 CODES AND STANDARDS:</b></p> <p>The Gas-Conditioning system shall be in accordance with the applicable codes and standards as referred in various equipment/component specifications, described in this document. Latest revisions of all applicable codes and standards shall be followed.</p> <p><b>4.4 TECHNICAL REQUIREMENTS FOR EQUIPMENTS/VESSELS:</b></p> <p>Technical Requirements of Gas Conditioning System is as given below:</p> <p><b>4.4.1 For</b></p> <ul style="list-style-type: none"> <li>(a) Project Details,</li> <li>(b) Site Data,</li> <li>(c) Fuel Gas properties,</li> <li>(d) System operating - Design Parameters of system,</li> </ul> <p>Please refer applicable Annexures.</p> <p><b>4.4.2 Corrosion allowance :</b></p> <p>3.2 mm shall be considered, unless otherwise specified. In case lower/ higher corrosion allowance is specified for any specific system, the specified corrosion allowance only will govern. No corrosion allowance need be considered for stainless steel.</p> <p><b>4.4.3 NACE Compliance :</b></p> <p>The materials selected shall be compliant to NACE – MR-01-75, wherever requirement is identified in the Job Specification. This is relevant for all the applicable materials. This requirement, if applicable will override the requirements specified in the particular specification, in case of any conflict.</p> <p><b>4.4.4 Statutory Approvals:</b></p> <p>All statutory approvals for the design, manufacture &amp; testing of any pressure vessels / equipment, wherever applicable is in the scope of bidder only. In case any third party to be appointed to meet the statutory approvals, same is also in the scope of bidder.</p>		
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<p align="center"><b>COPYRIGHT AND CONFIDENTIAL</b></p> <p>The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED . It must not be used directly or indirectly in any way detrimental to the interest of the company.</p>		<p><b>4.4.5 Description of the Gas Conditioning System:</b></p> <p>The Gas Conditioning system will basically consist of the following components, namely:</p> <ol style="list-style-type: none"> <li>(1) Emergency shutdown (ESD) valves</li> <li>(2) Pressure Control Station(s)</li> <li>(3) Multi cyclone scrubber(s)</li> <li>(4) Filter separator(s)</li> <li>(5) Fuel Gas Condensate Drain system</li> <li>(6) Fuel Gas vent system</li> <li>(7) Inter connecting Piping</li> <li>(8) Instrumentation</li> </ol> <p>Depending on the (i) fuel gas composition, and (ii) fuel gas parameters like pressure, temperature at plant battery limit and (iii) fuel gas parameters required at inlet of Gas Turbine, the configuration of the system is designed and accordingly incorporated in the <b>P&amp;ID</b> enclosed with the Job Specification.</p> <p>Based on the configuration required, the system may contain all of / some of above components, as indicated in the <b>P&amp;ID</b>. <b>Hence, the system need to be provided strictly as per the P&amp;ID enclosed with the job specification.</b></p> <p><b>4.4.6 Emergency Shut Down Valves (ESD valves):</b></p> <ol style="list-style-type: none"> <li>(i) Emergency Shut Down valve(s) are provided to facilitate complete Isolation of Gas Turbine from Fuel Gas supply during upset operating conditions like high level, high pressure, and also in emergency conditions like fire, as indicated in <b>P&amp;ID</b>.</li> <li>(ii) The emergency shutdown valves can be of Ball type or Globe type. The relevant applicable type is as per P &amp; ID.</li> <li>(iii) The Ball Type emergency shutdown valve shall be as per the relevant data sheet as part of <b>Annexure-7A: Instrument Data sheets</b>.</li> <li>(iv) The Globe Type emergency shutdown valve shall be as per the relevant data sheet as part of <b>Annexure 7A-: Instrument Data sheets</b>.</li> </ol>		
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<p align="center"><b>COPYRIGHT AND CONFIDENTIAL</b></p> <p>The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED . It must not be used directly or indirectly in any way detrimental to the interest of the company.</p>			<p><b>4.4.7 Pressure Reducing Station:</b></p> <p>(i) The fuel gas pressure reducing station is provided in the fuel gas conditioning system to maintain required pressure downstream of the system, as required by Gas Turbine.</p> <p>(ii) The pressure reducing station can be one of the following types.</p> <p>(a) Conventional Pressure Reducing Station</p> <p>(b) Active Monitoring Type Pressure Reducing Station</p> <p>The relevant applicable type is as per the <b>P&amp;I D</b> enclosed.</p> <p><b>(a) Conventional Pressure Reducing Station:</b></p> <p>(i) Conventional Pressure Reducing Station consists of globe type control valves.</p> <p>(ii) The pressure control valve shall be designed for the min. / max. CV requirement as indicated in the job specification.</p> <p>(iii) The control valves shall be as per the relevant data sheet as part of Annexure-VII: Instrument Data sheets.</p> <p><b>(b) Active Monitoring Type Pressure Reducing Station:</b></p> <p>(i) The Active monitoring type pressure reducing station consists of self-actuating type active and monitoring control valves with an upstream self-actuating type shut down valve. In case of failure of active type control valve, the monitoring type control valve will come in to action. In case of failure of both active and monitoring type control valves, the shutdown valve will trip the fuel gas supply to the Gas Turbine. The no. of streams shall be provided as per P &amp; I D. The operation of self-actuated valves in the system as explained above is achieved through staggered set points.</p> <p>(ii) A block discharge pressure relief valve provided downstream of active monitoring system will normally be designed for a suitable capacity to ensure that the shutdown valve will not be tripped due to transients in flow.</p> <p>(iii) The Active Monitoring type control system shall be as per the standard design of the approved vendors and also taking into consideration of relevant data sheet as part of Annexure-VII: Instrument Data sheets.</p> <p>(iv) The pressure control system shall be designed for the min. / max. CV requirement as indicated in the job specification.</p>	
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<p align="center"><b>COPYRIGHT AND CONFIDENTIAL</b></p> <p>The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED . It must not be used directly or indirectly in any way detrimental to the interest of the company.</p>		<p><b>4.4.8 Multi Cyclone Scrubber:</b></p> <ul style="list-style-type: none"> <li>(a) Vertical dry gas scrubber with multi cyclone design shall be provided. Scrubber with single cyclones instead of multi cyclone is not acceptable.</li> <li>(b) The dirty gas enters tangentially into the cyclones causing high centrifugal force, and the solid and liquid particles are thrown against the walls of the cyclone. The clean gas changes direction at the vortex of cyclone and comes out of scrubber through the center tubes of the cyclones. The heavier impurities go down and fall in to the storage area of scrubber, which will be subsequently drained by the drain control system.</li> <li>(c) Scrubber vessel shall be designed &amp; constructed as a pressure vessel as per <b>clause 4.5.0</b> of this specification – “<b>Design Basis for Pressure Vessels</b>”.</li> <li>(d) Scrubber vessel and its internal components shall be essentially maintenance free for continuous unattended operation.</li> <li>(e) The unit shall have a fabricated steel skirt ring to allow erection on a steel skid.</li> <li>(f) The scrubber shall be complete with all Vents, Drains, Instrumentation provisions, Inspection &amp; Maintenance holes etc. as shown in the <b>P&amp;I D</b>.</li> <li>(g) The feed nozzle may be taken, as equal to that of the inlet pipe; similarly the gas out let nozzle may be equal to the gas out let pipe diameter. <b>In case different inlet nozzle is required due to design requirement of vessel, vendor to bring out same with justification.</b></li> <li>(h) Required Insulation cleats to be provided for the heater to support insulation, if applicable as indicated in the <b>Job Specification</b>.</li> <li>(i) A five minute liquid hold up time shall be provided with three minute for normal control &amp; two minutes extra time for operator intervention in emergencies. However, the minimum liquid height of 350 mm shall be considered.</li> <li>(j) Further Height &amp; diameter shall be as per process requirement. Vendor to provide basis of selection for it.</li> </ul>		
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<p style="text-align: center;"><b>COPYRIGHT AND CONFIDENTIAL</b></p> <p>The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED . It must not be used directly or indirectly in any way detrimental to the interest of the company.</p>			<p>(k) The cyclones shall be of SS 316 L materials. The scrubber body materials shall be of <b>CS/SS</b> as per <b>P&amp;I D</b> and in line with corresponding material requirements specified vide <b>clause 4.5.0</b> of this specification – “<b>Design Basis for Pressure Vessels</b>”.</p> <p>(l) The scrubber shall be able to give the following removal efficiency for entire range of flow and operating pressures as indicated in job specification, i.e. minimum flow to maximum flow and for the range of operating pressures given in the <b>job specification / P&amp;ID</b>.</p> <p>(i) The normal pressure drop across scrubber skid shall be <math>\leq 0.2 \text{ kg/cm}^2</math>.</p> <p>(ii) <b>Liquid removal efficiency</b></p> <p style="padding-left: 40px;">10 microns and larger – 100%</p> <p style="padding-left: 40px;"><b>Solid removal efficiency</b></p> <p style="padding-left: 40px;">8 micron and larger - 100%</p> <p style="padding-left: 40px;">6-8 micron and larger - 99%</p> <p style="padding-left: 40px;">4-6 micron and larger - 90%</p> <p style="padding-left: 40px;">2-4 micron and larger - 85%</p> <p style="padding-left: 40px;">Turndown - 4:1</p> <p>(m) A format for ‘<b>Scrubber Data Sheet</b>’ is enclosed as <b>Annexure-2A</b>, for vendor’s compliance as a part of Documentation.</p> <p><b>4.4.9 Filter Separators :</b></p> <p>(b) Filter Separator units are normally provided downstream of scrubber for fine filtration of fuel gas.</p> <p>(c) The filter separator units shall be of horizontal type / vertical type as indicated in <b>P&amp;ID</b>.</p> <p>(d) Filter separator shall be designed &amp; constructed as a pressure vessel., as per the <b>clause 4.5.0</b> of this specification – “<b>Design Basis for Pressure Vessels</b>”.</p> <p>(e) The filter separator will have 2-stage filtration.</p> <p style="padding-left: 40px;">The first stage shall use an agglomerator that consists of a tubular fiberglass filter elements. The solid particles in gas stream are entrapped by filter elements.</p> <p style="padding-left: 40px;">The liquid particles will get agglomerated and will be carried on to second stage for further removal.</p>	
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<div><div><div>COPYRIGHT AND CONFIDENTIAL</div><div>The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED . It must not be used directly or indirectly in any way detrimental to the interest of the company.</div></div><div><p>The filter elements shall be of disposable type.</p><p>The second stage consists of mist extractor, which is of corner vane type. The second stage will separate agglomerated particles from the fuel gas. No wire mesh will be accepted.</p><p>(f) Filter separator shall be complete with all Vents, Drains, Controls, Inspection &amp; Maintenance holes etc. as shown in the <b>P&amp;I D</b>.</p><p>(g) The feed nozzle may be taken, as equal to that of the inlet pipe, similarly the gas out let nozzle may be equal to the gas out let pipe diameter. <b>In case different size of inlet/ outlet nozzle is required due to design requirement of vessel vendor to bring out same with justification.</b></p><p>(h) Filter separator shall be provided with suitable davit Assembly for ease of replacement of elements.</p><p>(i) Required Insulation cleats to be provided for the heater to support insulation, if applicable as indicated in the <b>Job Specification</b>.</p><p>(j) The filter separator body materials shall be <b>CS/SS</b> as per <b>P&amp;I D</b> and in line with material requirements specified vide <b>clause 4.5.0</b> of this specification – “<b>Design Basis for Pressure Vessels</b>”.</p><p>(k) The combined efficiency of the filter separator [both stages together] shall be as given below:</p><div><div>i. The clean pressure drop across filter separator shall be <math>\leq 0.2</math> kg/cm<sup>2</sup></div><div>ii. Liquid removal efficiency</div><div><div>8 microns and larger– 100%</div><div>0.5 to 8 microns– 99.5%</div></div><div>Solid removal efficiency</div><div><div>3 microns and larger- 100%</div><div>0.5 to 3 microns- 99.5%</div><div>Turndown- 100%</div></div></div><p>(l) A format for ‘<b>Filter Separator Data Sheet</b>’ is enclosed as <b>Annexure-2 B</b>, for vendor’s compliance as a part of Documentation.</p></div></div>						
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#### 4.5.0 DESIGN BASIS FOR PRESSURE VESSELS:

#### 4.5.1 Applicable standards:

- (i) Vessels with design pr of  $1.0 \text{ kg/cm}^2 \text{ (g)}$  and above, and less than  $210 \text{ Kg/Cm}^2 \text{ (g)}$  shall be designed, fabricated inspected and tested as per ASME Sec. VIII Div.1.
- (ii) Vessels full of liquid and/or with design pressure,  $\leq 1.0 \text{ Kg/cm}^2 \text{ (g)}$  shall also be designed, fabricated inspected and tested as per ASME Sec. VIII Div.1. However, this clause is not applicable for shell of water bath heater, which shall be designed as per API-12 K standard.

#### 4.5.2 Materials:

- (i) Materials to be used shall conform to :
  - (a) ASME Section II
  - (b) Indian Standard Specification of equivalent grade

The following table gives general guidelines for material selection for various pressure Parts / Non pressure parts of the equipment.

	Pressure Parts				Non-Pressure Parts		
Design Temp, Deg. C	Plate	Pipe (see Note-1)	Forging	Bolts/Studs/Nuts (External)	Structural attachment welded to pressure parts	Internal pipes/plates	Bolts/Studs/Nuts (Internal)
Above (-) 29 to 0 Deg. C	SA 516 (all grade s) – see Note-2	SA 106 Gr. B – see Note-2	SA 105/ SA 286 - see Note-2	SA 193 Gr. B7 / SA 194 Gr. 2 H	SA 516 (all grades)	SA 106 Gr. B	SA 193 Gr. B8/ SA 194 Gr. 8
	SA 240 type 304– see	SA 312 TP, 321 ,	SA 182 F 304	SA 193 Gr. B7 / SA 194 Gr. 2 H	Same as pressure parts	Same as pressure parts	SA 193 Gr. B8/ SA 194 Gr. 8

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	<b>Note-2</b>						
Above 0 to 343 Deg. C	SA 516 (all grades)	SA 106 Gr. B	SA 105/SA 286	SA 193 Gr. B7 / SA 194 Gr. 2 H	a) 2062 plates up to 300 Deg. C b) Same as pressure parts for above 300 Deg. C	SA 106 Gr. B	SA 193 Gr. B8/SA 194 Gr. 8
	SA 240 type 304-	SA 312 TP, 321 .	SA 182 F 304	SA 193 Gr. B7 / SA 194 Gr. 2 H	Same as pressure parts	Same as	SA 193 Gr. B8/SA 194 Gr. 8

NOTES:-

1. All pipes shall be of seamless construction.
2. Check for impact testing requirement as per UCS – 66 for coincident temperature and part thickness.

### 4.5.3 Minimum Wall thickness:

- (i) For Carbon and alloy steels:

The Minimum wall thickness shall be calculated as per code. However same shall be cross checked as follows:

Minimum wall thickness – 6 mm (including corrosion allowance), but not less than calculated as follows:

(1) FOR DIA LESS THAN 2400 MM


$$\text{Wall thk} = (\text{Dia} / 1000) + 1.5 + \text{CA}$$


(2) FOR DIA 2400 MM AND ABOVE


$$\text{Wall thk} = (\text{Dia} / 1000) + 2.5 + \text{CA}$$


All dimensions are in mm.


- (ii) For Stainless steels:


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<p style="text-align: center;"><b>COPYRIGHT AND CONFIDENTIAL</b></p> <p>The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED . It must not be used directly or indirectly in any way detrimental to the interest of the company.</p>		<div style="float: right; width: 100px;"> <p>• The Minimum wall thickness shall be calculated as per code. However same shall be cross checked as follows :</p> <p>Minimum wall thickness – 3 mm, but not less than calculated as follows:</p> <p>(1) FOR DIA LESS THAN 1500 MM</p> <p>Wall thk = (Dia /1000) + 2.5</p> <p>All dimensions are in mm.</p> <p>Corrosion allowance if any, shall be added to the minimum thickness calculated as Above.</p> <p><b>4.5.4 Corrosion Allowance:</b></p> <p>Minimum corrosion allowance shall be 3.2 mm for pressure vessels, unless otherwise specified. Same is not applicable for stainless steel material.</p> <p><b>4.5.5 Specification of Plate Materials:</b></p> <p><b>(i) Carbon Steel Plates:</b></p> <p><b>A) Chemical Analysis:</b></p> <p>(a) Plates used shall conform to latest issue of SA-20 with additional requirements mentioned herein.</p> <ul style="list-style-type: none"> <li>• Only normalized plates free from injurious defects with workmanlike finish shall be used. Reconditioning / repair of plates by welding shall not be permitted.</li> <li>• One product analysis of each heat shall be carried out and reported. Chemical analysis shall be as per applicable specification with carbon content not exceeding 0.23%.</li> <li>• Additionally, any of the following requirements for carbon equivalents (Ceq.) based on heat analysis shall be satisfied:</li> </ul> <p><math>Ceq = C + Mn/6 \leq 0.42</math> ---- (1)</p> <p><math>Ceq = C + MN/6 + (CR+Mo+V)/5 + (Cu + Ni)/15 \leq 0.43</math> --- (2)</p> <p>Eq. 1 shall be used when applicable material specify C and Mn only.</p> </div>		
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<p>Eq. 2 is applicable for restricted chemistry requirements or for supplementary requirements of S19 &amp; S21 of specification SA-20.</p> <p><b>B) Ultrasonic examination of plates</b></p> <p>(a) Plates having thickness 16 mm to 50 mm (both inclusive) shall be examined ultrasonically as per specification SA-435.</p> <p>(b) For quenched and tempered plates, ultrasonic examination shall be carried out after the specified heat treatment.</p> <p>(c) Charpy V-notch impact testing as per S-5 of spec. SA-20 to be carried out at design temperature for low temperature service.</p> <p>(d) Plates needed for IBR vessels shall meet the requirements of IBR.</p> <p><b>(ii) Stainless Steel Plates/Pipes/Fittings:</b></p> <p><b>A) Chemical Analysis:</b></p> <p>(a) All plates shall be hot rolled, annealed, pickled and shall have no.1 finish on both sides with reference to specification SA-480.</p> <p>(b) Unless otherwise specified, plates, pipes, forgings and fittings representative of each heat shall be subjected to inter granular corrosion tests as per ASTM A 262 practice E for all the 300 series material. The bend test specimen shall be examined at a magnification of 200 x.</p> <p>(c) Plates having thickness 16 mm to 50 mm (both inclusive) shall be examined ultrasonically as per specification SA-435.</p> <p><b>4.5.6 Heads:</b></p> <p>(a) Heads shape, dimensions proposed by the manufacturer must be stated in the drawings. All carbon steel dished heads and toricones up to 16 mm thickness (nominal) shall be stress relieved and more than 16 mm thickness shall be normalized if cold pressed or formed. However, in case hot forming is carried out in the normalizing range, no stress relieving is necessary.</p> <p>(b) Cold formed dished ends of SS vessels shall not be solution annealed unless any of the following conditions exists:</p>				
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<p align="center"><b>COPYRIGHT AND CONFIDENTIAL</b></p> <p>The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED . It must not be used directly or indirectly in any way detrimental to the interest of the company.</p>		<div data-bbox="475 315 1347 495"> <ul style="list-style-type: none"> <li>(i) Specifically called or particular equipment/service</li> <li>(ii) Hardness value after forming exceeds 235 BHN</li> <li>(iii) Nominal thickness of plate is 16 mm or above.</li> </ul> <p>(c) Hot formed dished ends of SS vessels shall be solution annealed.</p> <p><b>4.5.7 Manholes, Hand holes and nozzles:</b></p> <ul style="list-style-type: none"> <li>(a) Manholes shall be minimum 600 mm NB unless otherwise specified. If the dimension of vessel does not permit, the manhole shall be minimum of 450 mm.</li> <li>(b) Manhole cover shall be provided with a davit or hinge.</li> <li>(c) Small vessels shall be provided with two pad type inspection openings of 150 NB. If it is not possible for small vessels (up to 300 mm diameter vessel) a suitable spool pipe shall be provided in the piping for inspection.</li> <li>(d) For vessels with diameter less than 900 mm and having removable internals, shell flanges shall be provided.</li> <li>(e) As a general rule all nozzles attachment to shell/head shall be set in type.</li> <li>(f) The reinforcement for the nozzle opening shall be integral type when required by the applicable code/standards or when the thickness of vessel wall exceeds 50 mm. Self-reinforcement type nozzles 80 NB and above shall be set-in type.</li> <li>(g) All vessel nozzles shall be welded to the vessel. Screwed connections into the vessel are not acceptable.</li> </ul> <p><b>4.5.8 Flanges:</b></p> <ul style="list-style-type: none"> <li>(a) All flanges shall be as per ASME B 16.5. Larger flanges not covered by 16.5 shall be ASME B 16.47. (Series B).</li> <li>(b) For nozzles 100 NB and below, only WN flanges shall be used. SO flanges may be used for nozzles above 100 mm NB for class 150 only.</li> <li>(c) Only WN flanges shall be used in H2 service, cyclic service and corrosive services and where corrosion allowance is in excess of 3 mm.</li> <li>(d) All flanges above class 150 shall be WN type.</li> <li>(e) All flanges of class 900 and above shall have gasket surfaces for RTJ.</li> </ul> </div>		
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<p align="center"><b>COPYRIGHT AND CONFIDENTIAL</b></p> <p>The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED . It must not be used directly or indirectly in any way detrimental to the interest of the company.</p>		<p>(f) All flanges shall be of raised face type with serrated finish unless specified otherwise. Plate flanges are not acceptable.</p> <p><b>4.5.9 Inspection:</b></p> <p>(a) All vessels shall be offered for stage-wise as well as for final inspection in line with approved QAP.</p> <p><b>4.5.10 Pressure Testing:</b></p> <p>(a) All vessels shall be hydrostatically or pneumatically tested as per the code. In order to safeguard against the risk of brittle fracture during hydrostatic test, temperature of test fluid shall meet the requirements of UG-99 of ASME Sec. VIII Div.1 and shall be preferably not less than 16 Deg. C. In case of hydro testing of SS vessels/piping, tested water must be used and chloride content should be limited to 30 ppm only.</p> <p><b>4.5.11 Welding:</b></p> <p>(a) Please refer to clause No. 4.6.0. of this document , regarding welding process, procedures and qualifications.</p> <p>(b) Full penetration weld shall be employed for joining pressure parts. Where both sides are not accessible for welding, root run by tungsten inert gas process or backing strip may be used to ensure full penetration. Backing strip, if used, is to be removed after welding, wherever possible.</p> <p align="center">All root runs / Single pass welds shall be carried out by TIG Welding.</p> <p align="center">Skip and/or stitch welding on all exterior structural welds is not permitted.</p> <p><b>4.5.12 Post Weld Heat Treatment:</b></p> <p>(a) Vessels shall be post weld heat treated wherever it is required due to service requirement or due to code requirements. Vessels shall be post weld-heat treated as a complete unit and no welding shall be permitted once post weld heat treatment is performed.</p> <p>(b) Whenever heat treatment on stainless is carried out, it shall be followed by micro etching test and IGC test as per ASTM A 262 practice E, unless otherwise specified, to ascertain suitability and effectiveness of solution annealing. The bend test specimen shall be examined at a magnification of 200 x.</p>		
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<p align="center"><b>COPYRIGHT AND CONFIDENTIAL</b></p> <p>The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED . It must not be used directly or indirectly in any way detrimental to the interest of the company.</p>		<p><b>4.5.13 Radiography / Non Destructive Testing:</b></p> <p>(i) The radiographic examination shall not be less than that specified in the code. However, spot radiography is the minimum requirement for all vessels.</p> <p>(ii) When spot radiography is specified, the following requirement shall supplement the requirement specified in ASME section VIII Division 1:</p> <ol style="list-style-type: none"> <li>1. All 'T' -joint shall be radio graphed.</li> <li>2. Minimum 5% of total weld length excluding 'T' - joint shall be radio graphed.</li> <li>3. Evaluation, tests and repair shall be as per applicable code.</li> </ol> <p>(iii) All nozzles fabricated from plate, irrespective of thickness, shall be 100% radio graphed.</p> <p>(iv) Weld seams of formed ends shall be 100% radio graphed after forming and heat treatment, if any.</p> <p>(v) The technique employed and the weld quality achieved shall meet the requirements of the code.</p> <p>(vi) All nozzles to shell welds (Root and Final run) shall be examined by magnetic particle/Dye penetrant test.</p> <p><b>4.5.14 Cleaning:</b></p> <p>(i) Vessels shall be cleaned internally to remove scale, rust, dirt, foreign material by wire brushing.</p> <p>(ii) Stainless steel surfaces both inside and outside shall be pickled and passivated in accordance with specification ASTM-A 380 after hydrotest.</p> <p><b>4.5.15 General:</b></p> <p>(a)Vessel shall be provided with lifting lugs, wherever required. Skirt supported vessels shall be provided with tailing lugs, if necessary.</p> <p>(b) Nozzles up to 50 mm NB size shall be stiffened with 2 number of 40 mm wide X 6 mm thick stiffeners welded at 90 degrees apart to avoid damage due to vibration during transportation.</p>		
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<p align="center"><b>COPYRIGHT AND CONFIDENTIAL</b></p> <p>The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED . It must not be used directly or indirectly in any way detrimental to the interest of the company.</p>		<p>(c)Vessel diameter 300 mm NB and below shall be made from seamless pipe only.</p> <p>(d) Nozzle connections used for vessels shall not be less than 40 mm NB.</p> <p>(e)Rolling direction of plate for shell shall be lengthwise.</p> <p>(f)All internal nuts and bolts shall be of stainless steel construction irrespective of material of construction of vessel.</p> <p>(g) For vessels in stainless steel construction, lower allowable stress values shall be considered</p> <p><b>4.6.0 WELDING PROCESS, PROCEDURES AND QUALIFICATIONS:</b></p> <p>a) <b>Welding processes:</b> The welding processes as defined by section IX of the ASME Boiler and Pressure Vessel (B&amp;PV) code are acceptable.</p> <p>b) <b>Welding Procedure specifications:</b> Each manufacturer shall prepare or obtain detailed written welding procedure specifications (WPS) outlining all essential, nonessential and supplementary essential variables as required by section IX of the ASME B&amp;PV code. Materials used in welding that are not classified under the ASME P-number base material grouping shall be qualified in accordance with the methods specified in section IX. It is the responsibility of the manufacturer to justify any base material and / or filler metal grouping that are not classified in section IX.</p> <p>c) <b>Welding Procedure Qualifications:</b> Each manufacturer shall qualify the procedures he intends to use in production, by producing weldments and having mechanical tests performed as required by section IX of the ASME B&amp;PV code. Where controlled hardness is required by NACE MR-01-75, the maximum hardness of the base materials, the weld metal, and the heat affected zone may be determined on the procedure Qualification. The results of all tests shall be recorded and certified on Procedure Qualification Records (PQR) by the manufacturer to support each WPS. Qualification by one manufacturer shall not qualify a WPS for any other manufacturer.</p> <p>d) <b>Welder Qualifications:</b> Each manufacturer shall qualify all welders and welding operators employed in welding in accordance with the requirements of section IX of the ASME B&amp;PV code. The results of all tests shall be recorded and certified on welder performance qualification (WPQ) by the manufacturer for each welder and welding operator. Qualification of individuals employed by one manufacturer shall not qualify them for employment by any other manufacturer without re-qualification.</p>		
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<div><div>COPYRIGHT AND CONFIDENTIAL</div><div>The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED . It must not be used directly or indirectly in any way detrimental to the interest of the company.</div></div>	<b>4.7.0</b>	<b>DESIGN BASIS FOR PIPING</b>	
	<b>4.7.1</b>	<b>Design Standard:</b>	
		(a) Piping design standard shall be ANSI B31.3 (Process Piping), unless otherwise specified.	
	<b>4.7.2</b>	<b>Piping Material Specification:</b>	
		(a) Piping material specification shall be strictly as per piping line specifications enclosed as per Annexure-III and “Technical Requirements for Piping” as per clause – 4.8.0 except for thickness of the pipe which is mentioned in the <b>P&amp;ID attached as Annexure-1</b> . Of this specification. The applicable line specifications are clearly marked in the P&ID of the system enclosed.	
	<b>4.7.3</b>	<b>Valves:</b>	
		All valves shall be of the type as per the legend indicated in the <b>P&amp;ID</b> . The various valves shall be as per the “Valve data sheets” enclosed as <b>Annexure-5</b> . and “Technical Requirements for Valves” vide <b>clause-4.9.0</b> Of this specification.	
	<b>4.7.4</b>	<b>Vents and Drains:</b>	
		<del>(a) All pipe line high point vents and low point drains shall be as per Annexure-8.</del>	
		Other vents and drains as shown in the <b>P&amp;ID</b> to be followed.	
<b>4.7.5</b>	<b>Piping Supports:</b>		
	(a) Good engineering practices shall be applied and the required proper supports shall be provided for the piping.		
	(b) Pads shall be welded on pipelines at all supported locations.		
<b>4.7.6</b>	<b>Welding:</b>		
	(a) Please refer to clause No. 5.11.0. of this document , regarding welding process, procedures and qualifications.		
	(b) Full penetration weld shall be employed for joining. Where both sides are not accessible for welding, root run by tungsten inert gas process or backing strip may be used to ensure full penetration. Backing strip, if used, is to be removed after welding, wherever possible.		
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(c)All root runs / Single pass welds shall be carried out by TIG Welding.

**4.7.7 Non-Destructive Testing:**

The non-destructive testing of piping shall be as given below for various piping line specifications.


**a) PIPING CLASS: 11A**


Temp (°C)	Pr.class	Pipe class	Type of examination	Type of weld Examined					Remarks
				Girth Butt weld	Socket weld	Attachment weld	Fabricated branch weld	Fabricated Weld of miter/reducers	
(-)29 to 400	150#	11A	a) Visual	100%	100%	100%	100%	100%	
			b) Radio graphy	10%	—	—	—	50%	
			c) MP/LP	—	10%	—	10%	50%	


  


**b) PIPING CLASS: 21A/31A/32A**


Temp (°C)	Pr.class	Pipe class	Type of examination	Type of weld Examined					Remarks
				Girth Butt weld	Socket weld	Attachment weld	Fabricated branch weld	Fabricated Weld of miter/reducers	
(-) 29 to 427	300# to #600	B1A	a) Visual	100%	100%	100%	100%	100%	
			b) Radio graphy	20%	—	—	—	100%	
			c) MP/LP	—	20%	—	20%	---	


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<p align="center"><b>COPYRIGHT AND CONFIDENTIAL</b></p> <p>The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED . It must not be used directly or indirectly in any way detrimental to the interest of the company.</p>		<p><b>4.8.0 TECHNICAL REQUIREMENTS FOR PIPING :</b></p> <p><b>4.8.1 General:</b></p> <p>This “Technical Requirements for piping” shall be read along with “Piping Material Specification – PMS, Annexure-III’. The purpose of this section is to cover General requirements to be considered as minimum for procurement of piping materials.</p> <p><b>4.8.2 Special Requirements for Austenitic Stainless Steel:</b></p> <ul style="list-style-type: none"> <li>• The following special requirements for Austenitic stainless steel are to be taken care of.</li> <li>- All items/parts shall be supplied in solution-annealed condition.</li> <li>- For all material, Inter Granular Corrosion (IGC) test shall be conducted as per the following.</li> <li>• ASTM A 262 Practice ‘B’ with acceptance criteria of 60 mils/year(max) for casting.</li> <li>• ASTM A262 practice ‘E’ with acceptance criteria of ‘No cracks as observed from 20 x magnification’ &amp; microscopic structure to be observed from 250 x magnification for other than casting.</li> <li>• For IGC test, two sets shall be drawn from each solution annealing lot; one set corresponding to highest carbon content and other set corresponding to highest rating/ thickness.</li> </ul> <p><b>4.8.3 Other requirements:</b></p> <p><b>4.8.3.1 Pipes:</b></p> <ul style="list-style-type: none"> <li>• Pipes made by acid-Bessemer process shall not be acceptable. Steel pipe shall be made by open-hearth, electric furnace (or) basic oxygen process.</li> <li>• Unless specifically exempted, welded pipes (if specified, in piping material specification) shall be acceptable only with longitudinal weld made by employing automatic welding.</li> <li>• Galvanized pipes (if specified, in piping material specification) shall be only Hot Dip galvanized to ASTM A 53.</li> <li>• Spiral welded pipes (wherever specified in piping material specification) are permitted only in Cat ‘D’ service.</li> </ul>		
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<p style="text-align: center;"><b>COPYRIGHT AND CONFIDENTIAL</b></p> <p>The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED . It must not be used directly or indirectly in any way detrimental to the interest of the company.</p>		<p><b>4.8.3.2 Fittings:</b></p> <ul style="list-style-type: none"> <li>• All fittings shall be of seamless construction unless otherwise specified.</li> <li>• Welded fittings (if specified, in piping material specification) shall be 100% radiographed by X-ray. ultrasonic testing in lieu of radiographic examination shall not be acceptable.</li> <li>• For reducing BW fittings having different wall thickness at each end, the greater one shall be employed and the end shall be matched to suit the respective thickness.</li> <li>• All welded fittings (if specified, in piping material specification ) shall be double welded. Inside weld projections shall not exceed 1.6 mm and the welds shall be ground smooth at least 25 mm from the ends.</li> <li>• For fittings made out of welded pipe (if applicable as per piping material specification), the pipe itself shall be of double welded type, manufactured with addition of filler material and made by employing automatic welding only.</li> <li>• All welded fittings (if applicable as per piping material specification) shall be normalized for CS, normalized and tempered for AS.</li> <li>• Bevel end of all BW fittings shall undergo 100% MP/DP test.</li> <li>• Usage of unions shall be restricted to utilities and instrumentation.</li> </ul> <p><b>4.8.3.3 Gaskets:</b></p> <ul style="list-style-type: none"> <li>• Spiral wound gaskets shall be of self-aligning type.</li> <li>• Canadian asbestos filler for spiral wound gaskets shall not have any color or dye.</li> <li>• Full face gaskets shall have bolt holes punched out.</li> <li>• Gaskets where CA filter is specified, Grafoil filer will also be acceptable.</li> <li>• Compliance to following requirements for spiral wound gaskets is mandatory:</li> <li>• <b>Outer centering ring is mandatory and shall be of minimum CS material.</b></li> <li>• <b>Inner ring material shall be same as spiral strip material and as minimum, shall be provided for the following:</b></li> </ul>		
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<p style="text-align: center;"><b>COPYRIGHT AND CONFIDENTIAL</b></p> <p>The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED . It must not be used directly or indirectly in any way detrimental to the interest of the company.</p>		<div style="display: flex; justify-content: space-between;"> <div data-bbox="406 347 1460 660"> <ul style="list-style-type: none"> <li>• 26" and above gaskets</li> <li>• All size gaskets for vacuum service. H-grade stainless steel, SS-437 and SS 321.</li> <li>• All size gaskets for Hydrogen and process + hydrogen services.</li> <li>• All size gaskets for CRYO classes.</li> <li>• All sizes where class temperature is higher than 427 Deg. C.</li> <li>• All sizes for classes 900# and above.</li> <li>• All gaskets with PTFE filler.</li> </ul> </div> <div data-bbox="406 694 662 728"> <p><b>4.8.3.4 Bolting:</b></p> </div> <div data-bbox="406 772 1460 1142"> <ul style="list-style-type: none"> <li>• Threads shall be unified (UNC for # 1" and BUN for 1" dia) as per ANSI B1.1 with class 2A fit for Studs. M/c Bolts and jack screws and class 2 B for nuts.</li> <li>• Stud bolts shall be threaded full length with two heavy hex nuts. Length tolerance shall be in accordance with the requirement of table F2 of Annexure F of ASME16.5.</li> <li>• The nuts shall be double chamfered, semi-finished, heavy hexagonal type and shall be made by hot forged process.</li> <li>• Wherever feritic steel flanges mate with stainless steel flanges over 371 Deg. C, bolting material shall be ASTM A 193 Gr B16 / A 194 Gr 4H.</li> </ul> </div> <div data-bbox="406 1176 678 1209"> <p><b>4.8.3.5 Strainers:</b></p> </div> <div data-bbox="406 1254 1460 1859"> <ul style="list-style-type: none"> <li>• All 2" &amp; higher sized strainers shall be provided with 3/4" threaded tap and solid threaded plug as drain connection. For less than 2", this shall be of 1/2" size. The tapped hole should be at the bottom to ensure proper drainage.</li> <li>• For fabricated strainers all the BW joints shall be fully radiographed and fillet welds shall be 100% DP/MP checked.</li> <li>• Bevel ends of strainers shall undergo 100% DP/MP test.</li> <li>• All welded strainers shall be normalized for CS and normalized and tempered for AS.</li> <li>• All strainers shall be hydrostatic tested at twice the design pressure.</li> <li>• Allowable pressure drop shall be certified by vendor along with offer. If asked specifically, vendor shall furnish pressure drop calculations.</li> </ul> </div> </div>		
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<p align="center"><b>COPYRIGHT AND CONFIDENTIAL</b></p> <p>The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED . It must not be used directly or indirectly in any way detrimental to the interest of the company.</p>		<div data-bbox="405 309 774 347"><b>4.8.3.6 Threaded Joints:</b></div> <ul style="list-style-type: none"> <li>• Up to 200 Deg. C, threaded joints shall be made with 1” width PTFE Joining tape.</li> <li>• Above 200 Deg. C, threaded joints shall be seal welded with a full Strength fillet weld.</li> <li>• All threaded joints irrespective of pressure and temperature of the lines carrying toxic fluid shall be seal welded with a full strength weld.</li> </ul> <div data-bbox="405 719 734 757"><b>4.8.3.7 Test Reports:</b></div> <ul style="list-style-type: none"> <li>• Test reports for all mandatory (as well as supplementary, wherever specified) tests shall be furnished.</li> </ul> <div data-bbox="405 904 671 943"><b>4.8.3.8 Marking:</b></div> <ul style="list-style-type: none"> <li>• All items shall be marked (stamped / etched) in accordance with applicable codes / standards / specification. The item code, if available shall also be marked.</li> <li>• For ease of identification, the color of painted strips, wherever applicable, shall be as per applicable standard.</li> <li>• Paint or ink for marking shall not contain any harmful metal or metal salts such as zinc, lead or copper which cause corrosive attack on heating.</li> <li>• Special items / smaller items shall have attached corrosive resistant tag providing salient features.</li> </ul> <div data-bbox="405 1464 671 1503"><b>4.8.3.9 Dispatch:</b></div> <ul style="list-style-type: none"> <li>• All items shall be dry, clean and free from moisture, dirt and loose foreign materials of any kind.</li> <li>• All items shall be protected from rust, corrosion, and any mechanical damage during transportation, shipment and storage.</li> <li>• Rust preventive on machined surfaces to be welded shall be easily removable with a petroleum solvent or shall not be harmful to welding.</li> <li>• Ends shall be suitably protected and the protectors shall be securely and tightly attached.</li> </ul>		
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<p align="center"><b>COPYRIGHT AND CONFIDENTIAL</b></p> <p>The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED . It must not be used directly or indirectly in any way detrimental to the interest of the company.</p>			<ul style="list-style-type: none"> <li>Each variety and size of item shall be supplied in separate packaging marked with purchase order No, item code (if available), and the salient specifications.</li> </ul> <p><b>4.9.0 TECHNICAL REQUIREMENTS OF VALVES:</b></p> <p><b>4.9.1 General:</b></p> <p>a) The “Technical requirements for valves” shall be read along with respective data sheets for valves, Annexure-V.</p> <p>b) All codes and standards for manufacture, testing, inspection etc., shall be of latest editions.</p> <p><b>4.9.2 Design and Construction:</b></p> <p>a) Following requirements for <b>check valves</b> shall be met over and above the valve data sheet requirements:</p> <p>(1) Unless otherwise specified in the data sheet all check valves 3” &amp; above (except in 900# 1500# &amp; 2500# rating) shall have a drain boss at location ‘G’ (Refer Fig.1 No.1. of ASME B 16.34). A tapped drain hole with plug shall be provided as per ASME B 16.34. Threads shall be as per ASME B1.20.1 (Taper) NPT.</p> <p>(2) Wherever check valve disc assembly is supported from the cover of the check valves the following shall be ascertained.</p> <p>(i) Positive location / positioning of cover must be provided to ensure correct alignment of the valve disc.</p> <p>(ii) Hinge pin design must permit accurate alignment of the disc and valve seat.</p> <p>(3) For heavy check valves, provisions shall be available for lifting by way of lugs, eye bolts and other such standard devices.</p> <p>b) If an overlay weld-deposit is used for the body seat ring seating surface, the corrosion resistance of the seat ring base material shall be at least equal to the corrosion resistance of the material of the shell.</p> <p>c) Valve body / bonnet shall be forged / cast as specified. Forgings are acceptable in Place of casting but not vice-versa.</p> <p>d) Material of construction of yoke shall be minimum equivalent to body / bonnet Material.</p>	
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<p align="center"><b>COPYRIGHT AND CONFIDENTIAL</b></p> <p>The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED . It must not be used directly or indirectly in any way detrimental to the interest of the company.</p>		<p>e) Stem shall be of forged or machined from forged rolled bar. No casting is permitted. However, integral stem of cast stainless steel ball valve is acceptable.</p> <p>f) Stellite / hard facing by deposition, shall be minimum 1.6 mm. Renewable seat rings shall be seal welded.</p> <p>g) Valves under “NACE” category shall meet the requirements specified in MR-01-75 unless otherwise specified.</p> <p>h) For all austenitic stainless steel valves Inter Granular Corrosion (IGC) test shall be conducted as per the following.</p> <p>(1) ASTM A 262 Practice “B” with acceptance criteria of ’60 mils/year (max.) for all materials – forged, rolled, wrought and casting.</p> <p align="center">(or)</p> <p>ASTM A 262 Practice “E” with acceptance criteria of “No cracks as observed from 20X magnification” for all materials other than castings. “Microscopic structure to be observed from 250X magnification” in addition.</p> <p>(2) When specifically asked for in data sheet for high temperature application of some grades of austenitic stainless steel (eg. SS 309, 310, 316, 316 H etc) ASTM A 262 Practice “C” with acceptance criteria of ’15 mils/year (max.)’ shall be conducted.</p> <p>(3) For the IGC test as described above, two sets of samples shall be drawn from each solution annealing lot. One set shall correspond to the highest Carbon content and the other to the highest pressure rating. When testing is conducted as per practice ‘E’, photograph of the microscopic structure shall be submitted for record.</p> <p>(4) All types of 321 or 347 stainless steel valves shall be in stabilized heat treated condition. Stabilizing heat treatment shall be carried out subsequent to the normal solution annealing. Soaking temperature and holding time for stabilizing heat treatment shall be 900 Deg. C and 4 hours respectively.</p> <p>i) Spiral wound bonnet gaskets are to be provided with inner / outer ring (where ever applicable) except when encapsulated gaskets type body-bonnet joints are employed. Outer ring may be avoided in case of non-circular spiral wound gasket used in 150# valve provided the outermost layer of spiral touches the bolts ascertaining the centering.</p>		
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<p style="text-align: center;"><b>COPYRIGHT AND CONFIDENTIAL</b></p> <p>The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED . It must not be used directly or indirectly in any way detrimental to the interest of the company.</p>		<p><b>4.9.3 Ball Valves:</b></p> <p>a) As a pre qualification, fire safe test as per API 607 / API 6 FA / BS 6755 - Part II shall be carried out on soft seated ball valves. The test shall be witnessed and certified by a third party inspection agency like Lloyds, BV, DNV , / Equivalent (subject to approval by BHEL). The vendor has to submit test certificate for the particular design of the valve offered.</p> <p>b) The face to face dimensions of all ball valves shall be same as those of gate valves of the corresponding ANSI class (except 10” onwards in Class 150 where the face-to face dimensions shall be as per API 6D long pattern).</p> <p>c) Unless otherwise specified in the data sheets, bore of all reduced bore ball valves shall be limited one size lower than the normal bore.</p> <p><b>4.9.4 General:</b></p> <p>a) Butt welding and socket welding carbon steel valves shall have a 0.35% maximum carbon content: free machining steel is not acceptable.</p> <p>b) Unless otherwise noted, copper, brass or silver alloys are not permitted in contact with the flowing medium in steel valves.</p> <p>c) All forged chrome-moly valves shall be furnished in normalized and tempered condition in accordance with ASTM A 182 M.</p> <p>d) The term ‘Valve Trim’ is defined as ‘All wetted internal parts of a valve’.</p> <p>e) Ball valve should be drilled to relieve pressure from the ball port area when the valve is closed. Thermal expansion of liquids contained the unrelieved and closed plug and ball valve ports, as is possible on heat traced installations, can exceed the body ratings of the valve.</p> <p>f) Whenever the term ‘STELLITE’ is mentioned it means facing of Seat and Disc or Wedge by Cobalt-Chromium-Tungsten alloy. Stelliteing should be able to maintain hardness of 375 BHN at high temperatures. Whenever the term “HARD” is mentioned with reference to Seat or Disc of valve, it should be 350-500 BHN (min.).</p> <p>g) Orientation of valves stem below horizontal position shall be avoided.</p> <p><b>4.9.5 Operation:</b></p> <p>a) Valves shall be provided with gear operation for sizes, as indicated in the data Sheet. Same shall be read along with following requirements also.</p>		
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<div style="display: flex; justify-content: space-between;"> <div style="width: 15%;"> <p style="writing-mode: vertical-rl; transform: rotate(180deg);"> <b>COPYRIGHT AND CONFIDENTIAL</b>            The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED .            It must not be used directly or indirectly in any way detrimental to the interest of the company.         </p> </div> <div style="width: 85%;"> <p>1) Gear operator shall be as under, with position indicators for open/close positions and with limit stops. (Limit stops are not applicable for globe valves).</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%;">For Globe Valves</td> <td>Totally enclosed bevel gear in grease case with grease nipples/plugs</td> </tr> <tr> <td>For Ball Valves</td> <td>Totally enclosed helical worm or combination of helical worm and spur gear in grease case with grease nipples/ plugs.</td> </tr> </table> <p>2) Where gear operator is not called for as per data sheet but vendor recommends a Gear operator, he shall provide the gear operator for such cases duly highlighting the same.</p> <p>3) Gear Operator shall be so designed as to operate effectively with the differential pressure across the closed valve equal to the cold non-shock pressure rating.</p> <p>4) Ball valves, even with wrench or lever operators shall have open/close position indicators with limit stops.</p> <p>5) Hand wheel diameter shall not exceed 750 mm and lever length shall not exceed 500 mm on either side. Effort to operate shall not exceed 35 Kg at hand wheel periphery. However, failing to meet the above requirements, vendor shall provide gear operated valve.</p> <p><b>4.9.6 Inspection and Testing:</b></p> <p>a) Every Valve shall be subjected to all the mandatory tests and checks called in the respective codes / datasheets. Extent of witness by BHEL / Other Inspection Agencies identified shall be as per the approved Quality Plan.</p> <p>b) The extent of inspection shall be as under:</p> <p>(i) Forged Valves</p> <ol style="list-style-type: none"> <li>1. Visual and dimensional inspection</li> <li>2. Review of material certificates</li> <li>3. Any mandatory or supplementary test</li> <li>4. Hydrostatic test on 10% valves selected on random basis.</li> <li>5. Strip check is required for 1% of total ordered quantity (min. 1 No.) Against valve used in the following services. Low Temperature, Cryogenic, Hydrogen, Corrosive</li> </ol> <p>(ii) Cast Steel Valves</p> </div> </div>				For Globe Valves	Totally enclosed bevel gear in grease case with grease nipples/plugs	For Ball Valves	Totally enclosed helical worm or combination of helical worm and spur gear in grease case with grease nipples/ plugs.
For Globe Valves	Totally enclosed bevel gear in grease case with grease nipples/plugs						
For Ball Valves	Totally enclosed helical worm or combination of helical worm and spur gear in grease case with grease nipples/ plugs.						
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<div><div><div>COPYRIGHT AND CONFIDENTIAL</div><div>The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED . It must not be used directly or indirectly in any way detrimental to the interest of the company.</div></div><div><div><div>1. Visual and dimensional inspection</div><div>2. Review of material certificates</div><div>3. Review of Radiographs/radiographic reports or any other NDT tests Whenever applicable as per data sheet</div><div>4. Any mandatory or supplementary test</div><div>5. Hydrostatic test 100% for body, 10% other test.</div><div>6. Strip check is required for 1% of total ordered quantity (min. 1 No.) against valve used in the following services.</div><div>Low Temperature, Cryogenic, Hydrogen, Corrosive</div><div>Samples of strip check shall be selected at random and shall generally be in The highest size in the lot.</div><div>4.9.7 Radiography of Cast Valves:</div><div><div><div>• Radiography procedure, areas of casting to be radio graphed and the acceptance criteria shall be as per ASME/ANSI B 16.34.</div><div>• All castings shall be radiographic quality castings.</div><div>• Minimum requirement of radiography examination for all materials is as follows:</div><table><tr><th>Class</th><th>Size</th><th>Qty</th></tr><tr><td>150</td><td>26” &amp; above</td><td>100% (except where used for category ‘D’ service)</td></tr><tr><td>300</td><td>18” &amp; above</td><td>100%</td></tr><tr><td>600 and above</td><td>All</td><td>100%</td></tr></table><div>• Minimum additional radiography requirements for casting sizes for special / critical piping classes (over and above the requirements covered in clause (a) above) is as follows:</div><div><div>1) For Hydrogen/ Hydrogen bearing Hydrocarbons, Oxygen, NACE &amp; Carbon steel classes requiring stress relieving.</div><table><tr><th>Class</th><th>Size</th><th>Qty</th></tr><tr><td>150</td><td>up to 24”</td><td>50%</td></tr><tr><td>300</td><td>up to 16” e</td><td>50%</td></tr></table></div></div></div></div></div></div>					Class	Size	Qty	150	26” & above	100% (except where used for category ‘D’ service)	300	18” & above	100%	600 and above	All	100%	Class	Size	Qty	150	up to 24”	50%	300	up to 16” e	50%
Class	Size	Qty																							
150	26” & above	100% (except where used for category ‘D’ service)																							
300	18” & above	100%																							
600 and above	All	100%																							
Class	Size	Qty																							
150	up to 24”	50%																							
300	up to 16” e	50%																							

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	Form No.		<p style="text-align: center;"><b>PRODUCT STANDARD</b></p> <p style="text-align: center;"><b>PROJECT ENGINEERING &amp; SYSTEMS DIVISION</b></p> <p style="text-align: center;"><b>HYDERABAD-32</b></p>	<p><b>PY51235</b></p> <p>Rev No. 01</p> <p>Page 46 of 56</p>
<p style="text-align: center;"><b>COPYRIGHT AND CONFIDENTIAL</b></p> <p>The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED . It must not be used directly or indirectly in any way detrimental to the interest of the company.</p>		<p>Further hooking of these earthing lugs with plant earthing system will be done by purchaser.</p> <p>g) Vendor should use good engineering practices in developing the layout of the gas conditioning system. Proper access to all operating points including valves &amp; Instruments shall be provided, with approaches and plat forms as required. Further, while developing the layout, the thickness of insulation (wherever applicable) also shall be taken into consideration, for assessing the clearances between various pipe lines/equipment.</p> <p>h) In addition to the details shown in the <b>P&amp;I D</b>, the required low point drains and high point vents shall be provided as per layout requirement.</p> <p>i) In the development of layout of piping, the thermal stresses on various equipment and allowable stresses shall be taken in to consideration.</p> <p>j) Copper jumpers shall be provided across the flanges to maintain electrical continuity.</p> <p>k) All branch connections joining flare header shall be joined tangentially in the direction of flow.</p> <p>l) “SKIP” and/or “STITCH” welding on all exterior or structural welds is not permitted.</p> <p>m) Cables shall be routed through <del>suitable GRP perforated channels</del> cable trays up to junction boxes. Separate cable trays shall be provided for the following cables:</p> <ul style="list-style-type: none"> <li>(i) Intrinsic safe – control cables</li> <li>(ii) Instrinsic safe – signal cables</li> <li>(iii) Solenoid valve power cables</li> <li>(iv) Power cables for heater etc..</li> <li>(v) RTD cables</li> <li>(vi) Thermocouple cables</li> </ul> <p>n) The power cables are terminated at the respective terminal block of the equipment such as heaters.</p> <p>o) Even, for the instruments , for which no separate junction box is envisaged, the required perforated cable tray shall be provided on the skid, so that purchaser can lay the cable through the tray directly from the instrument. Similarly, the power cable tray form heater etc., shall be brought up to skid edge (wherever applicable), so that purchaser can lay the cable, accordingly.</p>		
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<p align="center"><b>COPYRIGHT AND CONFIDENTIAL</b></p> <p>The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED . It must not be used directly or indirectly in any way detrimental to the interest of the company.</p>		<p>p) All instrument tubing shall be laid on the skid as per good engineering practices with proper supports and clamping arrangements.</p> <p><b>7.0 TESTING AND INSPECTION REQUIREMENTS:</b></p> <p>a) Pressure Vessels : As per clause 4.5.9, 4.5.10 &amp; 4.5.13. (ie. Scrubber, Filter separator,</p> <p>b) Individual piping components : As per clause 4.7.7</p> <p>c) Individual valves : As per clause 4.9.7.</p> <p>d) Instrumentation : As per Annexure-VII.</p> <p>e) In general for all the equipment the scope of inspection and testing shall include verification of material test certificates, mandatory tests as well as supplementary tests (wherever specified) as per the applicable code.</p> <p>f) <b>Entire skid including vessels to be Hydro tested in fully assembled condition at a pressure as required by ANSI B 31.3. In case it is recommended that filter element/instruments should not be exposed for hydro testing then same can be remove/isolated during Hydrotest.</b> However the above test shall include instrument hook up lines also. In case of hydro testing of SS vessels/piping treated water must be used. Chloride content shall be limited to 30 ppm only.</p> <p>g) In addition to above, complete skid with filter elements &amp; instruments installed shall be factory assembled and tested for pneumatic leak test at a pressure of 80 PSIG.</p> <p>(The above is on the following premise: The purpose of pneumatic leak test is to ensure that there are no leakages at flange joints due to misalignment in the piping and forces due to improper assembly. Further, there is no need to test the skid at full operating pressure at vendor's works, as (i) conducting pneumatic leak test at vendor's works at high pressures is not safe, (ii) Even if leakage test is conducted at vendor's works, re-testing is required at site due to loosening of flange joints during transportation, unloading etc..).</p> <p><b>SPECIAL REQUIREMENT:</b></p> <ul style="list-style-type: none"> <li>• <del>VALID TYPE TEST CERTIFICATE OF ALL INSTRUMENTS TO BE SUBMITTED.</del></li> <li>• <del>VALID TYPE TEST CERTIFICATES FOR FILTER ELEMENTS TO BE SUBMITTED.</del></li> </ul>		
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<p align="center"><b>COPYRIGHT AND CONFIDENTIAL</b></p> <p>The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED . It must not be used directly or indirectly in any way detrimental to the interest of the company.</p>		<p>h) <b><u>Inspection agency:</u></b></p> <p>BHEL/Third Party appointed by BHEL/Customer/customer's consultant. The various inspection stages will be witnessed by individual agencies (or) Group of Agencies as per above, in line with approved quality plan.</p> <p><b>8.0 PAINTING SCHEME:</b></p> <p>The painting scheme shall be as per <b>Annexure-17</b>.</p> <p><b>8.1 <del>Recommended vendors for paints:</del></b></p> <p><del>As per the approved vendors list for the system.</del></p> <p><b>8.2 <del>Precautions for painting:</del></b></p> <p><b>8.2.1 <del>Blast Cleaning:</del></b></p> <p><del>Shot/grit blasting shall not be undertaken when job temperature is less than 3 Deg. C above dew point of surrounding air and relative humidity is greater than 85%. The air temperature and relative humidity shall be measured at least twice daily and before and coating operations. Final blasting is permitted only during daylight hours. The blast cleaned surface shall be cleaned by dry compressed air to remove dust. The average surface profile after blast to be recorded as per ASTM D4417 to ensure 25 to 80 micrometers or as specified by paint manufacturer. Sand blasting is not permitted. Surface preparation by power tool is permitted at places where blasting is technically impossible. Surface preparation shall be coated with primer within 4 hours of blasting. Surface prepared by pickling for carbon steel piping to SSPC SP8 is acceptable. All surfaces to be painted which do not require blast cleaning or power tool cleaning, viz., Galvanized items, Stainless Steel &amp; Non-Ferrous items (below 100_C) shall be clean down thoroughly by scrubbing with diluted ammonia solution, followed by washing with drinking grade water.</del></p> <p><b>8.2.2 <del>Paint Application:</del></b></p> <p><del>All paint homogenizing, mixing, thinning, over coat interval, maintenance of pot-life, spray gun distance from job, nozzle pressure, nozzle tip diameter, nozzle angle, etc. are as per instructions of paint manufacturer. Paint shall be applied with spray, but brush can be used on areas where spray cannot be done adequately. Coating work shall not be undertaken when surrounding temperature is less than 5 Deg. C, job temperature is less than 3 Deg. C. above dew point of surrounding air &amp; relative humidity is greater than 85% or as specified by paint manufacturer. The metal temperature at a representative area shall be checked before application of any coating. Stripe coat of paint shall be applied by brush at edges, welds, corners, angles, flanges, brackets, bolts, nuts &amp; interstices — before application of each coat — to ensure that these areas have at least the minimum specified film thickness.</del></p>		
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<p align="center"><b>COPYRIGHT AND CONFIDENTIAL</b></p> <p>The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED . It must not be used directly or indirectly in any way detrimental to the interest of the company.</p>			<p><del>Zinc rich primer shall not be applied in the direct vicinity of austenitic stainless steel. Wet Film Thickness (WFT) is to be taken as often as necessary to obtain the specified Dry Film Thickness (DFT). For a particular paint system paints from same manufacturer are to be used. Non metallic items, non ferrous items, valve spindles, name plates, small instruments, gauges, servo valves, etc. are to be protected before painting.</del></p> <p><b>8.2.3 — Dry Film Inspection:</b></p> <p><del>When curing is not complete after twice recommended curing time, the paint shall be removed &amp; a new coating shall be applied. DFT shall be measured after each coat. The density of measuring points shall be once every 4 square meters for large areas &amp; once every 1 square meter for small areas or at the discretion of the inspector. DFT of each paint film coat shall be within +/- 25% of the specified thickness. The total DFT shall never be less than the specified minimum DFT. Average, minimum &amp; maximum DFT values for each coat are to be recorded. The instruments used for measurement of DFT shall have an accuracy of better than +/- 10% &amp; working range shall cover a minimum of 150% of the expected DFT. The adhesion of paint shall be determined by tests in accordance with ISO2409/ISO4624. Finish coat shall be even in gloss &amp; correct shade. Holiday / pinhole detection shall be conducted on all conventional thin film thickness, having total DFT 0.5mm or less, by low voltage wet sponge method as per ASTM D5162. This is carried out after top coat applied &amp; fully cured / dried. For tank &amp; vessel internals 100% of the surface shall be tested. Special attention shall be paid to welds, edges &amp; irregular surfaces for holiday / pinhole testing. For external surfaces, random inspection, which shall be representation of entire surface shall be tested. No pinhole is acceptable.</del></p> <p><b>9.0 STORING, HANDLING, PACKING AND DISPATCH OF EQUIPMENTS / COMPONENT:</b></p> <p>1) Packing shall be accomplished in accordance with acceptable commercial practices &amp; as per attached BHEL Code of Practice / Specification (for domestic or foreign Shipments – as applicable / as indicated in the BHEL Purchase Order or Quotation request.).</p> <p>The Vendor shall make shipment using the minimum number of shipping containers consistent with the requirements of safe transit, available mode of transportation and the routing of the consignment.</p> <p>It shall be the vendor's responsibility to determine that packing as done is adequate to assure that all equipments shall arrive at the destination in an undamaged condition , no damage is expected during storing at site &amp; also it shall be ready for intended use .</p> <p>In particularly the vendor shall ensure that the equipments packed are adequately protected against shock during shipment / handling.</p>	
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<p align="center"><b>COPYRIGHT AND CONFIDENTIAL</b></p> <p>The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED . It must not be used directly or indirectly in any way detrimental to the interest of the company.</p>		<div data-bbox="331 347 1449 748"> <p>1.1) Ref. BHEL Code of Practice – HY 0490572 (<b>ANNEXURE-12</b>) - Code of practice for storing, handling, packing and dispatch of components. ( Domestic Shipments ) &amp; with associated Standards specified therein.</p> <p>1.2) Ref. BHEL Specification – HY 0490574 (<b>ANNEXURE-12</b>) – Specification for sea worthy packing (for export orders) .</p> <p>2.0) Preservation before Packing &amp; Marking – as per attached BHEL specifications.</p> <p>3.0) <u>Vendor shall confirm compliance</u> of the above requirements in their Technical Offer.</p> </div> <div data-bbox="272 786 496 822"> <p><b>10.0 SPARES:</b></p> </div> <div data-bbox="389 860 1449 1227"> <p>a) <b>Commissioning spares:</b> Commissioning spares should form a part of main skid itself. Same shall be as per <b>Annexure-9</b>.</p> <p>b) <b>Mandatory spares:</b> Mandatory spares should form a part of main skid itself. Same shall be as per <b>Annexure-14</b>.</p> <p>c) <b>Two years operational spares:</b> Two years operational spares shall be as per <b>Annexure-13</b>.</p> </div> <div data-bbox="272 1265 1139 1303"> <p><b>11.0 CONFLICTS IN SPECIFICATION REQUIREMENTS:</b></p> </div> <div data-bbox="316 1341 1449 1417"> <p>In case of any conflict between this specification and Annexures stringent of the requirement will govern.</p> </div> <div data-bbox="256 1451 1201 1525"> <p><b>12.0 DRAWINGS/ DOCUMENTS REQUIRED DURING DETAIL ENGINEERING</b></p> </div> <div data-bbox="316 1563 1449 1637"> <p>The successful bidder shall submit as per the Master Document List enclosed vide <b>Annexure-15</b>.</p> </div> <div data-bbox="304 1673 695 1709"> <p><b>12.1 Master Document List:</b></p> </div> <div data-bbox="389 1747 1449 1968"> <p>a) Documentation shall be submitted by bidder during detailed engineering stage, as per the Master Document List (Annexure-15).</p> <p>b) Bidder shall ensure submission of all documentation as per approved Master Document List.</p> <p>c) Bidder to note that the dates of submission of all the documents shall be finalized by him considering the time required for approval of various</p> </div>		
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<p style="writing-mode: vertical-rl; transform: rotate(180deg);"><b>COPYRIGHT AND CONFIDENTIAL</b></p> <p style="writing-mode: vertical-rl; transform: rotate(180deg);">The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED . It must not be used directly or indirectly in any way detrimental to the interest of the company.</p>		<p style="text-align: center;">documents at Purchaser's end. It shall be solely bidder's responsibility to get approval on the entire document from purchaser to meet project schedule.</p> <p><b>12.2 Drawing approval category:</b></p> <p>1) The master document list shall clearly identify the class of review to be performed against each document.</p> <p>2) Following classes of review shall be followed for all the documents engineered by the bidder</p> <ul style="list-style-type: none"> <li>• <b>APPROVAL (A)</b> Approval is mandatory and bidder cannot proceed without obtaining Purchaser's approval.</li> <li>• <b>INFORMATION / RECORDS (I)</b> This type of documents shall be submitted to Purchaser for his information. Bidder can proceed if Purchaser's comments are not received within 14 working days of receipt in Purchaser's office.</li> </ul> <p>However, if any deviation to contract specification for any design deficiency is detected in the course of review after stipulated period, it shall be the responsibility of the bidder to see that such deviations and deficiencies are corrected to ensure compliance to contract without any cost and time implication to purchaser</p> <p><b>12.3 Drawings Review &amp; Approvals:</b></p> <p>12.3.1 Bidder to understand that efficient handling of drawings and documents to be prepared by him under the contract is the key to the timely completion of the skid package. By accepting the contract the bidder undertakes to ensure that all drawings and documents to be submitted by him to the Purchaser / End Customer shall be of professional quality and conforming to the contractual requirements.</p> <p>12.3.2 Bidder to note that the dates of submission of all the documents shall be finalized by him considering the time required for approval of various documents at Purchaser's end. It shall be solely bidder's responsibility to get approval on the entire document from purchaser to meet project schedule.</p> <p>12.3.3 Each drawing submitted by the bidder shall be clearly marked with the name of the Owner, the unit designation, the specifications, title, the specification number and the name of the Project with revision No. and date. If standards, catalogue pages are submitted the applicable items shall be indicated therein. All titles, noting, markings and writings on the drawings shall be in English.</p> <p>12.3.4 The approval and /or review by the Purchaser /End customer shall not be construed by the bidder as limiting any of his responsibilities and liabilities</p>		
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	12.3.5 The sole responsibility of the correctness of Design, Engineering shall lie with the bidder, irrespective of the fact that the Drawings / Documents submitted are reviewed or not by the Purchaser /End customer.																														
	12.3.6 The bidder shall correct all faulty designs & constructions detected at any stage of work (irrespective of the fact whether drawings related to such faulty designs & or constructions are approved by purchaser), without any cost and time implication to the Purchaser.																														
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<div style="display: flex; justify-content: space-between;"> <div style="width: 30%;"> <p style="text-align: center;"> <b>COPYRIGHT AND CONFIDENTIAL</b>            The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED .            It must not be used directly or indirectly in any way detrimental to the interest of the company.         </p> </div> <div style="width: 65%;"> <table border="1" style="width: 100%;"> <tr> <td style="width: 5%;">7</td> <td style="width: 40%;">Draft O &amp; M Manuals with out test certificates</td> <td style="width: 10%;">2</td> <td style="width: 45%;">2 months before the delivery date of equipment</td> </tr> <tr> <td>8</td> <td>Revised O &amp; M Manuals with Test Certificates to be submitted to BHEL (Hyderabad)</td> <td>17</td> <td>Within one month after dispatch of equipment</td> </tr> <tr> <td>9</td> <td>PO status of bought out items</td> <td></td> <td>Status to be furnished by vendor every 15 days.</td> </tr> <tr> <td>10</td> <td>Final O&amp;M Manuals in a CD</td> <td>3</td> <td>Within one month after dispatch of equipment</td> </tr> </table> <p><b>NOTES:</b></p> <ol style="list-style-type: none"> <li>1) The above schedule for drawing approval is only indicative. Bidder to furnish a bar chart for dispatch of skid as per the agreed delivery requirement of project. This schedule also shall indicate drawing submission and approval schedules meeting the delivery schedule of the equipment. Bidder and BHEL shall put all the efforts to meet the planned schedules.</li> <li>2) The O&amp;M manuals shall contain the following as minimum.               <ul style="list-style-type: none"> <li>• The identification details of the equipment like BHEL P.O. No., Vendor's Job Identification No., and full contact address with telephone, fax, &amp; e-mail details.</li> <li>• Brief description of the system.</li> <li>• System unloading, storage, erection, startup, commissioning, shut down requirements.</li> <li>• System operating and maintenance requirements.</li> <li>• Operational &amp; Environmental safety instructions.</li> <li>• Final data sheets and drawings.</li> <li>• O&amp;M Manuals, Catalogues of the equipment (like pump, motor, etc.) &amp; instrumentation</li> <li>• Recommended 2 years operational spares</li> </ul> </li> </ol> <p><b>13.0 PRE-BID CLARIFICATIONS AND DEVIATIONS:</b></p> <ol style="list-style-type: none"> <li>a) Bidders shall comply with various requirements of this specification. It may please be noted that the requirements specified here in this specification are the standard</li> </ol> </div> </div>					7	Draft O & M Manuals with out test certificates	2	2 months before the delivery date of equipment	8	Revised O & M Manuals with Test Certificates to be submitted to BHEL (Hyderabad)	17	Within one month after dispatch of equipment	9	PO status of bought out items		Status to be furnished by vendor every 15 days.	10	Final O&M Manuals in a CD	3	Within one month after dispatch of equipment
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<p>practices being followed by the bidders. However, same things are presented in a structured form so that it can be ensured that the requirements of ultimate customer are complied with.</p> <p>b) <u>Bidders can bring out only those deviations which are impractical to meet, for our review in pre bid clarification only.</u></p> <p>c) Bidders may also please note that the data sheets for, valves, instruments etc., submitted along with the offer will be considered as indicative only, as the requirements specified in the specification are standard in nature. These will not be reviewed by BHEL before award of contract. Same will be reviewed during order execution stage in line with the requirements of specification and agreed deviations.</p> <p><b>14.0 SUB VENDOR LIST:</b></p> <p>a) Sub-vendor list shall be as per Annexure-16.</p> <p>• <b><u>VARIANT TABLE:</u></b></p> <table border="1"> <thead> <tr> <th><u>Variant</u></th> <th><u>Item</u></th> <th><u>Remarks</u></th> </tr> </thead> <tbody> <tr> <td>01</td> <td>Fuel gas Scrubber</td> <td><i>Low Pressure Fuel Gas Scrubber (1X100%) skid: 1 no.</i></td> </tr> <tr> <td>02</td> <td>Fuel gas filter separator</td> <td><i>Low Pressure Fuel Gas Filter Separator (2X100%) skid:- 1</i></td> </tr> <tr> <td>03</td> <td>Fuel gas Coalescent filter skid</td> <td><i>High Pressure Fuel Gas Coalescent Filter (2X100%) skid:- 1 no</i></td> </tr> <tr> <td>04</td> <td>Fuel gas final scrubber</td> <td><i>High Pressure Fuel Gas final scrubber (1X100%) skid:- 1 no</i></td> </tr> <tr> <td>05</td> <td>C&amp;I spares for Fuel gas Scrubber</td> <td><i>WO : 1685302001</i></td> </tr> <tr> <td>06</td> <td>Mechanical spares for Fuel gas Scrubber</td> <td><i>WO : 1685138201</i></td> </tr> <tr> <td>07</td> <td>C&amp;I spares for Fuel gas filter separator</td> <td><i>WO : 1685302001</i></td> </tr> <tr> <td>08</td> <td>Mechanical spares for Fuel gas filter separator</td> <td><i>WO : 1685138201</i></td> </tr> <tr> <td>09</td> <td>C&amp;I spares for Fuel gas Coalescent filter skid</td> <td><i>WO : 1685302001</i></td> </tr> <tr> <td>10</td> <td>Mechanical spares for Fuel gas Coalescent filter skid</td> <td><i>WO : 1685138201</i></td> </tr> <tr> <td>11</td> <td>C&amp;I spares for Fuel gas final scrubber</td> <td><i>WO : 1685302001</i></td> </tr> <tr> <td>12</td> <td>Mechanical spares for Fuel gas final scrubber</td> <td><i>WO : 1685138201</i></td> </tr> </tbody> </table>				<u>Variant</u>	<u>Item</u>	<u>Remarks</u>	01	Fuel gas Scrubber	<i>Low Pressure Fuel Gas Scrubber (1X100%) skid: 1 no.</i>	02	Fuel gas filter separator	<i>Low Pressure Fuel Gas Filter Separator (2X100%) skid:- 1</i>	03	Fuel gas Coalescent filter skid	<i>High Pressure Fuel Gas Coalescent Filter (2X100%) skid:- 1 no</i>	04	Fuel gas final scrubber	<i>High Pressure Fuel Gas final scrubber (1X100%) skid:- 1 no</i>	05	C&I spares for Fuel gas Scrubber	<i>WO : 1685302001</i>	06	Mechanical spares for Fuel gas Scrubber	<i>WO : 1685138201</i>	07	C&I spares for Fuel gas filter separator	<i>WO : 1685302001</i>	08	Mechanical spares for Fuel gas filter separator	<i>WO : 1685138201</i>	09	C&I spares for Fuel gas Coalescent filter skid	<i>WO : 1685302001</i>	10	Mechanical spares for Fuel gas Coalescent filter skid	<i>WO : 1685138201</i>	11	C&I spares for Fuel gas final scrubber	<i>WO : 1685302001</i>	12	Mechanical spares for Fuel gas final scrubber	<i>WO : 1685138201</i>
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