
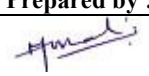
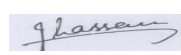




ESP-001-2A Rev.00	 HYDERABAD	PROJECT ENGINEERING & SYSTEMS DIVISION (Technical Specification for Gas Conditioning System)		Std. / Doc. Number	
				PY-51702	
				Rev. No.	00
				Sheet 1 of 50	

COPYRIGHT AND CONFIDENTIAL
 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.

TECHNICAL SPECIFICATION FOR OFF-BASE GAS CONDITIONING SYSTEM (Scrubber cum Filter Separator Skids)


PROJECT :	IOCL PADIP REFINERY, FUEL GAS CONVERSION PROJECT (GT#1, GT#2, GT#3)
CUSTOMER :	M/s INDIAN OIL CORPORATION LIMITED
CONSULTANT :	--


Revisions: Refer to record of revisions	Prepared by :	Checked by :	Approved by :	Date :
	 R. MURALIDHAR	 IFTEKHAR	 M. S.S. NAGESH	05.01.2020

Form No.		PRODUCT STANDARD PROJECT ENGINEERING & SYSTEMS DIVISION HYDERABAD-32	PY51702																																																																								
			Rev No. 00																																																																								
			Page 2 of 50																																																																								
INDEX																																																																											
<table border="1"> <thead> <tr> <th>S. No.</th> <th>DESCRIPTION</th> </tr> </thead> <tbody> <tr> <td>1.0</td> <td>Intent of Specification</td> </tr> <tr> <td></td> <td>Project information</td> </tr> <tr> <td>2.0</td> <td>Special Instructions to Bidders</td> </tr> <tr> <td>3.0</td> <td>Job Specification</td> </tr> <tr> <td>4.0</td> <td>General Specification</td> </tr> <tr> <td>5.0</td> <td>Instrumentation</td> </tr> <tr> <td>6.0</td> <td>Skid and Layout</td> </tr> <tr> <td>7.0</td> <td>Testing and Inspection requirements</td> </tr> <tr> <td>8.0</td> <td>Painting Scheme</td> </tr> <tr> <td>9.0</td> <td>Storing, Handling , Packing and Dispatch of Equipment</td> </tr> <tr> <td>10.0</td> <td>Spares</td> </tr> <tr> <td>11.0</td> <td>Conflict in specification requirements</td> </tr> <tr> <td>12.0</td> <td>Drawings and Documents to be submitted during Detail Engineering.</td> </tr> <tr> <td>13.0</td> <td>Pre Bid clarifications and deviations</td> </tr> <tr> <td>14.0</td> <td>Sub vendor list</td> </tr> <tr> <td></td> <td>Annexure 1 – P&ID for Natural Gas System</td> </tr> <tr> <td></td> <td>Annexure 2 – Scrubber & Filter Separator datasheet</td> </tr> <tr> <td></td> <td>Annexure 3- Piping Material Specification(PMS)</td> </tr> <tr> <td></td> <td>Annexure 4-Fuel Gas Composition</td> </tr> <tr> <td></td> <td>Annexure 5- Valve Material Specification</td> </tr> <tr> <td></td> <td>Annexure 6-Valve Schedule</td> </tr> <tr> <td></td> <td>Annexure 7- Instrument Datasheet, Hook-Up, Control Valve and ON-OFF Valve Inputs.</td> </tr> <tr> <td></td> <td>Annexure 8- Vent & Drain connection detail</td> </tr> <tr> <td></td> <td>Annexure 9- Price Bid Format for Fuel Gas Skids</td> </tr> <tr> <td></td> <td>Annexure 10- Checklist for Fuel Gas Skid</td> </tr> <tr> <td></td> <td>Annexure 11- Pre Bid Clarification</td> </tr> <tr> <td></td> <td>Annexure 12- Packing Details</td> </tr> <tr> <td></td> <td>Annexure 13- 2 Year Spares</td> </tr> <tr> <td></td> <td>Annexure 14- Mandatory Spares</td> </tr> <tr> <td></td> <td>Annexure 15- Master Documentation List</td> </tr> <tr> <td></td> <td>Annexure 16- Sub vendor List</td> </tr> <tr> <td></td> <td>Annexure 17- Painting Specification</td> </tr> <tr> <td></td> <td>Annexure 18- Deviation Format</td> </tr> <tr> <td></td> <td>Annexure 19- Typical Quality Assurance Plan</td> </tr> <tr> <td></td> <td>Annexure 20- Technical Details of Scrubber cum Filter Separator (Ramgarh Project)</td> </tr> </tbody> </table>				S. No.	DESCRIPTION	1.0	Intent of Specification		Project information	2.0	Special Instructions to Bidders	3.0	Job Specification	4.0	General Specification	5.0	Instrumentation	6.0	Skid and Layout	7.0	Testing and Inspection requirements	8.0	Painting Scheme	9.0	Storing, Handling , Packing and Dispatch of Equipment	10.0	Spares	11.0	Conflict in specification requirements	12.0	Drawings and Documents to be submitted during Detail Engineering.	13.0	Pre Bid clarifications and deviations	14.0	Sub vendor list		Annexure 1 – P&ID for Natural Gas System		Annexure 2 – Scrubber & Filter Separator datasheet		Annexure 3- Piping Material Specification(PMS)		Annexure 4-Fuel Gas Composition		Annexure 5- Valve Material Specification		Annexure 6-Valve Schedule		Annexure 7- Instrument Datasheet, Hook-Up, Control Valve and ON-OFF Valve Inputs.		Annexure 8- Vent & Drain connection detail		Annexure 9- Price Bid Format for Fuel Gas Skids		Annexure 10- Checklist for Fuel Gas Skid		Annexure 11- Pre Bid Clarification		Annexure 12- Packing Details		Annexure 13- 2 Year Spares		Annexure 14- Mandatory Spares		Annexure 15- Master Documentation List		Annexure 16- Sub vendor List		Annexure 17- Painting Specification		Annexure 18- Deviation Format		Annexure 19- Typical Quality Assurance Plan		Annexure 20- Technical Details of Scrubber cum Filter Separator (Ramgarh Project)
S. No.	DESCRIPTION																																																																										
1.0	Intent of Specification																																																																										
	Project information																																																																										
2.0	Special Instructions to Bidders																																																																										
3.0	Job Specification																																																																										
4.0	General Specification																																																																										
5.0	Instrumentation																																																																										
6.0	Skid and Layout																																																																										
7.0	Testing and Inspection requirements																																																																										
8.0	Painting Scheme																																																																										
9.0	Storing, Handling , Packing and Dispatch of Equipment																																																																										
10.0	Spares																																																																										
11.0	Conflict in specification requirements																																																																										
12.0	Drawings and Documents to be submitted during Detail Engineering.																																																																										
13.0	Pre Bid clarifications and deviations																																																																										
14.0	Sub vendor list																																																																										
	Annexure 1 – P&ID for Natural Gas System																																																																										
	Annexure 2 – Scrubber & Filter Separator datasheet																																																																										
	Annexure 3- Piping Material Specification(PMS)																																																																										
	Annexure 4-Fuel Gas Composition																																																																										
	Annexure 5- Valve Material Specification																																																																										
	Annexure 6-Valve Schedule																																																																										
	Annexure 7- Instrument Datasheet, Hook-Up, Control Valve and ON-OFF Valve Inputs.																																																																										
	Annexure 8- Vent & Drain connection detail																																																																										
	Annexure 9- Price Bid Format for Fuel Gas Skids																																																																										
	Annexure 10- Checklist for Fuel Gas Skid																																																																										
	Annexure 11- Pre Bid Clarification																																																																										
	Annexure 12- Packing Details																																																																										
	Annexure 13- 2 Year Spares																																																																										
	Annexure 14- Mandatory Spares																																																																										
	Annexure 15- Master Documentation List																																																																										
	Annexure 16- Sub vendor List																																																																										
	Annexure 17- Painting Specification																																																																										
	Annexure 18- Deviation Format																																																																										
	Annexure 19- Typical Quality Assurance Plan																																																																										
	Annexure 20- Technical Details of Scrubber cum Filter Separator (Ramgarh Project)																																																																										
Ref. Doc																																																																											

COPYRIGHT AND CONFIDENTIAL


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.

Form No.	 HYDERABAD	PRODUCT STANDARD PROJECT ENGINEERING & SYSTEMS DIVISION HYDERABAD-32	PY51702
			Rev No. 00
			Page 3 of 50
<div style="display: flex; justify-content: space-between;"> <div style="width: 15%;"> <p style="writing-mode: vertical-rl; transform: rotate(180deg);"> COPYRIGHT AND CONFIDENTIAL 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>1.0 INTENT OF SPECIFICATION</p> <p>1.1 The specification is intended to cover Design, Engineering, Fabrication, Assembly & Inspection and Testing at vendor's / sub-vendor's works, proper packing and forwarding, shipment & delivery at site of Gas Conditioning System(Scrubber cum Filter Separator Skid) as per the specifications and requirements indicated in different sections of this specification.</p> <p>1.2 Erection and Commissioning is not in the scope of bidder. However, bidder to furnish recommended Erection and Commissioning procedures along with all the drawing / documents required to facilitate Erection and Commissioning of the Skids by others.</p> <p>1.3 The contractor shall be responsible for providing all material, equipment & services required to ensure operability, maintainability, reliability and safety of the Gas Conditioning System as covered under this specification, irrespective of whether they have been specifically indicated in this specification or not.</p> <p>1.4 It is not the intent to specify herein all the details of design and manufacture. However, the equipment / system shall conform in all respects to high standards of design, engineering and workmanship and shall be capable of performing the required duties in a manner acceptable to purchaser who will interpret the meaning of drawings and specifications and shall be entitled to reject any work or material which in his judgement is not in full accordance herewith.</p> <p>1.5 The general terms and conditions, instructions to tenderer and other attachment referred to elsewhere are hereby made part of the tender specifications. The equipment / material and works covered by their specification are subject to all the attachments referred in the specification. The tenderer shall be responsible for adherence to all requirements stipulated herein.</p> <p>1.6 All text/ numeric in the document / drawings to be generated by the successful bidder will be in English language only.</p> <p>1.7 Unless specified otherwise, all through the specification, the word contractor shall have same meaning as successful bidder/vendor and customer /purchaser/ employer will mean BHEL as interpreted by BHEL in the relevant context.</p> </div> </div>			
Ref. Doc			

Form No.		PRODUCT STANDARD PROJECT ENGINEERING & SYSTEMS DIVISION HYDERABAD-32	PY51702																																																																														
			Rev No. 00																																																																														
			Page 4 of 50																																																																														
<p style="text-align: center;"><u>PROJECT INFORMATION</u></p> <table border="1"> <tr> <td></td> <td>Owner</td> <td>Indian Oil Corporation Ltd. PARADIP Refinery</td> </tr> <tr> <td>1.</td> <td>Project</td> <td>FUEL GAS CONVERSION PROJECT (GT#1, GT#2, GT#3)</td> </tr> <tr> <td>2.</td> <td>Owner's consultant</td> <td>--</td> </tr> <tr> <td>3.</td> <td>Location</td> <td>PARADIP, ODHISHA</td> </tr> <tr> <td>4.</td> <td>Nearest Airport</td> <td>Bhubaneswar</td> </tr> <tr> <td>5.</td> <td>Nearest Railway Station</td> <td>Mangalore</td> </tr> <tr> <td>6.</td> <td>Access to site</td> <td>Road / Rail / Air</td> </tr> <tr> <td>7.</td> <td>Coordinates</td> <td>Later</td> </tr> <tr> <td>8.</td> <td></td> <td>Later</td> </tr> <tr> <td>9.</td> <td>Maximum Ambient Air Temperature</td> <td>Later</td> </tr> <tr> <td>10.</td> <td>Minimum Ambient Air Temperature</td> <td>Later</td> </tr> <tr> <td>11.</td> <td>Dry Bulb Temperatures</td> <td>Later</td> </tr> <tr> <td>12.</td> <td>Highest recorded :</td> <td>Later</td> </tr> <tr> <td>13.</td> <td>Lowest recorded :</td> <td>Later</td> </tr> <tr> <td>14.</td> <td>Wet Bulb Temperatures</td> <td>Later</td> </tr> <tr> <td>15.</td> <td>Design AMB WBT</td> <td>Later</td> </tr> <tr> <td>16.</td> <td>Relative Humidity</td> <td>Later</td> </tr> <tr> <td>17.</td> <td>Design AMB Humidity</td> <td>Later</td> </tr> <tr> <td>18.</td> <td>Annual Mean</td> <td>Later</td> </tr> <tr> <td>19.</td> <td>Rainfall</td> <td>Later</td> </tr> <tr> <td>20.</td> <td>Annual Total</td> <td>Later</td> </tr> <tr> <td>21.</td> <td>Wind data</td> <td>Later</td> </tr> <tr> <td>22.</td> <td>Wind Speed</td> <td>Later</td> </tr> <tr> <td>23.</td> <td>Prevailing Wind Direction</td> <td>Later</td> </tr> <tr> <td>24.</td> <td>Wind Pressure</td> <td>Later</td> </tr> <tr> <td>25.</td> <td>Seismic coefficient</td> <td>Later</td> </tr> </table>					Owner	Indian Oil Corporation Ltd. PARADIP Refinery	1.	Project	FUEL GAS CONVERSION PROJECT (GT#1, GT#2, GT#3)	2.	Owner's consultant	--	3.	Location	PARADIP, ODHISHA	4.	Nearest Airport	Bhubaneswar	5.	Nearest Railway Station	Mangalore	6.	Access to site	Road / Rail / Air	7.	Coordinates	Later	8.		Later	9.	Maximum Ambient Air Temperature	Later	10.	Minimum Ambient Air Temperature	Later	11.	Dry Bulb Temperatures	Later	12.	Highest recorded :	Later	13.	Lowest recorded :	Later	14.	Wet Bulb Temperatures	Later	15.	Design AMB WBT	Later	16.	Relative Humidity	Later	17.	Design AMB Humidity	Later	18.	Annual Mean	Later	19.	Rainfall	Later	20.	Annual Total	Later	21.	Wind data	Later	22.	Wind Speed	Later	23.	Prevailing Wind Direction	Later	24.	Wind Pressure	Later	25.	Seismic coefficient	Later
	Owner	Indian Oil Corporation Ltd. PARADIP Refinery																																																																															
1.	Project	FUEL GAS CONVERSION PROJECT (GT#1, GT#2, GT#3)																																																																															
2.	Owner's consultant	--																																																																															
3.	Location	PARADIP, ODHISHA																																																																															
4.	Nearest Airport	Bhubaneswar																																																																															
5.	Nearest Railway Station	Mangalore																																																																															
6.	Access to site	Road / Rail / Air																																																																															
7.	Coordinates	Later																																																																															
8.		Later																																																																															
9.	Maximum Ambient Air Temperature	Later																																																																															
10.	Minimum Ambient Air Temperature	Later																																																																															
11.	Dry Bulb Temperatures	Later																																																																															
12.	Highest recorded :	Later																																																																															
13.	Lowest recorded :	Later																																																																															
14.	Wet Bulb Temperatures	Later																																																																															
15.	Design AMB WBT	Later																																																																															
16.	Relative Humidity	Later																																																																															
17.	Design AMB Humidity	Later																																																																															
18.	Annual Mean	Later																																																																															
19.	Rainfall	Later																																																																															
20.	Annual Total	Later																																																																															
21.	Wind data	Later																																																																															
22.	Wind Speed	Later																																																																															
23.	Prevailing Wind Direction	Later																																																																															
24.	Wind Pressure	Later																																																																															
25.	Seismic coefficient	Later																																																																															
Ref. Doc																																																																																	

COPYRIGHT AND CONFIDENTIAL

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.

Form No.		<div><div><div>बी एच ई एल</div><div></div><div>HYDERABAD</div></div></div>	<div>PRODUCT STANDARD</div> <div>PROJECT ENGINEERING & SYSTEMS DIVISION</div> <div>HYDERABAD-32</div>	PY51702
				Rev No. 00
				Page 5 of 50

COPYRIGHT AND CONFIDENTIAL

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.

2.0

SPECIAL INSTRUCTIONS TO BIDDERS

2.1

This specification shall be read in conjunction with all its Annexures. In case of any discrepancy arising between this specification & its Annexures, the most stringent of all (as determined by purchaser) shall be followed. Further, if a requirement in this specification or any of the enclosures, calls for a decision from the Purchaser, it shall be bidder's sole responsibility to clearly bring out/highlight the same distinctively in his pre-bid queries, so as to enable purchaser to furnish their decision/clarification. If such issues/requirements are not duly addressed by bidder during the pre-bid stage and if such issues/requirements are observed later during order execution stage, it shall be binding on the bidder to comply with the final decision made by the purchaser subsequently, without any cost, delivery, or any other commercial implications.

2.2

Any additional equipment, material, services etc., which are not specifically mentioned in this specification, but required to make the Gas Conditioning System complete in all respects, in accordance with the intent of this technical specification, contractual agreement, statutory requirements, relevant/applicable codes/standards, good engineering practices, and for safe and trouble-free operation, shall be deemed to be covered under the scope of this specification.

2.3

Any specific hardware/software/item/ etc. required as indicated in 2.2. Above but not listed elsewhere in this specification or its enclosures, shall be deemed to be included in the basic price quoted by the bidder. Also, all mounting hardware/accessories/fittings/conduits/etc. required for the Erection & Commissioning of the Gas Conditioning System shall be deemed to be included in the basic price quoted by the bidder. Bidder, at no point of time, shall be eligible to raise any extra claim in this regard.

2.4

The Bidder shall accept full responsibility for the completeness and for the reliable operation of Gas Conditioning System as a whole. These shall be executed on the basis of proven design principle. Standardization of equipment, materials etc. shall be employed in the design. Care shall be taken to ensure safe operation as well as simplicity of Erection & Commissioning of the Gas Conditioning System. Even though, the requirements are specified in detail to the extent possible, bidder to apply good engineering practices in the design, selection of equipment, manufacturing, procurement, transportation, fabrication, painting, inspection & testing, supervision of erection & commissioning of system etc., wherever same is not clearly spelt out.

2.5


By accepting the contract, the bidder shall be deemed to have accepted the obligation of supplying everything that is necessary for the purpose mentioned above, regardless of any omission in the specification or on the drawings for the fulfillment of complete main plant package.


2.6

Bidder to note that the Purchase Order for the Scope of supply shall be placed on lump sum fixed prices based as per tender specification requirements.
Bidder to further note that they shall not be permitted for any claim for additional commercial implication on any account during the detail engineering stage.

Ref.


Doc


	Form No.	 HYDERABAD	<p align="center">PRODUCT STANDARD</p> <p align="center">PROJECT ENGINEERING & SYSTEMS DIVISION</p> <p align="center">HYDERABAD-32</p>	<p align="center">PY51702</p> <p align="center">Rev No. 00</p> <p align="center">Page 6 of 50</p>
<p align="center">COPYRIGHT AND CONFIDENTIAL</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>2.7 Bidder shall quote strictly as per the scope of supply and requirements of this specification. Bidder offer shall be strictly as per these specification requirements. Unsolicited or Alternate offers from the bidders will not be entertained.</p> <p>2.8 In case bidder feels that it is necessary to exclude some components of scope of supply or some of the features of specification requirements due to any technical constraints, bidder shall bring the same to the notice of purchaser during pre-bid stage and take their prior approval before submission of their bid. All such clarifications required by the bidder shall be intimated to BHEL together as a single notice within a week of receipt of enquiry by bidder and clarifications on the same shall be obtained by the bidder from the purchaser. In case no such clarifications are sought during pre-bid stage, it will be assumed that bidder has no comments or observations on BHEL's specification and no deviations to the specifications will be taken by the bidder.</p> <p>2.9 Bidder to quote strictly as per BHEL's Price Bid format (Annexure-9). Failure to do shall make their offer liable for rejection. Any tampering/modification/change of the BHEL's price format is not allowed and is liable for rejection of bidders offer.</p> <p>2.10 In case Bidder is unable to offer due to any specific requirement of specification, Bidder shall bring out the same in their regret letter. Otherwise it will be considered that non participation by the bidder is attributable to reasons other than any specification requirements.</p> <p>2.11 Compliance with this specification shall not relieve the bidder of the responsibility of furnishing equipment and accessories/auxiliaries of proper design, materials and workmanship to meet the specified start up and operating conditions.</p> <p>2.12 The design information, specifications and drawings indicate the "Minimum" requirements and are intended to enable Bidders to ascertain the extent of the work involved. Bidders are expected to supplement the 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 end Customer based on civil inputs furnished by the bidder during detail engineering. In case of any changes in the civil input drawing after civil work</p>	
	Ref. Doc			


Form No.		PRODUCT STANDARD PROJECT ENGINEERING & SYSTEMS DIVISION HYDERABAD-32	PY51702
			Rev No. 00
			Page 7 of 50
Ref. Doc	is completed, necessary prices on account of modification of the civil work shall be deducted from bidder's account.		
	<p>3.0 <u>JOB SPECIFICATION:</u></p> <p>This job specification gives details specific to the project, which have to be integrated with the general requirements indicated in General Specification.</p> <p>3.1 SCOPE OF SUPPLY:</p> <p>The fuel conditioning system shall be capable of providing clean, dry fuel gas as acceptable to the Gas Turbine's fuel gas quality requirements. The system shall be capable of providing the required quantity under the maximum fuel consumption condition without affecting the operation and efficiency of the fuel gas conditioning system. The scope of supply shall be for supply of three (03) numbers of Gas Conditioning Skids(Scrubber cum Filter Separator Skids) for commissioning of Gas Turbines with natural gas a fuel.</p> <p>3.1.1 MAIN OFFER:</p> <p>A. IOCL Paradip Fuel Gas Conversion Project: 3 No. of Scrubber (1X100%) cum Filter Separator (2X100%) skids required.</p> <p>Scope of Supply for Scrubber cum Filter Separator Skid:</p> <ol style="list-style-type: none"> The scope of supply shall be strictly as per P & ID enclosed as Annexure-1 wherein skid boundaries are clearly marked. The system shall be provided as per P&ID which includes equipment, piping & valves, supports, instruments, cables from instruments up to junction box, cable trays, junction box, cable glands, etc., taking into consideration the corresponding specific/standard requirements as specified in this Job specification as well as specified elsewhere in this specification. Counter flanges: Counter flanges at all terminal points along with bolts, nuts and gaskets are in the scope of bidder. Foundation bolts: Foundation bolts for skids along with shims (if required), are in the scope of bidder. Commissioning spares: Commissioning Spares shall be provided as per Annexure-9. Mandatory Spares: Mandatory Spares shall be quoted for the items as per the list furnished in Annexure-14. <p>B. Detail of RVUNL Ramgarh Skid Issues to Successful Bidder:</p> <p>1 No. of Scrubber(1X100%) cum filter separator(2X100%) skid is issued to successful bidder. The following details of the skid are provided in the specification and its annexures:</p>		

COPYRIGHT AND CONFIDENTIAL

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.

Form No.	 HYDERABAD	PRODUCT STANDARD PROJECT ENGINEERING & SYSTEMS DIVISION HYDERABAD-32	PY51702
			Rev No. 00
			Page 8 of 50
Ref. Doc		<div> <div> COPYRIGHT AND CONFIDENTIAL 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> <ol style="list-style-type: none"> P&ID and GAD (with technical details) of Scrubber cum filter separator is enclosed as Annexure-20. Major BoQ of skid consists of the following equipment/ components/ accessories: <ol style="list-style-type: none"> Scrubber, filter separator vessel Drain pot of filter separator Piping and its fittings Multicyclones in scrubber vessel Filter elements and vane pack assembly in filter separator vessel Manual Ball, gate, globe and NRV valves. Pneumatic ON-Off valves Pneumatic Operated Control Valves Safety Valves Local Gauge Board Instrumentation like PG, LG, LT, DPT, DPG. Flame Proof Junction Boxes Cable Trays and cables Scrubber cum filter separator is located at Factory of BHEL-Ramachandrapuram, Hyderabad, Telangana State. The skid shall be handed over to L1 Bidder in, as it is condition at BHEL works. Freight and transit insurance from BHEL works to L1 bidder's works is in bidders scope. Bidder shall visit BHEL works to assess the skid and its components before submission of techno commercial offer. After assessment of the skid, bidder may use the useful components from the skid and supply the new 3 Nos of scrubber(1X100%) cum filter separator(2X100%) skids for IOCL Paradip fuel gas conversion project as per this specification and its annexures. <p>3.1.2 OPTIONAL ITEMS:</p> <p>a) 2-years operational spares: Unit rates for 2 years operational spares shall be quoted for the items as per the list furnished in Annexure-13.</p> <p>b) Per Diem Rates for “Supervision of Erection and commissioning” to be quoted for the following:</p> <p>3.2 TECHNICAL DETAILS:</p> <p>3.2.1 Location of Gas Conditioning System:</p> <p>Outdoor with shed, sides open <input type="checkbox"/></p> <p>Outdoor without shed <input checked="" type="checkbox"/></p> <p>3.2.2 Fuel Gas Properties:</p> </div> </div>	

Form No.	 HYDERABAD	PRODUCT STANDARD PROJECT ENGINEERING & SYSTEMS DIVISION HYDERABAD-32	PY51702	
			Rev No. 00	
			Page 9 of 50	
COPYRIGHT AND CONFIDENTIAL 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.	Fuel Gas Specification: Enclosed as Annexure – 4			
	3.2.3 System Operating- Design parameters: The minimum, normal, maximum, mechanical design parameters of pressure, temperature and flow at various stages of system are indicated in the P&ID enclosed as Annexure –1 for consideration of the same in the selection /design of the equipment.			
	3.2.4 Main equipment isolation valves: Main equipment isolation valves shall be full bore trunnion mounted ball valves as indicated in the P&ID .			
	3.2.5 Corrosion Allowance: As indicated in General Spec or elsewhere <input checked="" type="checkbox"/> Any other <input type="checkbox"/>			
	3.2.6 Non Destructive Testing for Pressure Vessels: As indicated in General Spec or elsewhere <input checked="" type="checkbox"/> Any other <input type="checkbox"/>			
	3.2.7 NACE Material: Applicable <input type="checkbox"/> Not Applicable <input checked="" type="checkbox"/>			
	3.2.8 Type of Level Control Valve on Filter Separator/Fine Filter 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 Vent valves/ Level Control Valve on Scrubber and vent valve on Filter Separator/Fine Filter skid in line with P&ID (Enclosure-I): Ball Type <input checked="" type="checkbox"/> Globe Type <input type="checkbox"/>			
	Ref. Doc			

Form No.	 HYDERABAD	PRODUCT STANDARD PROJECT ENGINEERING & SYSTEMS DIVISION HYDERABAD-32	PY51702
			Rev No. 00
			Page 10 of 50

COPYRIGHT AND CONFIDENTIAL

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.

Not applicable ☐

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

Conventional pressure reduction station ☐

Active monitoring control system ☐

Not applicable ☒

3.2.11 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 ² (abs)			
P2, Kg/Cm ² (abs)			
DP(P1-P2)			
Cv			
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.

3.2.12 CV value to be considered for Level Control Valves: 0.63
(LCV on Filter Separator)

3.2.13 CV value to be considered for on/off solenoid operated Valves (1"): 0.63
(On/off valve on Scrubber skid, filter separator skid, fine filter skid)


3.2.14 Insulation cleats as required, to be provided for the following equipment to support insulation:


Scrubber skid ☒


Filter separator skid ☒


Not Applicable ☐


Ref.
Doc


Form No.	 HYDERABAD	PRODUCT STANDARD PROJECT ENGINEERING & SYSTEMS DIVISION HYDERABAD-32	PY51702
			Rev No. 00
			Page 11 of 50
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>3.2.15 Insulation to be provided for the following equipment:</p> <p>Scrubber/ F/s skid <input type="checkbox"/></p> <p>Filter separator skid <input type="checkbox"/></p> <p>Not Applicable <input checked="" type="checkbox"/></p> <p>Note: Only cleats shall be provided by bidder. However, supply of insulation material is excluded from bidder scope of supply.</p> <p>3.2.16 Electrical Hazardous Area Classification to be considered for applicable instruments/equipment on the Gas Conditioning System:</p> <p>Group IIA, IIB as per IS 2148 <input checked="" type="checkbox"/></p> <p>Group IIA, IIB & IIC as per IS 2148 <input type="checkbox"/> (as the fuel gas contains appreciable amount of Hydrogen)</p> <p>3.2.17 FRP Canopy to be provided for following:</p> <p>Transmitters (PT,DPT, LT etc) <input checked="" type="checkbox"/></p> <p>Positioners <input checked="" type="checkbox"/></p> <p>Solenoid Valve <input checked="" type="checkbox"/></p> <ul style="list-style-type: none"> FRP canopy design shall be UV Resistant Type. FRP canopy drawing need to be approved by BHEL. Canopy to cover the instrument from all sides with a front window & openable shutter for terminal side (for Transmitters) & with a front openable shutter for junction Boxes. All canopy drawings & arrangements shall be furnished for review & approval. <p>3.2.18 Mounting arrangement of Filter Separator/Fine Filter</p> <p>Horizontal <input checked="" type="checkbox"/></p> <p>Vertical <input type="checkbox"/></p> <p>3.2.19 Bolts and Studnuts for Valves, Piping Flanges and Vessels:</p> <p>(i).All bolts and studnuts require for valves, piping flanges and vessels shall be of M.S with galvanized.</p> <p>(ii).All bolts used for the mounting of Instruments & junction Boxes shall be of M.S with Galvanised.</p>	
Ref. Doc			


Form No.		PRODUCT STANDARD PROJECT ENGINEERING & SYSTEMS DIVISION HYDERABAD-32	PY51702
			Rev No. 00
			Page 12 of 50
COPYRIGHT AND CONFIDENTIAL 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.	3.2.20 Performance of Equipment A) Performance of Scrubber: Liquid removal efficiency: 10 microns & larger: 100% Solids Removal efficiency: 8 microns & larger: 100% 6 - 8 microns: 99% 4 - 6 microns: 90% 2-4 microns: 85% Turn Down: 4:1 B) Performance of Filter Separator: <u>Liquid removal efficiency</u> 8 microns and larger – 100% 0.5 to 8 microns – 99.5% <u>Solid removal efficiency</u> 3 microns and larger - 100% 0.5 - 3 microns - 99.5% Turndown - 100% C) Performance of Fine Filter: <u>Liquid removal efficiency</u> 8 microns and larger – 100% For droplets smaller than 3 microns: – 99.98% <u>Solid removal efficiency</u> 3 microns and larger - 100% 0.5 - 3 microns - 99.5% Turndown - 100% The clean pressure drop across scrubber skid shall be $\leq 0.2 \text{ kg/cm}^2$ and filter separator skid shall be $\leq 0.2 \text{ kg/cm}^2$ 3.2.21 Sub vendors for Filters of Filter Separator/Fine Filter: Sub vendors for Filters of Filter Separator/Fine Filter shall be from Pall/Burgess Manning/Peco/Vannair/Forain/Multitex only. 3.2.22 Field Instruments:		
	Ref. Doc		


Form No.	 HYDERABAD	PRODUCT STANDARD PROJECT ENGINEERING & SYSTEMS DIVISION HYDERABAD-32	PY51702	
			Rev No. 00	
			Page 13 of 50	
COPYRIGHT AND CONFIDENTIAL 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.	Applicable <input checked="" type="checkbox"/> Not Applicable <input type="checkbox"/>			
	3.2.23 Flame Arrestor Applicable <input type="checkbox"/> Not Applicable <input checked="" type="checkbox"/>			
	3.2.22 Liquid Hold up capacity & Dia. of Scrubber Vessel <p>A five minute liquid hold up time shall be provided with three minute for normal control & two minutes extra time for operator intervention in emergencies.</p> <p>However, the minimum liquid height of 350 mm shall be considered. Further Height & diameter shall be as per process requirement. Vendor to provide basis of selection for it.</p>			
	3.2.23 Packing Details: <p>The material shall be packed as per Annexure-12.</p>			
	3.2.24 Power Supply for Solenoid Valves: <div style="display: flex; justify-content: space-between;"> <div> 24 V DC 120 V DC 230 V DC </div> <div> <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> </div> </div>			
	3.2.25 Type of Solenoid Valves: <div style="display: flex; justify-content: space-between;"> <div> Intrinsic safe Explosion proof </div> <div> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> </div> </div>			
	3.2.26 Limit switch type: <div style="display: flex; justify-content: space-between;"> <div> Proximity type Mechanical Type </div> <div> <input checked="" type="checkbox"/> <input type="checkbox"/> </div> </div>			
	3.2.27 Power Supply for Transmitters: <div style="display: flex; justify-content: space-between;"> <div> 24 V DC (Loop powered, 2 wire) 110 V DC 220 AC </div> <div> <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> </div> </div>			
	Ref. Doc			

Form No.	 HYDERABAD	PRODUCT STANDARD PROJECT ENGINEERING & SYSTEMS DIVISION HYDERABAD-32	PY51702												
			Rev No. 00												
			Page 14 of 50												
Ref. Doc	<p>3.2.28</p> <p>a. Project Specific Sub vendors to be followed by bidder</p> <p>As per list enclosed as Annexure-16 Any item not specifically covered in the approved list of vendors shall be sourced from the current approved vendors of BHEL"</p> <p>This is to cover bulk items of piping like pipes, fittings, flanges, gaskets, valves, fasteners etc. <input checked="" type="checkbox"/></p> <p>b. Price bid format:</p> <p>As per Annexure-9 <input checked="" type="checkbox"/></p> <p>c. Inspection Agency:</p> <p>BHEL/ Third party appointed by BHEL <input checked="" type="checkbox"/></p> <p>d. Instrument Air:</p> <p>Availability of Instrument air at skid terminal point:</p> <table> <tr> <td>Normal</td> <td>:</td> <td>6 Kg/cm² (g)</td> </tr> <tr> <td>Minimum</td> <td>:</td> <td>6 Kg/cm² (g)</td> </tr> <tr> <td>Maximum</td> <td>:</td> <td>7 Kg/cm² (g)</td> </tr> <tr> <td>Mech. Design</td> <td>:</td> <td>10 kg/cm² (g).</td> </tr> </table> <p>e. Back pressure of safety valves:</p> <p>Atmospheric <input type="checkbox"/></p> <p>As indicated in the P&ID <input checked="" type="checkbox"/></p> <p>Any other details to be indicated [1.7 kg/cm² (g)] <input type="checkbox"/></p> <p>f. Project Specific Piping Material Specification to be followed by bidder:</p> <p>As per list enclosed as Annexure-3.</p> <p>g. Type of Level Transmitters:</p> <p>Guided Wave Radar type for all skids <input checked="" type="checkbox"/></p> <p>Torque tube type <input type="checkbox"/></p>			Normal	:	6 Kg/cm ² (g)	Minimum	:	6 Kg/cm ² (g)	Maximum	:	7 Kg/cm ² (g)	Mech. Design	:	10 kg/cm ² (g).
	Normal	:	6 Kg/cm ² (g)												
Minimum	:	6 Kg/cm ² (g)													
Maximum	:	7 Kg/cm ² (g)													
Mech. Design	:	10 kg/cm ² (g).													
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.															


Form No.		PRODUCT STANDARD PROJECT ENGINEERING & SYSTEMS DIVISION HYDERABAD-32	PY51702
			Rev No. 00
			Page 15 of 50
<div style="display: flex; justify-content: space-between;"> <div style="width: 15%;"> <p style="writing-mode: vertical-rl; transform: rotate(180deg);"> COPYRIGHT AND CONFIDENTIAL 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> h. Type of Canopy for all electrical/electronic instruments: </p> <p> FRP canopy for electrical/electronic instruments <input checked="" type="checkbox"/> </p> <p> Conventional Mechanical type <input type="checkbox"/> </p> <p> i. Hook up for instruments: Refer Annexure-7 </p> <p> Prefabricated Close Coupled Hook Up <input type="checkbox"/> </p> <p> As Prefabricated Close coupled hook ups are envisaged for this project, the first isolation valves are also part of hook-up assembly. </p> <p> j. Check list to be furnished along with the offer: </p> <p> Bidders are requested to fill and furnish the check list for the offer, Enclosed as Annexure-10. </p> <p> 4 GENERAL SPECIFICATION: </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> 4.1 APPLICATION: </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> <p> 4.2 SCOPE OF SUPPLY: </p> <p> Scope of supply of the system shall be as indicated in the job specification. </p> <p> 4.3 CODES AND STANDARDS: </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> </div> </div>			
Ref. Doc			

	Form No.		<p align="center">PRODUCT STANDARD</p> <p align="center">PROJECT ENGINEERING & SYSTEMS DIVISION</p> <p align="center">HYDERABAD-32</p>	<p>PY51702</p> <p>Rev No. 00</p> <p>Page 16 of 50</p>
<p align="center">COPYRIGHT AND CONFIDENTIAL</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>4.4 TECHNICAL REQUIREMENTS FOR EQUIPMENTS/VESSELS:</p> <p>Technical Requirements of Gas Conditioning System is as given below:</p> <p>4.4.1 For</p> <ul style="list-style-type: none"> (a) Project Details, (b) Site Data, (c) Fuel Gas properties, (d) System operating - Design Parameters of system, <p>Please refer applicable Annexures.</p> <p>4.4.2 Corrosion allowance :</p> <p>3 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>4.4.3 NACE Compliance :</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>4.4.4 Statutory Approvals:</p> <p>All statutory approvals for the design, manufacture & 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> <p>4.4.5 Description of the Gas Conditioning System:</p> <p>The Gas Conditioning system will basically consist of the following components, namely:</p> <ul style="list-style-type: none"> (1) Emergency shutdown (ESD) valves (2) Pressure Control Station(s) (3) Multi cyclone scrubber(s) (4) Filter separator(s) (5) Fuel Gas Condensate Drain system (6) Fuel Gas vent system (7) Inter connecting Piping (8) Instrumentation 		
Ref.	Doc			


Form No.		PRODUCT STANDARD PROJECT ENGINEERING & SYSTEMS DIVISION HYDERABAD-32	PY51702
			Rev No. 00
			Page 17 of 50
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>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 P&ID 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 P&ID. Hence, the system need to be provided strictly as per the P&I D enclosed with the job specification.</p> <p>4.4.6 Emergency Shut Down Valves (ESD valves):</p> <ul style="list-style-type: none"> (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 P&I D. (ii) The emergency shutdown valves can be of Ball type or Globe type. The relevant applicable type is as per P & ID. (iii) The Ball Type emergency shutdown valve shall be as per the relevant data sheet as part of Annexure-7: Instrument Data sheets. (iv) The Globe Type emergency shutdown valve shall be as per the relevant data sheet as part of Annexure-7:- Instrument Data sheets. <p>4.4.7 Pressure Reducing Station:</p> <ul style="list-style-type: none"> (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. (ii) The pressure reducing station can be one of the following types. <ul style="list-style-type: none"> (a) Conventional Pressure Reducing Station (b) Active Monitoring Type Pressure Reducing Station <p>The relevant applicable type is as per the P&I D enclosed.</p> <p>(a) Conventional Pressure Reducing Station:</p> <ul style="list-style-type: none"> (i) Conventional Pressure Reducing Station consists of globe type control valves. 	
Ref. Doc			


	Form No.		<p align="center">PRODUCT STANDARD</p> <p align="center">PROJECT ENGINEERING & SYSTEMS DIVISION</p> <p align="center">HYDERABAD-32</p>	<p>PY51702</p> <p>Rev No. 00</p> <p>Page 18 of 50</p>
<p align="center">COPYRIGHT AND CONFIDENTIAL</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>(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-9: Instrument Data sheets.</p> <p>(b) Active Monitoring Type Pressure Reducing Station:</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 & 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> <p>4.4.8 Multi Cyclone Scrubber:</p> <p>a) Vertical dry gas scrubber with multi-cyclone design shall be provided.</p> <p>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.</p> <p>c) Scrubber vessel shall be designed & constructed as a pressure vessel as per clause 4.5.0 of this specification – “Design Basis for Pressure Vessels”.</p> <p>d) Scrubber vessel and its internal components shall be essentially maintenance free for continuous unattended operation.</p>	
Ref. Doc				

<div>Form No.</div>		<div><div><div>बी एच ई एल</div><div>BHEL</div><div>HYDERABAD</div></div></div>	<div>PRODUCT STANDARD</div> <div>PROJECT ENGINEERING & SYSTEMS DIVISION</div> <div>HYDERABAD-32</div>		<div>PY51702</div>
					<div>Rev No. 00</div>
					<div>Page 19 of 50</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>e)</div><div>The unit shall have a fabricated steel skirt ring to allow erection on a steel skid.</div></div>			
		<div><div>f)</div><div>The scrubber shall be complete with all Vents, Drains, Instrumentation provisions, Inspection & Maintenance holes etc. as shown in the P&I D.</div></div>			
		<div><div>g)</div><div>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. In case different inlet nozzle is required due to design requirement of vessel, vendor to bring out same with justification.</div></div>			
		<div><div>h)</div><div>Required Insulation cleats to be provided for the heater to support insulation, if applicable as indicated in the Job Specification.</div></div>			
		<div><div>i)</div><div>A five minute liquid hold up time shall be provided with three minute for normal control & two minutes extra time for operator intervention in emergencies.</div><div>However, the minimum liquid height of 350 mm shall be considered.</div></div>			
		<div><div>j)</div><div>Further Height & diameter shall be as per process requirement. Vendor to provide basis of selection for it.</div></div>			
		<div><div>k)</div><div>The cyclones shall be of SS 316 L materials. The scrubber body materials shall be of CS/SS as per P&I D and in line with corresponding material requirements specified vide clause 4.5.0 of this specification – “Design Basis for Pressure Vessels”.</div></div>			
		<div><div>l)</div><div>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 job specification / P&ID.</div></div>			
		<div><div><div>(i)</div><div>The normal pressure drop across scrubber skid shall be ≤ 0.2 kg/cm².</div></div></div>			
		<div><div><div>(ii)</div><div><div>Liquid removal efficiency</div><div><div><div>10 microns and larger</div><div>– 100%</div></div><div><div>Solid removal efficiency</div><div><div>8 micron and larger</div><div>- 100%</div></div><div><div>6-8 micron and larger</div><div>- 99%</div></div><div><div>4-6 micron and larger</div><div>- 90%</div></div><div><div>2-4 micron and larger</div><div>- 85%</div></div></div></div></div></div></div>			
<div>Ref.</div>	<div>Doc</div>				

	Form No.	 HYDERABAD	<p align="center">PRODUCT STANDARD</p> <p align="center">PROJECT ENGINEERING & SYSTEMS DIVISION</p> <p align="center">HYDERABAD-32</p>	<p>PY51702</p> <p>Rev No. 00</p> <p>Page 20 of 50</p>
<p align="center">COPYRIGHT AND CONFIDENTIAL</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 align="center">Turndown - 4:1</p> <p>m) A format for 'Scrubber Data Sheet' is enclosed as Annexure-2, for vendor's compliance as a part of Documentation.</p> <p>4.4.9 Filter Separators/Fine Filter :</p> <p>a) Filter Separator units are normally provided downstream of scrubber for fine filtration of fuel gas.</p> <p>b) The filter separator units shall be of horizontal type / vertical type as indicated in P&ID.</p> <p>c) Filter separator shall be designed & constructed as a pressure vessel., as per the clause 4.5.0 of this specification – "Design Basis for Pressure Vessels".</p> <p>d) The filter separator will have 2-stage filtration.</p> <p>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. The liquid particles will get agglomerated and will be carried on to second stage for further removal.</p> <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>e) Filter separator shall be complete with all Vents, Drains, Controls, Inspection & Maintenance holes etc. as shown in the P & I D.</p> <p>f) 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. In case different size of inlet/ outlet nozzle is required due to design requirement of vessel vendor to bring out same with justification.</p> <p>g) Filter separator shall be provided with suitable davit Assembly for ease of replacement of elements.</p> <p>h) Required Insulation cleats to be provided for the heater to support insulation, if applicable as indicated in the Job Specification.</p>		
Ref.	Doc			

<div>Form No.</div>		<div><div><div>बी एच ई एल</div><div>BHEL</div><div>HYDERABAD</div></div></div>	<div>PRODUCT STANDARD</div> <div>PROJECT ENGINEERING & SYSTEMS DIVISION</div> <div>HYDERABAD-32</div>		<div>PY51702</div>
					<div>Rev No. 00</div>
					<div>Page 21 of 50</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>i)</div><div>The filter separator body materials shall be CS/SS as per P&I D and in line with material requirements specified vide clause 4.5.0of this specification – “Design Basis for Pressure Vessels”.</div></div><div><div>j)</div><div>The combined efficiency of the filter separator [both stages together] shall be as given below:<div><div>i.</div><div>The clean pressure drop across filter separator shall be ≤0.2 kg/cm²</div></div></div></div></div>			
		<div><div><div>For Filter Separator:</div><div>Liquid removal efficiency<div><div>8 microns and larger</div><div>– 100%</div></div><div><div>0.5 to 8 microns</div><div>– 99.5%</div></div></div><div>Solid removal efficiency<div><div>3 microns and larger</div><div>- 100%</div></div><div><div>0.5 to 3 microns</div><div>- 99.5%</div></div><div><div>Turndown</div><div>- 100%</div></div></div><div><div>For Fine Filter Separator:</div><div>Liquid removal efficiency<div><div>8 microns and larger</div><div>– 100%</div></div><div><div>For droplets smaller than 3 microns:</div><div>– 99.98%</div></div></div><div>Solid removal efficiency<div><div>3 microns and larger</div><div>- 100%</div></div><div><div>0.5 to 3 microns</div><div>- 99.5%</div></div><div><div>Turndown</div><div>- 100%</div></div></div></div><div><div>k)</div><div>A format for ‘Filter Separator Data Sheet’ and Fine Filter Separator Data Sheet is enclosed as Annexure-2, for vendor’s compliance as a part of Documentation.</div></div></div></div>			
<div>4.5.0 DESIGN BASIS FOR PRESSURE VESSELS:</div>					
<div>4.5.1 Applicable standards:</div>					
<div><div><div>(i)</div><div>Vessels with design pr of 1.0 kg/cm² (g) and above, and less than 210 Kg/Cm² (g) shall be designed, fabricated inspected and tested as per ASME Sec. VIII Div.1.</div></div><div><div>(ii)</div><div>Vessels full of liquid and/or with design pressure, ≤1.0 Kg/cm² (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.</div></div></div>					
<div>4.5.2 Materials:</div>					
<div>Ref.</div>	<div>Doc</div>				


Form No.	 HYDERABAD	PRODUCT STANDARD PROJECT ENGINEERING & SYSTEMS DIVISION HYDERABAD-32				PY51702																																														
						Rev No. 00																																														
						Page 22 of 50																																														
<div style="display: flex; justify-content: space-between;"> <div style="width: 15%;"> <p style="writing-mode: vertical-rl; transform: rotate(180deg);"> COPYRIGHT AND CONFIDENTIAL 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>(i) Materials to be used shall conform to :</p> <p>(a) ASME Section II</p> <p>(b) Indian Standard Specification of equivalent grade</p> <p>The following table gives general guidelines for material selection for various pressure Parts / Non pressure parts of the equipment.</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th rowspan="2">Design Temp, Deg. C</th> <th colspan="4">Pressure Parts</th> <th colspan="3">Non-Pressure Parts</th> </tr> <tr> <th>Plate</th> <th>Pipe (see Note-1)</th> <th>Forging</th> <th>Bolts/Studs/Nuts (External)</th> <th>Structural attachment welded to pressure parts</th> <th>Internal pipes/ plates</th> <th>Bolts/Studs/Nuts (Internal)</th> </tr> </thead> <tbody> <tr> <td rowspan="2">Above (-) 29 to 0 Deg. C</td> <td>SA 516 (all grades) – see Note-2</td> <td>SA 106 Gr. B – see Note-2</td> <td>SA 105/ SA 286 – see Note-2</td> <td>SA 193 Gr. B7 / SA 194 Gr. 2 H</td> <td>SA 516 (all grades)</td> <td>SA 106 Gr. B</td> <td>SA 193 Gr. B8/ SA 194 Gr. 8</td> </tr> <tr> <td>SA 240 type 304 – see Note-2</td> <td>SA 312 TP, 321 ,</td> <td>SA 182 F 304</td> <td>SA 193 Gr. B7 / SA 194 Gr. 2 H</td> <td>Same as pressure parts</td> <td>Same as pressure parts</td> <td>SA 193 Gr. B8/ SA 194 Gr. 8</td> </tr> <tr> <td rowspan="2">Above 0 to 343 Deg. C</td> <td>SA 516 (all grades)</td> <td>SA 106 Gr. B</td> <td>SA 105/ SA 286</td> <td>SA 193 Gr. B7 / SA 194 Gr. 2 H</td> <td>a) 2062 plates up to 300 Deg. C b) Same as pressure parts for above 300 Deg. C</td> <td>SA 106 Gr. B</td> <td>SA 193 Gr. B8/ SA 194 Gr. 8</td> </tr> <tr> <td>SA 240 type 304 –</td> <td>SA 312 TP, 321 ,</td> <td>SA 182 F 304</td> <td>SA 193 Gr. B7 / SA 194 Gr. 2 H</td> <td>Same as pressure parts</td> <td>Same as pressure parts</td> <td>SA 193 Gr. B8/ SA 194 Gr. 8</td> </tr> </tbody> </table> </div> </div>								Design Temp, Deg. C	Pressure Parts				Non-Pressure Parts			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 grades) – 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 Note-2	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	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 pressure parts	SA 193 Gr. B8/ SA 194 Gr. 8
Design Temp, Deg. C	Pressure Parts				Non-Pressure Parts																																															
	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 grades) – 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 Note-2	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																																													
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 pressure parts	SA 193 Gr. B8/ SA 194 Gr. 8																																													
Ref. Doc																																																				


	Form No.		<p align="center">PRODUCT STANDARD</p> <p align="center">PROJECT ENGINEERING & SYSTEMS DIVISION</p> <p align="center">HYDERABAD-32</p>	<p>PY51702</p> <p>Rev No. 00</p> <p>Page 23 of 50</p>
<p align="center">COPYRIGHT AND CONFIDENTIAL</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>NOTES:-</p> <ol style="list-style-type: none"> 1. All pipes shall be of seamless construction. 2. Check for impact testing requirement as per UCS – 66 for coincident temperature and part thickness. <p>4.5.3 Minimum Wall thickness:</p> <p>(i) For Carbon and alloy steels:</p> <p>(a) The Minimum wall thickness shall be calculated as per code. However same shall be cross checked as follows :</p> <p>Minimum wall thickness – 6 mm (including corrosion allowance), but not less than calculated as follows:</p> <p>(1) FOR DIA LESS THAN 2400 MM</p> <p>Wall thk = (Dia /1000) + 1.5 + CA</p> <p>(2) FOR DIA 2400 MM AND ABOVE</p> <p>Wall thk = (Dia /1000) + 2.5 + CA</p> <p>All dimensions are in mm.</p> <p>(ii) For Stainless steels:</p> <p>(a) 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>4.5.4 Corrosion Allowance:</p> <p>(i) Minimum corrosion allowance shall be 3 mm, unless otherwise specified. Same is not applicable for stainless steel material.</p>		
Ref.	Doc			


Ref. Doc	Form No.	<div><div>बी एच ई एल</div><div>BHEL</div><div>HYDERABAD</div></div>	<div>PRODUCT STANDARD</div> <div>PROJECT ENGINEERING & SYSTEMS DIVISION</div> <div>HYDERABAD-32</div>	PY51702
				Rev No. 00
				Page 24 of 50
<div>4.5.5 Specification of Plate Materials:</div> <div><div>(i) Carbon Steel Plates:</div><div>A) Chemical Analysis:<div><div>(a) Plates used shall conform to latest issue of SA-20 with additional requirements mentioned herein.</div><div>(b) Only normalized plates free from injurious defects with workmanlike finish shall be used. Reconditioning / repair of plates by welding shall not be permitted.</div><div>(c) 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%.</div><div>(d) Additionally, any of the following requirements for carbon equivalents (Ceq.) based on heat analysis shall be satisfied:<div><div><div>$Ceq = C + Mn/6 \leq 0.42$</div><div>----</div><div>(1)</div></div><div>$Ceq = C + MN/6 + (CR+Mo+V)/5 + (Cu + Ni)/15 \leq 0.43$</div><div>---</div><div>(2)</div></div><div>Eq. 1 shall be used when applicable material specify C and Mn only.</div><div>Eq. 2 is applicable for restricted chemistry requirements or for supplementary requirements of S19 & S21of specification SA-20.</div></div></div><div>B) Ultrasonic examination of plates<div><div>(a) Plates having thickness 16 mm to 50 mm (both inclusive) shall be examined ultrasonically as per specification SA-435.</div><div>(b) For quenched and tempered plates, ultrasonic examination shall be carried out after the specified heat treatment.</div><div>(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.</div><div>(d) Plates needed for IBR vessels shall meet the requirements of IBR.</div></div></div></div><div>(ii) Stainless Steel Plates/Pipes/Fittings:</div><div>A) Chemical Analysis:<div><div>(a) All plates shall be hot rolled, annealed, pickled and shall have no.1 finish on both sides with reference to specification SA-480.</div></div></div></div>				


COPYRIGHT AND CONFIDENTIAL


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.


	Form No.		<p align="center">PRODUCT STANDARD</p> <p align="center">PROJECT ENGINEERING & SYSTEMS DIVISION</p> <p align="center">HYDERABAD-32</p>	<p>PY51702</p> <p>Rev No. 00</p> <p>Page 25 of 50</p>
<p align="center">COPYRIGHT AND CONFIDENTIAL</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) 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>4.5.6 Heads:</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> <p>(i) Specifically called or particular equipment/service</p> <p>(ii) Hardness value after forming exceeds 235 BHN</p> <p>(iii) Nominal thickness of plate is 16 mm or above.</p> <p>c) Hot formed dished ends of SS vessels shall be solution annealed.</p> <p>4.5.7 Manholes, Handholes and nozzles:</p> <p>(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.</p> <p>(b) Manhole cover shall be provided with a davit or hinge.</p> <p>(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.</p> <p>(d) For vessels with diameter less than 900 mm and having removable internals, shell flanges shall be provided.</p> <p>(e) As a general rule all nozzles attachment to shell/head shall be set in type.</p> <p>(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.</p>		
Ref.	Doc			

	Form No.		<p align="center">PRODUCT STANDARD</p> <p align="center">PROJECT ENGINEERING & SYSTEMS DIVISION</p> <p align="center">HYDERABAD-32</p>	<p>PY51702</p> <p>Rev No. 00</p> <p>Page 26 of 50</p>
<p align="center">COPYRIGHT AND CONFIDENTIAL</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>(g) All vessel nozzles shall be welded to the vessel. Screwed connections into the vessel are not acceptable.</p> <p>4.5.8 Flanges:</p> <p>(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).</p> <p>(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.</p> <p>(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.</p> <p>(d) All flanges above class 150 shall be WN type.</p> <p>(e) All flanges of class 900 and above shall have gasket surfaces for RTJ.</p> <p>(f) All flanges shall be of raised face type with serrated finish unless specified otherwise. Plate flanges are not acceptable.</p> <p>4.5.9 Inspection:</p> <p>(a) All vessels shall be offered for stage-wise as well as for final inspection in line with approved QAP.</p> <p>4.5.10 Pressure Testing:</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>4.5.11 Welding:</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>(c) All root runs / Single pass welds shall be carried out by TIG Welding.</p>		
Ref.	Doc			

	Form No.		<p align="center">PRODUCT STANDARD</p> <p align="center">PROJECT ENGINEERING & SYSTEMS DIVISION</p> <p align="center">HYDERABAD-32</p>	<p>PY51702</p> <p>Rev No. 00</p> <p>Page 27 of 50</p>
<p align="center">COPYRIGHT AND CONFIDENTIAL</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 align="center">(d) Skip and/or stitch welding on all exterior structural welds is not permitted.</p> <p>4.5.12 Post Weld Heat Treatment:</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> <p>4.5.13 Radiography / Non Destructive Testing:</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"> All 'T' -joint shall be radio graphed. Minimum 5% of total weld length excluding 'T' - joint shall be radio graphed. Evaluation, tests and repair shall be as per applicable code. <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>4.5.14 Cleaning:</p> <p>(i) Vessels shall be cleaned internally to remove scale, rust, dirt, foreign material by wire brushing.</p>		
Ref.	Doc			

	Form No.		<p align="center">PRODUCT STANDARD</p> <p align="center">PROJECT ENGINEERING & SYSTEMS DIVISION</p> <p align="center">HYDERABAD-32</p>	<p>PY51702</p> <p>Rev No. 00</p> <p>Page 28 of 50</p>
<p align="center">COPYRIGHT AND CONFIDENTIAL</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>(ii) Stainless steel surfaces both inside and outside shall be pickled and passivated in accordance with specification ASTM-A 380 after hydrotest.</p> <p align="center">4.5.15 General:</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> <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>4.6.0 Welding Process, Procedures and Qualifications:</p> <p>a) Welding processes: The welding processes as defined by section IX of the ASME Boiler and Pressure Vessel (B&PV) code are acceptable.</p> <p>b) Welding Procedure specifications: 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&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) Welding Procedure Qualifications: 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&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>		
Ref.	Doc			

	Form No.	 HYDERABAD	<p align="center">PRODUCT STANDARD</p> <p align="center">PROJECT ENGINEERING & SYSTEMS DIVISION</p> <p align="center">HYDERABAD-32</p>	<p>PY51702</p> <p>Rev No. 00</p> <p>Page 29 of 50</p>
<p align="center">COPYRIGHT AND CONFIDENTIAL</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>d) Welder Qualifications: Each manufacturer shall qualify all welders and welding operators employed in welding in accordance with the requirements of section IX of the ASME B&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> <p>4.7.0 Design Basis for Piping</p> <p>4.7.1 Design Standard:</p> <p>a) Piping design standard shall be ANSI B31.3 (Process Piping), unless otherwise specified.</p> <p>4.7.2 Piping Material Specification:</p> <p>(a) Piping material specification shall be strictly as per piping line specifications enclosed as per Annexure-3 and “Technical Requirements for Piping” as per clause – 4.8.0 except for thickness of the pipe which is mentioned in the PID attached as Annex-1. of this specification. The applicable line specifications are clearly marked in the P&I D of the system enclosed.</p> <p>4.7.3 Valves:</p> <p>(a) All valves shall be of the type as per the legend indicated in the P&I D. The various valves shall be as per the “Valve data sheets” enclosed as Annexure-5. and “Technical Requirements for Valves” vide clause- 4.9.0 Of this specification.</p> <p>4.7.4 Vents and Drains:</p> <p>(a) All pipe line high point vents and low point drains shall be as per Annexure-8.</p> <p>Other vents and drains as shown in the P&ID to be followed.</p> <p>4.7.5 Piping Supports:</p> <p>(a) Good engineering practices shall be applied and the required proper supports shall be provided for the piping.</p> <p>(b) Pads shall be welded on pipelines at all supported locations.</p> <p>4.7.6 Welding:</p> <p>(a) Please refer to clause No. 5.11.0. of this document , regarding welding process, procedures and qualifications.</p>	
Ref. Doc				

Form No.	 HYDERABAD	PRODUCT STANDARD PROJECT ENGINEERING & SYSTEMS DIVISION HYDERABAD-32							PY51702
									Rev No. 00
									Page 30 of 50

COPYRIGHT AND CONFIDENTIAL

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.

(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.

(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: A1A

Temp (°C)	Pr.class	Pipe class	Type of examination	Type of weld					Remarks
				Girth Butt weld	Socket weld	Attachment weld	Fabricated branch weld	Fabricated Weld of miters/reducers	
(-)29 to 400	150#	A1A	a) Visual	100%	100%	100%	100%	100%	
			b) Radio graphy	10%	—	—	—	50%	
			c) MP/LP	—	10%	—	10%	50%	


b) PIPING CLASS: B1A

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 miters/reducers	
(-) 29 to 425	300#	21A, 31A	a) Visual	100%	100%	100%	100%	100%	
			b) Radio graphy	20%	—	—	—	100%	
			c) MP/LP	—	20%	—	20%	---	

c) PIPING CLASS: D1A

Temp	Pr.class	Pipe	Type of	Type of weld Examined	Remarks

Ref. Doc

Ref. Doc	Form No.	 HYDERABAD	PRODUCT STANDARD PROJECT ENGINEERING & SYSTEMS DIVISION HYDERABAD-32							PY51702	
										Rev No. 00	
										Page 31 of 50	

COPYRIGHT AND CONFIDENTIAL

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.

(°C)	600#	31A	examination	Girth Butt weld	Socket weld	Attachment weld	Fabricated branch weld	Fabricated Weld of miter/reducers	Remarks
(-)29 to 425			a) Visual	100%	100%	100%	100%	100%	
			b) Radiography	20%	—	—	—	100%	
			c) MP/LP	—	20%	—	20%	---	

d) PIPING CLASS: A1K

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 371	150#	12A	a) Visual	100%	100%	100%	100%	100%	
			b) Radiography	20%	—	—	—	100%	
			c) MP/LP	—	20%	—	20%	---	

e) PIPING CLASS: B1K


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 500	300#	22A	a) Visual	100%	100%	100%	100%	100%	
			b) Radiography	20%	—	—	—	100%	
			c) MP/LP	—	20%	—	20%	---	


4.8.0 TECHNICAL REQUIREMENTS FOR PIPING :


4.8.1 General:


This “Technical Requirements for piping” shall be read along with “Piping Material Specification – PMS, Annexure-3’. The purpose of this section is to cover General requirements to be considered as minimum for procurement of piping materials.


4.8.2 Special Requirements for Austenitic Stainless Steel:


	Form No.		<p align="center">PRODUCT STANDARD</p> <p align="center">PROJECT ENGINEERING & SYSTEMS DIVISION</p> <p align="center">HYDERABAD-32</p>	<p>PY51702</p> <p>Rev No. 00</p> <p>Page 32 of 50</p>
<p align="center">COPYRIGHT AND CONFIDENTIAL</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>The following special requirements for Austenitic stainless steel are to be taken care of.</p> <ul style="list-style-type: none"> - All items/parts shall be supplied in solution-annealed condition. - For all material, Inter Granular Corrosion (IGC) test shall be conducted as per the following. <p>(b) ASTM A 262 Practice 'B' with acceptance criteria of 60 mils/year(max) for casting.</p> <p>(c) ASTM A262 practice 'E' with acceptance criteria of 'No cracks as observed from 20 x magnification' & microscopic structure to be observed from 250 x magnification for other than casting.</p> <p>(d) 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.</p> <p>4.8.3 Other requirements:</p> <p>4.8.3.1 Pipes:</p> <ul style="list-style-type: none"> (b) Pipes made by acid-Bessemer process shall not be acceptable. Steel pipe shall be made by open-hearth, electric furnace (or) basic oxygen process. (c) Unless specifically exempted, welded pipes (if specified, in piping material specification) shall be acceptable only with longitudinal weld made by employing automatic welding. (d) Galvanized pipes (if specified, in piping material specification) shall be only Hot Dip galvanized to ASTM A 53. (e) Spiral welded pipes (wherever specified in piping material specification) are permitted only in Cat 'D' service. <p>4.8.3.2 Fittings:</p> <ul style="list-style-type: none"> a) All fittings shall be of seamless construction unless otherwise specified. b) 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. c) 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. 		
Ref.	Doc			


	Form No.		<p align="center">PRODUCT STANDARD</p> <p align="center">PROJECT ENGINEERING & SYSTEMS DIVISION</p> <p align="center">HYDERABAD-32</p>	<p>PY51702</p> <p>Rev No. 00</p> <p>Page 33 of 50</p>
<p align="center">COPYRIGHT AND CONFIDENTIAL</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>d) 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.</p> <p>e) 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.</p> <p>f) All welded fittings (if applicable as per piping material specification) shall be normalized for CS, normalized and tempered for AS.</p> <p>g) Bevel end of all BW fittings shall undergo 100% MP/DP test.</p> <p>h) Usage of unions shall be restricted to utilities and instrumentation.</p> <p>4.8.3.3 Gaskets:</p> <p>a. Spiral wound gaskets shall be of self-aligning type.</p> <p>b. Canadian asbestos filler for spiral wound gaskets shall not have any color or dye.</p> <p>c. Full face gaskets shall have bolt holes punched out.</p> <p>d. Gaskets where CA filter is specified, Grafoil filler will also be acceptable.</p> <p>e. Compliance to following requirements for spiral wound gaskets is mandatory:</p> <p>(i) Outer centering ring is mandatory and shall be of minimum CS material.</p> <p>(vii) Inner ring material shall be same as spiral strip material and as minimum, shall be provided for the following:</p> <ol style="list-style-type: none"> 1. 26" and above gaskets 2. All size gaskets for vacuum service. H-grade stainless steel, SS-437 and SS-321. 3. All size gaskets for Hydrogen and process + hydrogen services. 4. All size gaskets for CRYO classes. 5. All sizes where class temperature is higher than 427 Deg. C. 6. All sizes for classes 900# and above. 7. All gaskets with PTFE filler. <p>4.8.3.4 Bolting:</p> <p>(a) 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.</p>	
Ref. Doc				


	Form No.		<p align="center">PRODUCT STANDARD</p> <p align="center">PROJECT ENGINEERING & SYSTEMS DIVISION</p> <p align="center">HYDERABAD-32</p>	<p>PY51702</p> <p>Rev No. 00</p> <p>Page 34 of 50</p>
<p align="center">COPYRIGHT AND CONFIDENTIAL</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) 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.</p> <p>(c) The nuts shall be double chamfered, semi-finished, heavy hexagonal type and shall be made by hot forged process.</p> <p>(d) 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.</p> <p>4.8.3.5 Strainers:</p> <p>a) All 2" & higher sized strainers shall be provided with ¾" threaded tap and solid threaded plug as drain connection. For less than 2", this shall be of ½" size. The tapped hole should be at the bottom to ensure proper drainage.</p> <p>b) For fabricated strainers all the BW joints shall be fully radiographed and fillet welds shall be 100% DP/MP checked.</p> <p>c) Bevel ends of strainers shall undergo 100% DP/MP test.</p> <p>d) All welded strainers shall be normalized for CS and normalized and tempered for AS.</p> <p>e) All strainers shall be hydrostatic tested at twice the design pressure.</p> <p>f) Allowable pressure drop shall be certified by vendor along with offer. If asked specifically, vendor shall furnish pressure drop calculations.</p> <p>4.8.3.6 Threaded Joints:</p> <p>a) Up to 200 Deg. C, threaded joints shall be made with 1" width PTFE Joining tape.</p> <p>b) Above 200 Deg. C, threaded joints shall be seal welded with a full Strength fillet weld.</p> <p>c) All threaded joints irrespective of pressure and temperature of the lines carrying toxic fluid shall be seal welded with a full strength weld.</p> <p>4.8.3.7 Test Reports:</p> <p>Test reports for all mandatory (as well as supplementary, wherever specified) tests shall be furnished.</p> <p>4.8.3.8 Marking:</p> <p>a) All items shall be marked (stamped / etched) in accordance with applicable codes / standards / specification. The item code, if available shall also be marked.</p>	
Ref.	Doc			


	Form No.		<p align="center">PRODUCT STANDARD</p> <p align="center">PROJECT ENGINEERING & SYSTEMS DIVISION</p> <p align="center">HYDERABAD-32</p>	<p>PY51702</p> <p>Rev No. 00</p> <p>Page 35 of 50</p>
<p align="center">COPYRIGHT AND CONFIDENTIAL</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>a) For ease of identification, the color of painted strips, wherever applicable, shall be as per applicable standard.</p> <p>b) 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.</p> <p>c) Special items / smaller items shall have attached corrosive resistant tag providing salient features.</p> <p>4.8.3.9 Dispatch:</p> <p>a) All items shall be dry, clean and free from moisture, dirt and loose foreign materials of any kind.</p> <p>b) All items shall be protected from rust, corrosion, and any mechanical damage during transportation, shipment and storage.</p> <p>c) Rust preventive on machined surfaces to be welded shall be easily removable with a petroleum solvent or shall not be harmful to welding.</p> <p>d) Ends shall be suitably protected and the protectors shall be securely and tightly attached.</p> <p>4.8.3.10 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.</p> <p>4.9.0 <u>TECHNICAL REQUIREMENTS OF VALVES:</u></p> <p>4.9.2 General:</p> <p>a) The “Technical requirements for valves” shall be read along with respective data sheets for valves, Annexure-5.</p> <p>b) All codes and standards for manufacture, testing, inspection etc., shall be of latest editions.</p> <p>4.9.3 Design and Construction:</p> <p>a) Following requirements for check valves 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” & above (except in 900# 1500# & 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>	
Ref. Doc				

	Form No.		<p align="center">PRODUCT STANDARD</p> <p align="center">PROJECT ENGINEERING & SYSTEMS DIVISION</p> <p align="center">HYDERABAD-32</p>	<p>PY51702</p>
				Rev No. 00
				Page 36 of 50
<p align="center">COPYRIGHT AND CONFIDENTIAL</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="margin-left: 40px;"> <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> </div> <div style="margin-left: 20px;"> <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> <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> <div style="margin-left: 40px;"> <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> </div> <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> </div>			
	Ref. Doc			


	Form No.	 HYDERABAD	<p align="center">PRODUCT STANDARD</p> <p align="center">PROJECT ENGINEERING & SYSTEMS DIVISION</p> <p align="center">HYDERABAD-32</p>	<p>PY51702</p> <p>Rev No. 00</p> <p>Page 37 of 50</p>
<p align="center">COPYRIGHT AND CONFIDENTIAL</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>(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> <p>4.9.4 Ball Valves:</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 , EIL / 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>4.9.5 General:</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>		
Ref.	Doc			


Form No.	 HYDERABAD	PRODUCT STANDARD PROJECT ENGINEERING & SYSTEMS DIVISION HYDERABAD-32	PY51702				
			Rev No. 00				
			Page 38 of 50				
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>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. Stellite 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>4.9.6 Operation:</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> <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"> <tr> <td>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>4.9.7 Inspection and Testing:</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>		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.						
Ref. Doc							


Form No.		PRODUCT STANDARD PROJECT ENGINEERING & SYSTEMS DIVISION HYDERABAD-32	PY51702												
			Rev No. 00												
			Page 39 of 50												
<p> Copyright and Confidential 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) The extent of inspection shall be as under: </p> <p> (i) Forged Valves </p> <ol style="list-style-type: none"> 1. Visual and dimensional inspection 2. Review of material certificates 3. Any mandatory or supplementary test 4. Hydrostatic test on 10% valves selected on random basis. 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 <p> (ii) Cast Steel Valves </p> <ol style="list-style-type: none"> 1. Visual and dimensional inspection 2. Review of material certificates 3. Review of Radiographs/radiographic reports or any other NDT tests Whenever applicable as per data sheet 4. Any mandatory or supplementary test 5. Hydrostatic test 100% for body, 10% other test. 6. 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 <p> Samples of strip check shall be selected at random and shall generally be in The highest size in the lot. </p> <p> 4.9.8 Radiography of Cast Valves: </p> <ol style="list-style-type: none"> a) Radiography procedure, areas of casting to be radio graphed and the acceptance criteria shall be as per ASME/ANSI B 16.34. b) All castings shall be radiographic quality castings. c) Minimum requirement of radiography examination for all materials is as follows: <table border="1"> <thead> <tr> <th><u>Class</u></th> <th><u>Size</u></th> <th><u>Qty</u></th> </tr> </thead> <tbody> <tr> <td>150</td> <td>26" & above</td> <td>100% (except where used for category 'D' service)</td> </tr> <tr> <td>300</td> <td>18" & above</td> <td>100%</td> </tr> <tr> <td>600 and above</td> <td>All</td> <td>100%</td> </tr> </tbody> </table>				<u>Class</u>	<u>Size</u>	<u>Qty</u>	150	26" & above	100% (except where used for category 'D' service)	300	18" & above	100%	600 and above	All	100%
<u>Class</u>	<u>Size</u>	<u>Qty</u>													
150	26" & above	100% (except where used for category 'D' service)													
300	18" & above	100%													
600 and above	All	100%													
Ref. Doc															


Form No.		PRODUCT STANDARD		PY51702																											
		PROJECT ENGINEERING & SYSTEMS DIVISION		Rev No. 00																											
		HYDERABAD-32		Page 40 of 50																											
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>d) 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:</p> <p>1) For Hydrogen/ Hydrogen bearing Hydrocarbons, Oxygen, NACE & Carbon steel classes requiring stress relieving.</p> <table border="1"> <thead> <tr> <th><u>Class</u></th> <th><u>Size</u></th> <th><u>Qty</u></th> </tr> </thead> <tbody> <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> </tbody> </table> <p>2) For LT / CRYO services:</p> <table border="1"> <thead> <tr> <th><u>Class</u></th> <th><u>Size</u></th> <th><u>Qty</u></th> </tr> </thead> <tbody> <tr> <td>150</td> <td>up to 24"</td> <td>20%</td> </tr> <tr> <td>300</td> <td>up to 16"</td> <td>20%</td> </tr> </tbody> </table> <p>2) For Stainless Steel Castings (over & above the requirement: covered in para (a) above and not covered in paras (1) and (2) above).</p> <table border="1"> <thead> <tr> <th><u>Class</u></th> <th><u>Size</u></th> <th><u>Qty</u></th> </tr> </thead> <tbody> <tr> <td>150</td> <td>up to 24"</td> <td>10%</td> </tr> <tr> <td>300</td> <td>up to 16" e</td> <td>10%</td> </tr> </tbody> </table> <p>e) Radiography procedure, areas of casting to be radio graphed shall be as per ASME B 16.34 and acceptance criteria shall be as per ASME B 16.34 Annexure-B. However, for areas of casting to be radio graphed for types of valves not covered in ASME B 16.34, vendor shall enclose details of areas to be radio graphed in line with B 16.34.</p> <p>f) Radiography wherever specified shall be done by X-ray / Gamma Ray to get the required sensitivity.</p> <p>4.9.9 Marking:</p> <p>a) Valve markings, symbols, abbreviations etc., shall be in accordance with MSS-SP-25 or the standard referred in specification sheet as applicable. Vendor's name, valve rating, material designation, nominal size, direction of flow (if any) etc., shall be integral on the body.</p>			<u>Class</u>	<u>Size</u>	<u>Qty</u>	150	up to 24"	50%	300	up to 16" e	50%	<u>Class</u>	<u>Size</u>	<u>Qty</u>	150	up to 24"	20%	300	up to 16"	20%	<u>Class</u>	<u>Size</u>	<u>Qty</u>	150	up to 24"	10%	300	up to 16" e	10%
<u>Class</u>	<u>Size</u>	<u>Qty</u>																													
150	up to 24"	50%																													
300	up to 16" e	50%																													
<u>Class</u>	<u>Size</u>	<u>Qty</u>																													
150	up to 24"	20%																													
300	up to 16"	20%																													
<u>Class</u>	<u>Size</u>	<u>Qty</u>																													
150	up to 24"	10%																													
300	up to 16" e	10%																													
Ref. Doc																															


Form No.		<div><div>बी एच ई एल</div><div>BHEL</div><div>HYDERABAD</div></div>	<div>PRODUCT STANDARD</div> <div>PROJECT ENGINEERING & SYSTEMS DIVISION</div> <div>HYDERABAD-32</div>	<div>PY51702</div> <div>Rev No. 00</div> <div>Page 41 of 50</div>
<div>COPYRIGHT AND CONFIDENTIAL</div> <div>The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED .</div> <div>It must not be used directly or indirectly in any way detrimental to the interest of the company.</div>		<div><div>b) Each valve shall have a corrosion resistant tag giving size, valve tag /code no., securely attached to the valve body.</div><div>c) 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.</div></div>		
		<div><div>4.9.10 Dispatch:</div><div><div>a) Valve shall be dry, clean and free from moisture, dirt and loose foreign materials of any kind.</div><div>b) Valves shall be protected from rust, corrosion and any mechanical damage during transportation, shipment and storage.</div><div>c) Rust preventive on machined surfaces to be welded shall be easily removable with a petroleum solvent or shall not be harmful to welding.</div><div>d) Each end of valve shall be protected with the following materials:</div><div><div><div>Flange Face</div><div>Beveled end</div><div>SW & SCRD End</div></div><div><div>Wood or plastic cover</div><div>Wood or plastic cover</div><div>Plastic Cap</div></div></div><div>e) End protectors of wood/plastic to be used on flange faces shall be attached by at least three bolts and shall not be smaller than the outside diameter of the flange. However, plastic caps for SW & SCRD end valves shall be press fit type.</div><div>f) End protectors to be used on beveled end shall be securely and tightly attached.</div></div></div>		
		<div><div><u>INSTRUMENTATION:</u></div><div>Refer Annexure-7</div><div><div>6.0</div><div><u>SKID AND LAYOUT:</u></div></div><div><div>a) The gas conditioning system is one complete system and shall be mounted on one skid . In case all the equipment cannot be mounted on one skid due to transport constraints, the system can be mounted on more than one skid.</div><div>b) All the equipment of Gas Conditioning skid system shall be mounted on adequately sized base plate of rugged construction with a beam of minimum size of 200 mm. The base frame shall be complete with all the required cross beams and channels. It shall be ensured that the equipment is supported from cross beams only.</div></div></div>		
Ref.	Doc			


	Form No.		<p align="center">PRODUCT STANDARD</p> <p align="center">PROJECT ENGINEERING & SYSTEMS DIVISION</p> <p align="center">HYDERABAD-32</p>	<p>PY51702</p> <p>Rev No. 00</p> <p>Page 42 of 50</p>
<p align="center">COPYRIGHT AND CONFIDENTIAL</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"> c) The top of the base frame shall be covered with a chequered plate completely without any openings. d) Interconnecting piping shall be provided between various equipment as per P&I D Enclosed. e) The base plate shall be provided with suitable lifting lugs for ease of handling. f) The skid shall be provided with earthing lugs. 2 nos. of earthing lugs of size 50X6 mm with M12 Bolts, mounted diagonally opposite on the skid shall be provided. All electricals on skid shall be connected to these earthing lugs. Further hooking of these earthing lugs with plant earthing system will be done by purchaser. g) Vendor should use good engineering practices in developing the layout of the gas conditioning system. Proper access to all operating points including valves & 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. h) In addition to the details shown in the P&I D, the required low point drains and high point vents shall be provided as per layout requirement. i) In the development of layout of piping, the thermal stresses on various equipment and allowable stresses shall be taken in to consideration. j) Copper jumpers shall be provided across the flanges to maintain electrical continuity. k) All branch connections joining flare header shall be joined tangentially in the direction of flow. l) “SKIP” and/or “STITCH” welding on all exterior or structural welds is not permitted. m) Cables shall be routed through suitable perforated channels / trays up to junction boxes. Separate cable trays shall be provided for the following cables: <ul style="list-style-type: none"> (i) Intrinsic safe – control cables (ii) Instrinsic safe – signal cables (iii) Solenoid valve power cables (iv) Power cables for heater etc.. (v) RTD cables (vi) Thermocouple cables 		
Ref.	Doc			

	Form No.		<p align="center">PRODUCT STANDARD</p> <p align="center">PROJECT ENGINEERING & SYSTEMS DIVISION</p> <p align="center">HYDERABAD-32</p>	<p>PY51702</p> <p>Rev No. 00</p> <p>Page 43 of 50</p>
<p align="center">COPYRIGHT AND CONFIDENTIAL</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>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> <p>p) All instrument tubing shall be laid on the skid as per good engineering practices with proper supports and clamping arrangements.</p> <p>7.0 TESTING AND INSPECTION REQUIREMENTS :</p> <p>a) Pressure Vessels : As per clause relevant clauses above. (ie., Scrubber, Filter separator)</p> <p>b) Individual piping components : As per relevant clause above</p> <p>c) Individual valves : As per clause relevant clause above.</p> <p>d) Instrumentation : As per Annexure-7.</p> <p>g) 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>h) Hydro testing shall be performed on pipe fabrications. 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>i) In addition to above, complete skid 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 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 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>SPECIAL REQUIREMENT:</p> <p>j) Entire skid test at design pressure will ensure alignment as well as dimensional tolerances of the equipment. In case if vendors have capability and facility to test</p>	
Ref.	Doc			

	Form No.	 HYDERABAD	<p align="center">PRODUCT STANDARD</p> <p align="center">PROJECT ENGINEERING & SYSTEMS DIVISION</p> <p align="center">HYDERABAD-32</p>	<p>PY51702</p> <p>Rev No. 00</p> <p>Page 44 of 50</p>
<p align="center">COPYRIGHT AND CONFIDENTIAL</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>the skid pneumatically at design pressures, then it is most preferred and vendor to carry out the same.</p> <p>k) For the vendors who do not have such facility, the following methodology is proposed:</p> <ul style="list-style-type: none"> • Individual hydrotest of the items. • Painting of the items • Assembly and hydrotest of the skid(hydrotest after painting is acceptable as this is done only to check the leakages from flanges and not at weld joints, Hence prior painting will not hinder the hydrotest any way. • Draining of water and dryingup by blowing of air, • Pneumatic leak test to ensure that the items(filters, control valves etc.,) are properly assembled. <p>l) <u>Inspection agency :</u></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>8.0 <u>PAINTING SCHEME:</u></p> <p>Painting shall be as per Annexure-17.</p> <p>Sl. 10.2 of Table-10 to be followed for scrubber and filter separator skid.</p> <p>Recommended vendors for paints: As per the approved vendors list for the system.</p> <p>9.0 <u>STORING, HANDLING, PACKING AND DISPATCH OF EQUIPMENTS / COMPONENT:</u></p> <p>As per Annexure-12</p> <p>10.0 <u>SPARES:</u></p> <p>a) Commissioning spares: Commissioning spares should form a part of main skid itself. Same shall be as per Annexure-19.</p> <p>b) Two years operational spares: Two years operational spares shall be as per Annexure-13. However common price for spares is not acceptable. Unit rates shall be quoted for each item, separately.</p>	
Ref.	Doc			


	Form No.	 HYDERABAD	<p align="center">PRODUCT STANDARD</p> <p align="center">PROJECT ENGINEERING & SYSTEMS DIVISION</p> <p align="center">HYDERABAD-32</p>	<p>PY51702</p> <p>Rev No. 00</p> <p>Page 45 of 50</p>
<p align="center">COPYRIGHT AND CONFIDENTIAL</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 align="center">11.0 <u>DRAWINGS/ DOCUMENTS REQUIRED DURING DETAIL ENGINEERING</u></p> <p>The successful bidder shall submit as per the Master Document List enclosed vide Annexure-15.</p> <p>11.1 All drawings shall be prepared as per BHEL's title block and bear BHEL's drawing No. and customer /consultant's drawing no; which will be forwarded to the successful bidder during detail engineering stage.</p> <p>11.2 Data sheets of various items shall be prepared by the bidder and shall be submitted to BHEL / customer / consultant for approval after placement of order and any changes required by BHEL / customer / consultant for the same shall be incorporated and adhered by the bidder without any commercial implications.</p> <p>11.3 GA drawing, nozzle schedule, design data, material of construction etc. shall be prepared by the bidder during detail engineering stage based on specification / contractual requirement and there should be no commercial implication on account of finalization of the drawings and documents.</p> <p>11.4 O & M manual shall be furnished to BHEL for approval during detailed engineering stage.</p> <p>11.5 All possible efforts shall be made by the bidder to get the approval of drawings and documents from BHEL / customer / consultant at the earliest and the documents prepared / generated by them or their sub-vendors shall be checked by their competent authority before submission to BHEL.</p> <p>11.6 Revision made by the bidder in any drawings and documents shall be highlighted by indicating the no. of revisions in a triangle without fail so that the minimum time is required by BHEL to review the drawings and documents.</p> <p>11.7 Any other drawings and documents in addition to the list of drawings and documents indicated in the NIT specification as required by BHEL for the execution of the project shall be furnished by them during detailed engineering stage and no commercial implication shall be entertained by BHEL for the same.</p> <p>11.8 Bidder to confirm that all the drawings shall be prepared in Auto Cad - 2010 version and required number of hardcopies and soft copies shall be furnished to BHEL during detailed engineering stage. Exact requirement of number of hard copies and soft copies of all drawings and documents as required by BHEL / customer / consultant shall be informed to the successful bidder during detail engineering stage and bidder to furnish the same for which no additional cost shall be entertained. However for estimation, bidder shall consider atleast 10 sets of hard copies as minimum quantity in their offer.</p>		
Ref.	Doc			


Form No.	 HYDERABAD	PRODUCT STANDARD PROJECT ENGINEERING & SYSTEMS DIVISION HYDERABAD-32	PY51702
			Rev No. 00
			Page 46 of 50
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>11.9 15 days time is required by BHEL to offer their comments on the drawings and documents being submitted by the bidder (during detailed engineering stage in the event of L.O.I being placed) from the date of receipt.</p> <p>11.10 Bidder to depute competent designer (s) at BHEL's office during detailed engineering stage to discuss drawings and other technical documents as and when required by BHEL. However, minimum 7 days notice shall be served for the same.</p> <p>11.11 All the drawings which are required to be furnished to BHEL during detailed engineering stage shall include technical parameters, details of paints, BOQ / BOM etc in tabular form indicating all components including bought out items and their quantity, material of construction indicating its applicable code / standard, weight, make etc.</p> <p>11.12 All drawings and documents including general arrangement drawing, data sheet, calculation etc. shall be furnished to BHEL during detailed engineering stage and shall include / indicate the following details for clarity w.r.t. inspection, construction, erection and maintenance etc.:-</p> <ol style="list-style-type: none"> All drawings and documents shall bear BHEL's title block and drawing / document number. However, BHEL's drawing / document numbering scheme shall be furnished to the successful bidder after the placement of L.O.I. All drawings and documents shall indicate the list of all reference drawings including general arrangement. All drawings shall include / show plan, elevation, side view, cross - section, skin section, blow - up view, all major self-manufactured and bought out items shall be labelled and included in BOQ / BOM in tabular form. <p>The O&M manuals shall contain the following as minimum.</p> <ul style="list-style-type: none"> The identification details of the equipment like BHEL P.O. No., Vendor's Job Identification No., full contact address with telephone, fax, & e-mail details. Brief description of the system. System unloading, storage, erection, start up, commissioning, shut down requirements. System operating and maintenance requirements. Operational & Environmental safety instructions. Final data sheets and drawings.. O&M Manuals, Catalogues of the equipment & instrumentation Recommended 2 years operational spares Test reports & certificates <p>The draft O&M manual can be submitted without test reports.</p>	
Ref. Doc			

Form No.	 HYDERABAD	PRODUCT STANDARD PROJECT ENGINEERING & SYSTEMS DIVISION HYDERABAD-32	PY51702
			Rev No. 00
			Page 47 of 50
Ref. Doc		<p> 13.0 PRE-BID CLARIFICATIONS AND DEVIATIONS </p> <p> Bidders are advised to quote strictly as per BHEL's specification requirements. In case bidder excludes some components of scope of supply or some features of specification requirements, the bidder will be required to include the same in the scope during offer evaluation stage /contract execution stage without any additional commercial and price implications on account of the same. Bidder to note that they won't be entitled for any price impact on account of withdrawal of deviation taken from BHEL spec during technical scrutiny/evaluation of the bidder's offer . Price impact will be allowed by BHEL only to the extent of change of specification during tender evaluation stage, if any, from BHEL end. </p> <p> In case bidder feels that it is necessary to exclude some components of scope of supply & some features of specification requirements, due to genuine constraints if any, bidder has to clearly bring out the same to the notice of BHEL and take their prior approval <u>before submission of bid</u>. Bidders are requested to bring out only those issues and deviations which are impractical to meet (or) not technically advisable as per the experience of bidder, for BHEL's review <u>before the submission of bid</u>. All such clarifications required by the bidder shall be intimated to BHEL together as a single notice within a week of receipt of the Enquiry/NIT/RFQ in the enclosed format (Annexure -11). </p> <p> All such applicable deviations /clarification shall have cross reference to page number /section / clause /para etc. of this specification or its annexure with proper reasons for the deviations for purchaser's consideration. Any such applicable deviations /clarification not listed under the above section, even if reflected in any other portion of the bidder's proposal shall not be considered applicable. </p> <p> Purchaser shall review the above pre-bid queries & deviations submitted by the bidder and furnish the necessary clarifications /instructions to the bidder immediately. </p> <p> Bidder shall submit their offer taking cognizance of these clarifications/instructions provided by Purchaser. </p> <p> In absence of any such pre-bid clarifications sought by the bidder and in case of contradictory requirements of the specification (if any), the more stringent requirement as interpreted of Purchaser/Customer shall prevail and shall be complied by the bidder without any commercial implication on account of the same. Further in case of any missing information in the specification not brought out by the prospective bidders as part of pre-bid clarification, the same shall be furnished by Purchaser/ Customer as and when brought to their notice either by the bidder or by purchaser/ customer themselves. However, such requirements shall be binding on the successful bidder without any commercial & delivery implication. </p> <p> The bidder's offer shall not carry any sections like clarification, interpretations and /or assumptions. </p> <p> Bidders are advised to quote strictly as per BHEL's specification requirements. In case bidder excludes some components of scope of supply or some features of specification </p>	

COPYRIGHT AND CONFIDENTIAL

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.

Form No.	 HYDERABAD	PRODUCT STANDARD PROJECT ENGINEERING & SYSTEMS DIVISION HYDERABAD-32	PY51702															
			Rev No. 00															
			Page 48 of 50															
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>requirements, the bidder will be required to include the same in the scope during offer evaluation stage /contract execution stage without any additional commercial and price implications on account of the same. Bidder to note that they won't be entitled for any price impact on account of withdrawal of deviation taken from BHEL spec during technical scrutiny stage. Price impact will be allowed by BHEL only to the extent of change of specification during tender evaluation stage, if any, from BHEL end.</p> <p>Information like Bill of materials (BOM), Instrument list, datasheets, and typical specifications enclosed by the bidder as a part of their bid, shall be retained for information only and shall not be referred by contractor in future as contractual agreement during contract execution stage. No implication shall be admissible on the basis of these documents during any stage of contract execution and the requirements of as specified/indicated this specification will be binding and final. System wise BOQ shall be finalized based on approved drawings during detail engineering stage.</p> <p>• <u>VARIANT TABLE:</u></p> <table border="1"> <thead> <tr> <th><u>Variant</u></th> <th><u>Item</u></th> <th><u>Material Code</u></th> </tr> </thead> <tbody> <tr> <td>01</td> <td>Common Fuel Gas Scrubber & Filter Separator Skid(1X100%) – 3 Nos</td> <td>PY9751702011</td> </tr> <tr> <td>02</td> <td>Mandatory Spares for Scrubber cum Fine Filter skid – 1 Set</td> <td>PY9751702020</td> </tr> <tr> <td></td> <td></td> <td></td> </tr> <tr> <td></td> <td></td> <td></td> </tr> </tbody> </table>		<u>Variant</u>	<u>Item</u>	<u>Material Code</u>	01	Common Fuel Gas Scrubber & Filter Separator Skid(1X100%) – 3 Nos	PY9751702011	02	Mandatory Spares for Scrubber cum Fine Filter skid – 1 Set	PY9751702020						
<u>Variant</u>	<u>Item</u>	<u>Material Code</u>																
01	Common Fuel Gas Scrubber & Filter Separator Skid(1X100%) – 3 Nos	PY9751702011																
02	Mandatory Spares for Scrubber cum Fine Filter skid – 1 Set	PY9751702020																
Ref. Doc																		

Form No.	 HYDERABAD	<div>PRODUCT STANDARD</div> <div>PROJECT ENGINEERING & SYSTEMS DIVISION</div> <div>HYDERABAD-32</div>			PY51702
					Rev No. 00
					Page 49 of 50
<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>	Rev .no.	Date	Revision Details	Revised By	Approved By
	00	06.01.21	Original Issue	-----	M.S.S Nagesh
	Ref.	Doc			