

**2 x 600 MW SCCL, ADILABAD - TPP.  
1 x 300 MW VISHAKHAPATNAM ABHIJEET TPP.**

**VOLUME -II B**

**TECHNICAL SPECIFICATION  
FOR  
CONDENSER ON LOAD TUBE CLEANING SYSTEMS (COLTCS)  
& DEBRIS FILTER (DF)**

**Specification No. : PE-TS- 381/382-165-N001 (REV. 0)**



**BHARAT HEAVY ELECTRICALS LIMITED  
POWER SECTOR  
PROJECT ENGINEERING MANAGEMENT  
PPEI BLDG., SEC-16A, PLOT NO. 25  
NOIDA - 201301 (UP)**

-1-

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**TITLE : TECHNICAL SPECIFICATION  
FOR  
CONDENSER ON LOAD TUBE CLEANING  
SYSTEMS (COLTCS) & DEBRIS FILTER (DF)  
PREAMBLE**

**SPEC. NO. PE-TS- 381/382-165-N001**

**VOLUME : II B**

**REV. NO. 0 | DATE :12.04.2012**

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1.0 The tender document contains three (3) volumes. The bidder shall meet the requirements of all the three volumes.

**1.1 Volume - I CONDITIONS OF CONTRACT**

This consists of four parts as below :

Volume - I A : This part contains instructions to bidders for making bids to BHEL.

Volume - I B : This part contains general commercial conditions of the tender and include provision that vendor shall be responsible for the quality of item supplied by their sub-vendors.

Volume - I C : This part contains special conditions of contract.

Volume - I D : This part contains commercial conditions for erection and commissioning site work, as applicable.

**1.2 Volume - II TECHNICAL SPECIFICATIONS**

Technical requirements are stipulated in Volume II which comprises of :

Volume - II A : General Technical Conditions

Volume - II B : Technical specification including drawings, if any

**1.2.1 Volume - II B :**

This volume is sub-divided into following sections:

Section - A : This section outlines the scope of enquiry.

Section - B : This section provides "Project Information"

Section - C : This section indicates technical requirements specific to the contract, not covered in Section-D.

Section - D : This section comprises of standard technical specifications of equipments complete with data sheet A, B & C.

Data sheet-A specifies data and other requirements pertaining to the equipment.

Data sheet - B specifies data to be filled by the bidder (Data Sheet B is contained in Volume - III)

Data sheet - C indicates data documents to be furnished after the award of contract as per agreed schedule by the vendor (as applicable).



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**1.2.2 Volume - III TECHNICAL SCHEDULES**

This volume contains technical schedules and Data Sheets - B, which are to be duly filled by the bidder and the same shall be furnished with the technical bid as per instructions given in Document No.PES-100-901 in Volume-III.

**2.0** The requirements mentioned in Section C/Data Sheets-A of Section-D shall prevail and govern in case of conflict between the same and the corresponding requirements mentioned in the descriptive portion in Section -D.

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**SECTION - A  
SCOPE OF ENQUIRY**



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### 1.00.0 SCOPE

This enquiry covers the design, manufacture, assembly, inspection and testing at manufacturer's and/or his sub-contractors works properly packed for delivery of the items as follows:

#### 1.01.0 Condenser On Load Tube Cleaning Systems :

Condenser On Load Tube Cleaning Systems (COLTCS) complete with all accessories as per the requirements specified in different sections of this specification *for* :

- **2 x 600 MW SINGARENI COLLIERIES COMPANY LTD.- ADILABAD TPP**
- **1 x 300 MW VISHAKHAPATNAM ABHIJEET TPP**

The bidder's scope also includes installation checks, commissioning, trial runs & PG Testing at site of COLTCS.

#### 1.02.0 Debris Filter :

Debris filter (DF) complete with all accessories as per the requirements specified in different sections of this specification *for*:

- **1 x 300 MW VISHAKHAPATNAM ABHIJEET TPP**

The bidder's scope also includes installation checks, commissioning, trial runs & PG testing at site of DF.

#### 1.03.0 The bids shall be evaluated as per NIT.

Equipments shall be ordered separately for each project.

In the event of more than one order being placed on the same bidder, the drawings/ documents etc. shall be submitted separately for each project during detailed engg. stage for approval.

### 2.00.0 GENERAL TECHNICAL INSTRUCTIONS:

- 2.01.00 It is not the intent to specify herein all the details of design and manufacture. However the equipment shall conform in all respects to high standard of design, engineering and workmanship, and shall be capable of performing the required duties in a manner acceptable to Engineer/ Owner, who will interpret the meaning of drawing and specifications, and shall be entitled to reject any component or material, which in his judgement is not in full accordance herewith.



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- 2.0.2.00 The omission of specific reference to any component/ accessory necessary for the proper performance of the equipments shall not relieve the bidder of the responsibility of providing such facilities to complete the supply of the equipments at quoted prices.
- 2.03.00 In case of any deviation from this Technical specification (Vol. IIB) and General Technical Conditions (Vol. IIC), the same shall be indicated in the schedule of deviations enclosed in Volume-III, Part-A. In the absence of duly filled schedules it will be assumed that the bid strictly conforms to the specification.
- 2.04.00 BHEL's/ Customer's representatives shall be given full access to the shop in which the equipments are being manufactured or tested and all test records shall be made available to him.
- 2.05.00 The equipments covered under this specification shall not be despatched unless the same have been finally inspected, accepted and shipping release issued by BHEL/ Customer
- 2.06.00 Un-priced copy of price bid shall be furnished alongwith the technical bid.



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## **SECTION - B**

### **PROJECT INFORMATION FOR FOLLOWING PROJECTS:**

**2 x 600 MW SCCL ADILABAD TPP**

**1 x 300 MW VISHAKHAPATNAM ABHIJEET TPP**



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**PROJECT INFORMATION**

**2 x 600 MW SCCL ADILABAD TPP**

CLAUSE NO.	PROJECT INFORMATION		
1.00.00	<p><b>BACKGROUND</b></p> <p>The Singareni Collieries Company Limited is a government coal mining companies jointly owned by the Government of Andhra Pradesh and Government of India on a 51:49 equity basis</p> <p>The present proposal is for setting up of a coal based Singareni Thermal Power Project (2x600 MW) to be owned by The Singareni Collieries Company Limited, which is A Government Company.</p>		
1.01.00	<p><b>LOCATION AND APPROACH</b></p> <p>The Singareni TPP is located near Pegadapalli village, Jaipur Mandal, District Adilabad of Andhra Pradesh. The latitude and longitude of Site are 18° 48' 30" to 18° 50' 35" and 79° 34' 00" to 79° 35' 30" respectively. The Site is 14.6 Km from nearest town Mancherial and 4.6 Km from State Highway. Distance from NH-16 (Nirmal-Chinnur section) is 500M.</p> <p>Nearest railway station is Mancherial railway station on Nagpur-Kazipet main rail line of South Central Railway, located at a distance of about 14.6 kms.</p> <p>Nearest airport is Shamshabad Airport, Hyderabad at a distance of about 250KM.</p> <p>Vicinity Plan of the project is placed at Annexure-I</p>		
1.02.00	<p><b>LAND REQUIREMENT</b></p> <p>About 490 hectares of land has been identified for the plant, CHP, water reservoir, Staff colony, ash dump area, Coal conveyor corridors, water pipelines and Green belts.</p>		
1.03.00	<p><b>WATER</b></p> <p>Water requirement has been assessed as 3700 cum/hr.</p> <p>Irrigation &amp; CAD Deptt., Govt. of Andhra Pradesh has allocated 1.0 TMC of water per annum from Pranahita Chevella Lift Irrigation Scheme vide Memo No. 17556/Maj.Irr.VIII(1)/08 dated 02.07.2008 (Annexure-2.1).</p> <p>During the no-flow period in the river, Govt. of Andhra Pradesh, Ground Water Department vide their letter No. 157/T/2008 dated 07.08.2008 addressed to SCCL have accorded approval for drawal of 18 MGD (3409 cum/hr) water through infiltration galleries in River Godavari at Shetpally Village for the project.</p>		
SINGARENI THERMAL POWER PROJECT (2X600 MW) BOILER TURBINE GENERATOR PACKAGE	TECHNICAL SPECIFICATION SECTION - VI PART-A	SUB-SECTION-I PROJECT INFORMATION	PAGE 1 OF 12

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	<p>SCCL has approached Govt. of Andhra Pradesh vide letter dated 29.08.09 to get allocation of 2 TMC of water from Sripada-Yellempalli Project including already allocated 1 TMC of water for the Power Project.</p> <p>Suitable intake system will be developed at a location as may be suggested by Ground Water Deptt., Govt. of Andhra Pradesh.</p>		
1.04.00	<b>COAL AVAILABILITY AND TRANSPORTATION</b>		
1.04.01	<b>Coal Availability</b>		
	<p>Coal requirement for 1200 MW capacity has been assessed as 4.784 mtpa.</p> <p>Coal will be sourced mainly from Srirampur OCM of SCCL and nearby coalmines of SCCL.</p>		
1.04.02	<b>Coal Transportation</b>		
	<p>Coal will be linked from Srirampur OCM &amp; nearby coalmines of SCCL. (-) 200 mm size Coal will be transported by Rail / MGR system from mines to plant site</p> <p>As a standby arrangement coal shall also be transported by road and the arrangement shall be made in Plant CHP to receive the coal through trucks by designing suitable ground hopper.</p>		
1.04.03	<b>Coal Quality Parameters and Fuel Oil Characteristics</b>		
	<p>The tentative Coal quality parameters and Fuel Oil Characteristics are enclosed as Annexures-II-1 and II-2 to this subsection.</p>		
1.05.00	<b>CAPACITY &amp; POWER EVACUATION</b>		
	<p>Power generated is proposed to be stepped upto 400 kV by generator transformer and will be evacuated through the double circuit overhead transmission system.</p>		
1.06.00	<b>METEOROLOGICAL DATA</b>		
	<p>Important meteorological data from nearest observatory at Ramagundam is placed at Annexure - III.</p>		
1.07.00	<b>PLANT WATER SCHEME</b>		
	<p>The Plant water scheme is described below.</p>		
<b>SINGARENI THERMAL POWER PROJECT (2X600 MW) BOILER TURBINE GENERATOR PACKAGE</b>	<b>TECHNICAL SPECIFICATION SECTION - VI PART-A</b>	<b>SUB-SECTION-I PROJECT INFORMATION</b>	<b>PAGE 2 OF 12</b>

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1.07.01	<p><b>Condenser Cooling (CW) Water System</b></p> <p>It is proposed to adopt re-circulating type CW system with induced draft cooling towers for the project.</p>		
1.07.02	<p><b>Equipment Cooling Water (ECW) System ( Unit Auxiliaries)</b></p> <p>The plant auxiliaries of Steam Generator shall be cooled by Demineralised water (DM) in a closed circuit. The primary circuit DM water shall be cooled through heat exchangers by Circulating Water tapped from CW system in a closed secondary circuit. The hot secondary circuit cooling water shall be cooled in the induced draft cooling towers and shall be returned back to the system.</p>		
1.07.03	<p><b>Station Auxiliaries Cooling Water System</b></p> <p>The station auxiliaries such as Air compressors, compressors of ash handling plant, Cooling water circuit of Air Conditioning systems of Main Plant and Service Building, compressor of mill reject system etc. shall be cooled by separate cooling water system using separate set of pumps and cooling towers.</p>		
1.07.04	<p><b>Ash Water System</b></p> <p>(a) It is proposed to operate ash water system in a closed circuit. The ash water from the ash dyke shall be recirculated. During re-circulation mode, the make up to the ash water system (to compensate for the ash water blow down and evaporation loss in ash dyke) shall be supplied from CW blow down.</p> <p>(b) During initial stage when decanted ash water is not available, the ash water system shall be operated in once through mode and make up water to ash water system shall be given from CW blowdown as well as raw water system.</p> <p>(c) Considering total ash handling plant water requirement of 1100 Cu.M/hr. (excluding the water required for cooling of air compressors and vacuum pumps but inclusive of seal water of ash slurry pumps during re-circulation mode operation, it is expected that about 930 M<sup>3</sup>/hr of decanted ash water shall return to the ash handling system after accounting for evaporation loss.</p>		
1.07.05	<p><b>Other Miscellaneous Water Systems</b></p> <p>(a) CW system blow down water shall be used for meeting the Fly ash and bottom ash system requirement. Clarified water shall be used for service water system. The service (wash water) water collected from various areas shall be treated using oil water separators, tube settlers, coal settling pits etc.</p>		
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	<p>as per requirement and treated water from liquid effluent treatment plant shall be recycled back to the service water system for re-use.</p> <p>(b) The drinking water requirement of the plant shall be provided from water treatment plant.</p> <p>(c) Steam Cycle make-up water, makeup to the primary circuit of ECW (unit auxiliaries) system, boiler fill water and makeup to the hydrogen generation plant shall be provided from existing Demineralising plant.</p> <p>(d) The quality of Raw water and Clarified water is enclosed with this sub-section.-</p> <p><b>1.08.00 Criteria for Wind Resistant Design of Structures and Equipment</b></p> <p>All structures and equipment of the power plant, including plant auxiliary structures and equipment, shall be designed for wind forces as given in Sub-Section- D-01, Part-B, Section-VI, i.e. Technical Specification for Civil and Structural Works.</p> <p><b>1.09.00 Criteria for Earthquake Resistant Design of Structures and Equipment</b></p> <p>All power plant structures and equipment, including plant auxiliary structures and equipment shall be designed for seismic forces as given in Sub-Section- D-01, Part-B, Section-VI, i.e. Technical Specification for Civil and Structural Works.</p>		
<p>SINGARENI THERMAL POWER PROJECT (2X600 MW) BOILER TURBINE GENERATOR PACKAGE</p>	<p>TECHNICAL SPECIFICATION SECTION - VI PART-A</p>	<p>SUB-SECTION-I PROJECT INFORMATION</p>	<p>PAGE 4 OF 12</p>

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**RAW WATER ANALYSIS**

S.No	Constituent	As	mg/l	
			Source-1	Source-2
1	Calcium	CaCO <sub>3</sub>	68.6	117.6
2	Magnesium	CaCO <sub>3</sub>	68.6	137.2
3	Sodium+ Potassium	CaCO <sub>3</sub>	34 + 66	4 + 8
	Total cations			
a)	Hexavalent Chromium	Cr <sup>+6</sup>	BDL	BDL
b)	Calcium	Ca	27.4	47
c)	Magnesium	Mg	16.6	33.3
d)	Total chromium	Cr	0.159	0.048
e)	Copper	Cu	BDL	BDL
f)	Magnesium	Mn	BDL	0.078
g)	Lead	Pb	0.058	0.074
h)	Zinc	Zn	BDL	BDL
i)	Aluminium	Al	BDL	BDL
4	Total alkalinity	-	119.38	326
5	HCO <sub>3</sub>	CaCO <sub>3</sub>	119.38	Nil
6	Chloride	Cl	43	67
7	Sulphate	SO <sub>4</sub>	23	39
	Total Anions			
	Flourides	F	0.77	0.814
	Nitrites	NO <sub>2</sub>	BDL	0.016
	Nitrates	NO <sub>3</sub>	0.04	0.06
	Sulphide	S <sup>-2</sup>	BDL	BDL
8	Silica, Reactive	Si	8.4	16.58
9	Iron (Total)	Fe	0.20	0.415
10	pH		8.4	7.6
11	Organics (KMnO <sub>4</sub> )		0.012	0.20
12	Turbidity	NTU	0.80	2.5
13	Temperature	0 <sup>c</sup>	25	25

BDL- Below Detective Limit

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**CLARIFIED WATER ANALYSIS**

S.No	Constituent	As	mg/l
1	Calcium	CaCo <sub>3</sub>	110
2	Magnesium	CaCo <sub>3</sub>	45
3	Sodium & Potassium	CaCo <sub>3</sub>	25
	Total cations	CaCo <sub>3</sub>	180
4	HCO <sub>3</sub>	CaCo <sub>3</sub>	120
5	P-alkalinity	CaCo <sub>3</sub>	0
6	Chloride	CaCo <sub>3</sub>	20
7	Sulphate	CaCo <sub>3</sub>	40
	Total Anions	CaCo <sub>3</sub>	180
8	Silica, Reactive	Si	10
9	Iron (Total)	Fe	0.3
10	pH		7.0-8.0
11	Turbidity	NTU	2
13	Temperature	0 <sup>c</sup>	15-36

**ANALYSIS OF DM WATER TO BE USED FOR MAKE-UP WATER TO CONDENSER**

Sl.No.	Characteristics	Value
1.	Silica (Max.)	0.02 ppm as Sio <sub>2</sub>
2.	Iron as Fe	Nil
3.	Total hardness	Nil
4.	pH value	6.8 to 7.2
5.	Conductivity	Not more than 0.1 μs/cm excluding the effects of free CO <sub>2</sub>

<b>SINGARENI THERMAL POWER PROJECT (2X600 MW) BOILER TURBINE GENERATOR PACKAGE</b>	<b>TECHNICAL SPECIFICATION SECTION - VI PART-A</b>	<b>SUB-SECTION-I PROJECT INFORMATION</b>	<b>PAGE 6 OF 12</b>
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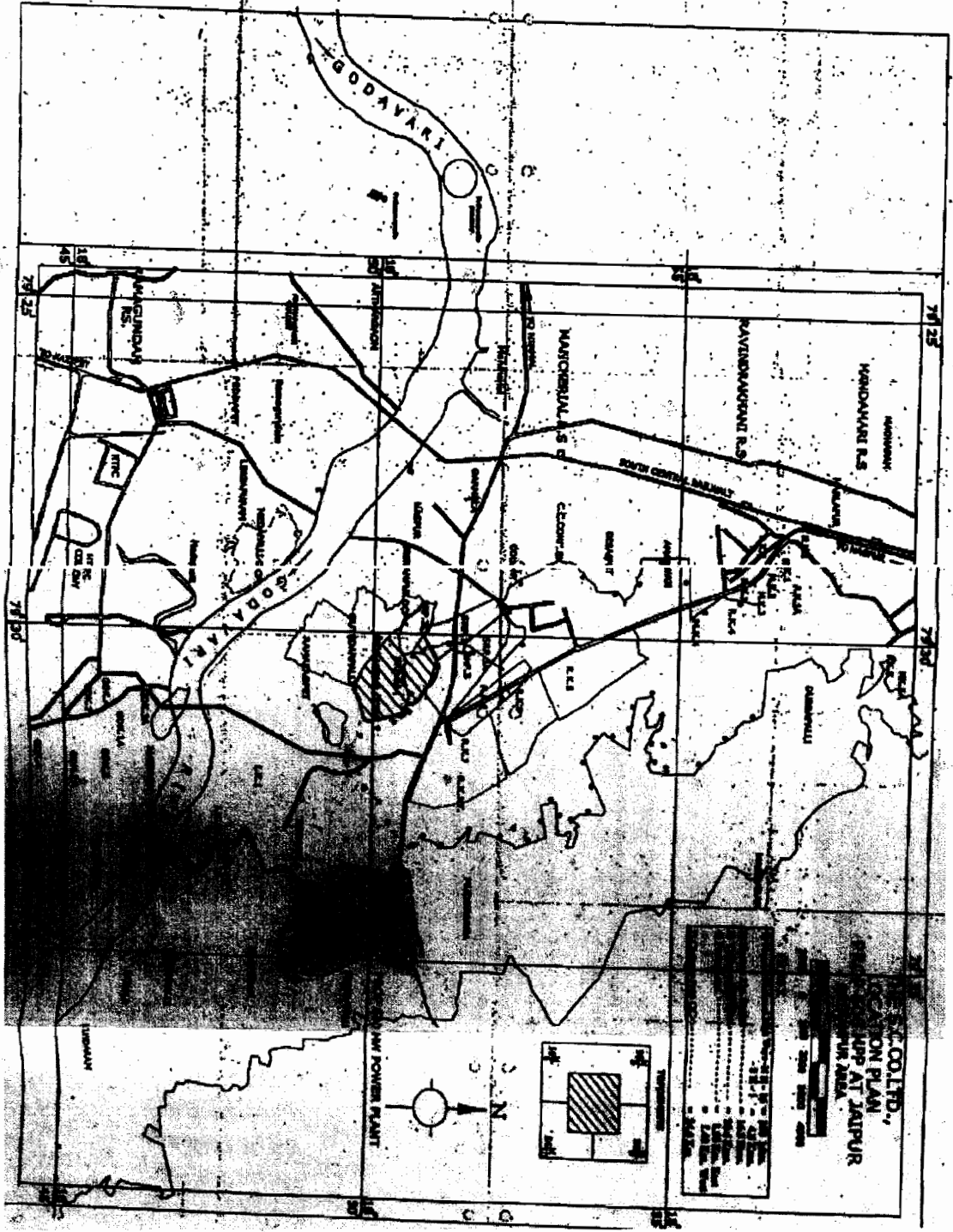
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VICINITY PLAN

ANNEXURE-I



SINGARENI THERMAL POWER PROJECT  
(2X600 MW)  
BOILER TURBINE GENERATOR PACKAGE

TECHNICAL SPECIFICATION  
SECTION - VI  
PART-A

SUB-SECTION-I  
PROJECT INFORMATION

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<b>ANNEXURE-II-1 (PAGE 1 OF 2)</b>							
<b>TABLE - 1 COAL CHARACTERISTICS</b>							
Sl. No.	Characteristics	Unit	Range of 95% Coal supplies			Range of (5%)Coal supplies	
			Design Coal	Worst Coal	Best Coal		
1	2	3	4	5	6	7	
1.0	<b>PROXIMATE ANALYSIS</b> (As received basis)						
1.1	Total Moisture	%	7.62	6.62	8.04	7.50- 12.00	
1.2	Ash	%	30.72	37.71	29.32	30.00 -48.00	
1.3	Volatile Matter	%	27.95	25.83	26.37	25.00 -30.00	
1.4	Fixed Carbon	%	33.71	29.84	36.27	35.00 -25.00	
2.0	<b>ULTIMATE ANALYSIS</b> (As received basis)						
2.1	Carbon	C%	49.41	41.63	49.38	40.00 - 55.00	
2.2	Hydrogen	H <sub>2</sub> %	2.83	2.50	3.93	2.50 - 4.00	
2.3	Nitrogen	N <sub>2</sub> %	0.85	0.81	1.12	0.50- 1.20	
2.4	Oxygen (by difference)	N <sub>2</sub> %	7.96	8.27	7.81	6.00 - 9.00	
2.5	Sulphur	S%	0.42	0.69	0.21	0.20 - 1.00	
2.6	Carbonates	CO <sub>2</sub> %	0.19	1.77	0.19	0.19 - 1.77	
2.7	Phosphorous	P <sub>2</sub> %	0.00	0.00	0.00	0.00	
2.8	Total Moisture	H <sub>2</sub> O%	7.62	6.62	8.04	7.50 -12.00	
2.9	Ash	%	30.72	37.71	29.32	30.00 -48.00	
2.10	Gross Calorific Value	KCal/Kg	4529	3786	4724	4800-3600	
(as received basis)							
2.11	Hard Grove Index			52	60	48	45 -70
2.12	YGP index			69.80	61.60	69.80	61.60 - 69.80
<b>SINGARENI THERMAL POWER PROJECT (2X600 MW) BOILER TURBINE GENERATOR PACKAGE</b>			<b>TECHNICAL SPECIFICATION SECTION - VI PART-A</b>		<b>SUB-SECTION-I PROJECT INFORMATION</b>		<b>PAGE 8 OF 12</b>

CLAUSE NO.	PROJECT INFORMATION					
<b>ANNEXURE-II-1 (PAGE 2 OF 2)</b>						
Sl. No.	Characteristics	Unit	Range of 95% Coal supplies			Range of (5%)Coal supplies
			Design Coal	Worst Coal	Best Coal	
1	2	3	4	5	6	7
<b>3.0</b>	<b>ASH ANALYSIS</b>					
3.1	Silica (SiO <sub>2</sub> )	%	67.36	66.11	59.966	55.00- 70.00
3.2	Alumina (Al <sub>2</sub> O <sub>3</sub> )	%	21.28	24.48	23.756	20.00 – 26.00
3.3	Iron Oxide (Fe <sub>2</sub> O <sub>3</sub> )	%	8.11	5.57	6.854	5.00 – 10.00
3.4	Titania (TiO <sub>2</sub> )	%	0.00	0.00	0.00	1.00 – 1.50
3.5	Phosphoric (P <sub>2</sub> O <sub>5</sub> ) Anhydride	%	0.00	0.00	0.00	0.0 – 0.50
3.6	Lime (CaO)	%	1.60	2.32	5.774	1.50 - 8.00
3.7	Magnesia (MgO)	%	0.00	0.00	0.00	0.00 – 3.00
3.8	Sulphuric (SO <sub>3</sub> ) Anhydride	%	0.00	0.00	0.00	0.40 – 0.80
3.9	Sodium Oxide (Na <sub>2</sub> O)	%	0.20	0.15	0.192	0.10 – 0.35
3.10	Balance Alkalies (by difference)	%	1.45	1.37	3.46	1.25 – 4.00
<b>4.0</b>	<b>ASH FUSION RANGE (Reducing Atmosphere)</b>					
4.1	Initial Deformation Temperature (IDT)	°C	1400	1380	1342	1150 – 1400
4.2	Hemispherical Temperature	°C	1400	1400	1400	1300 - 1400
4.3	Flow Temp.	°C	1400	1400	1400	1400 - 1400
<b>SINGARENI THERMAL POWER PROJECT (2X600 MW) BOILER TURBINE GENERATOR PACKAGE</b>		<b>TECHNICAL SPECIFICATION SECTION - VI PART-A</b>		<b>SUB-SECTION-I PROJECT INFORMATION</b>		<b>PAGE 9 OF 12</b>

CLAUSE NO.	PROJECT INFORMATION			
	<b>ANNEXURE-II-2 (PAGE 1 OF 2)</b>			
	<b>FUEL OIL CHARACTERISTICS</b>			
Sl. No.	Characteristics	Heavy Furnace Oil Grade HV IS-1593-1982	Low Sulphur Heavy Stock (LSHS) IS-11489-1985	Heavy Petroleum Stock (HPS) IS-11489-1985
1.	Total sulphur content	4.5% Max.	1.0% Max.	4.5% Max.
2.	Gross calorific value (KCal/kg)	of the order of 10,000	of the order of 10,000	of the order of 10,000
3.	Flash Point (Min)	66 deg C	66 deg C	72 deg C
4.	Water content by volume (Max)	1.0%	1.0%	1.0%
5.	Sediment by weight (Max)	0.25%	0.25%	0.25%
6.	Asphaltene content by weight (Max.)	2.5%	2.5%	2.5%
7.	Kinematic viscosity in Centistokes at - (Max)	370 at 50deg C	100 at 100deg C	100 at 100deg C
8.	Ash Content by weight (Max.)	0.1%	0.1%	0.1%
9.	Acidity (inorganic)	Nil	Nil	Nil
10.	Pour Point (Max.)	57 deg C	66 deg C	72 deg C
11.	Sodium content	—	—	100 ppm
12.	Vanadium content	25 ppm	25 ppm	25 ppm
13.	Specific heat below pour point (KCal/Kg °C)		0.65	

CLAUSE NO.	PROJECT INFORMATION																								
	<p style="text-align: right;"><b>ANNEXURE-II-2 (PAGE 2 OF 2)</b></p> <p style="text-align: center;"><b>LIGHT DIESEL OIL CHARACTERISTICS</b></p> <p style="text-align: center;"><b>AS PER IS 1460-2000</b></p> <table border="0" style="width: 100%;"> <thead> <tr> <th style="text-align: left;">Characteristics</th> <th style="text-align: left;">LDO</th> </tr> </thead> <tbody> <tr> <td>1. Pour Point (max)</td> <td>21 °C &amp; 12°C for Summer and Winter respectively</td> </tr> <tr> <td>2. Kinematic viscosity in centistokes at 40 deg.C</td> <td>2.5 to 15.7</td> </tr> <tr> <td>3. Sediment percent by mass (max)</td> <td>0.10</td> </tr> <tr> <td>4. Total sulphur percent by mass (max)</td> <td>1.8</td> </tr> <tr> <td>5. Ash percentage by mass (max)</td> <td>0.02</td> </tr> <tr> <td>6. Carbon residue (Rans bottom) percent by pass (max.)</td> <td>1.50</td> </tr> <tr> <td>7. Acidity inorganic</td> <td>Nil</td> </tr> <tr> <td>8. Flash point (Min.) - Pensky Martens</td> <td>66 deg.C</td> </tr> <tr> <td>9. Copper strip corrosion for 3 hours at 100°C</td> <td>Not worse than No. 2</td> </tr> <tr> <td>10. Water content, % by volume (max)</td> <td>0.25</td> </tr> </tbody> </table>			Characteristics	LDO	1. Pour Point (max)	21 °C & 12°C for Summer and Winter respectively	2. Kinematic viscosity in centistokes at 40 deg.C	2.5 to 15.7	3. Sediment percent by mass (max)	0.10	4. Total sulphur percent by mass (max)	1.8	5. Ash percentage by mass (max)	0.02	6. Carbon residue (Rans bottom) percent by pass (max.)	1.50	7. Acidity inorganic	Nil	8. Flash point (Min.) - Pensky Martens	66 deg.C	9. Copper strip corrosion for 3 hours at 100°C	Not worse than No. 2	10. Water content, % by volume (max)	0.25
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<b>SINGARENI THERMAL POWER PROJECT (2X600 MW) BOILER TURBINE GENERATOR PACKAGE</b>	<b>TECHNICAL SPECIFICATION SECTION - VI PART-A</b>	<b>SUB-SECTION-I PROJECT INFORMATION</b>	<b>PAGE 11 OF 12</b>																						

CLAUSE NO.

PROJECT INFORMATION

CLIMATOLOGICAL TABLE

ANNEXURE-III

(PAGE 1 OF 1)

CLIMATOLOGICAL TABLE

1971-8 2000 WTS 4.5 km x 4.5 km  
BASED ON OBSERVATIONS FROM 1981 TO 1990

120° 17' 42" E LONGITUDE  
18° 10' 45" N LATITUDE

MONTH	MEAN												EXTREME		HUMIDITY		GLASS		WIND		RAINFALL		TOTAL IN MONTH	TOTAL IN YEAR	NO. OF DAYS	WIND SPEED																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																						
	WET	WET	WET	WET	WET	WET	WET	WET	WET	WET	WET	WET	WET	WET	WET	WET	WET	WET	WET	WET	WET	WET					WET	WET	WET	WET																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		
JAN	26.1	26.2	26.3	26.4	26.5	26.6	26.7	26.8	26.9	27.0	27.1	27.2	27.3	27.4	27.5	27.6	27.7	27.8	27.9	28.0	28.1	28.2	28.3	28.4	28.5	28.6	28.7	28.8	28.9	29.0	29.1	29.2	29.3	29.4	29.5	29.6	29.7	29.8	29.9	30.0	30.1	30.2	30.3	30.4	30.5	30.6	30.7	30.8	30.9	31.0	31.1	31.2	31.3	31.4	31.5	31.6	31.7	31.8	31.9	32.0	32.1	32.2	32.3	32.4	32.5	32.6	32.7	32.8	32.9	33.0	33.1	33.2	33.3	33.4	33.5	33.6	33.7	33.8	33.9	34.0	34.1	34.2	34.3	34.4	34.5	34.6	34.7	34.8	34.9	35.0	35.1	35.2	35.3	35.4	35.5	35.6	35.7	35.8	35.9	36.0	36.1	36.2	36.3	36.4	36.5	36.6	36.7	36.8	36.9	37.0	37.1	37.2	37.3	37.4	37.5	37.6	37.7	37.8	37.9	38.0	38.1	38.2	38.3	38.4	38.5	38.6	38.7	38.8	38.9	39.0	39.1	39.2	39.3	39.4	39.5	39.6	39.7	39.8	39.9	40.0	40.1	40.2	40.3	40.4	40.5	40.6	40.7	40.8	40.9	41.0	41.1	41.2	41.3	41.4	41.5	41.6	41.7	41.8	41.9	42.0	42.1	42.2	42.3	42.4	42.5	42.6	42.7	42.8	42.9	43.0	43.1	43.2	43.3	43.4	43.5	43.6	43.7	43.8	43.9	44.0	44.1	44.2	44.3	44.4	44.5	44.6	44.7	44.8	44.9	45.0	45.1	45.2	45.3	45.4	45.5	45.6	45.7	45.8	45.9	46.0	46.1	46.2	46.3	46.4	46.5	46.6	46.7	46.8	46.9	47.0	47.1	47.2	47.3	47.4	47.5	47.6	47.7	47.8	47.9	48.0	48.1	48.2	48.3	48.4	48.5	48.6	48.7	48.8	48.9	49.0	49.1	49.2	49.3	49.4	49.5	49.6	49.7	49.8	49.9	50.0	50.1	50.2	50.3	50.4	50.5	50.6	50.7	50.8	50.9	51.0	51.1	51.2	51.3	51.4	51.5	51.6	51.7	51.8	51.9	52.0	52.1	52.2	52.3	52.4	52.5	52.6	52.7	52.8	52.9	53.0	53.1	53.2	53.3	53.4	53.5	53.6	53.7	53.8	53.9	54.0	54.1	54.2	54.3	54.4	54.5	54.6	54.7	54.8	54.9	55.0	55.1	55.2	55.3	55.4	55.5	55.6	55.7	55.8	55.9	56.0	56.1	56.2	56.3	56.4	56.5	56.6	56.7	56.8	56.9	57.0	57.1	57.2	57.3	57.4	57.5	57.6	57.7	57.8	57.9	58.0	58.1	58.2	58.3	58.4	58.5	58.6	58.7	58.8	58.9	59.0	59.1	59.2	59.3	59.4	59.5	59.6	59.7	59.8	59.9	60.0	60.1	60.2	60.3	60.4	60.5	60.6	60.7	60.8	60.9	61.0	61.1	61.2	61.3	61.4	61.5	61.6	61.7	61.8	61.9	62.0	62.1	62.2	62.3	62.4	62.5	62.6	62.7	62.8	62.9	63.0	63.1	63.2	63.3	63.4	63.5	63.6	63.7	63.8	63.9	64.0	64.1	64.2	64.3	64.4	64.5	64.6	64.7	64.8	64.9	65.0	65.1	65.2	65.3	65.4	65.5	65.6	65.7	65.8	65.9	66.0	66.1	66.2	66.3	66.4	66.5	66.6	66.7	66.8	66.9	67.0	67.1	67.2	67.3	67.4	67.5	67.6	67.7	67.8	67.9	68.0	68.1	68.2	68.3	68.4	68.5	68.6	68.7	68.8	68.9	69.0	69.1	69.2	69.3	69.4	69.5	69.6	69.7	69.8	69.9	70.0	70.1	70.2	70.3	70.4	70.5	70.6	70.7	70.8	70.9	71.0	71.1	71.2	71.3	71.4	71.5	71.6	71.7	71.8	71.9	72.0	72.1	72.2	72.3	72.4	72.5	72.6	72.7	72.8	72.9	73.0	73.1	73.2	73.3	73.4	73.5	73.6	73.7	73.8	73.9	74.0	74.1	74.2	74.3	74.4	74.5	74.6	74.7	74.8	74.9	75.0	75.1	75.2	75.3	75.4	75.5	75.6	75.7	75.8	75.9	76.0	76.1	76.2	76.3	76.4	76.5	76.6	76.7	76.8	76.9	77.0	77.1	77.2	77.3	77.4	77.5	77.6	77.7	77.8	77.9	78.0	78.1	78.2	78.3	78.4	78.5	78.6	78.7	78.8	78.9	79.0	79.1	79.2	79.3	79.4	79.5	79.6	79.7	79.8	79.9	80.0	80.1	80.2	80.3	80.4	80.5	80.6	80.7	80.8	80.9	81.0	81.1	81.2	81.3	81.4	81.5	81.6	81.7	81.8	81.9	82.0	82.1	82.2	82.3	82.4	82.5	82.6	82.7	82.8	82.9	83.0	83.1	83.2	83.3	83.4	83.5	83.6	83.7	83.8	83.9	84.0	84.1	84.2	84.3	84.4	84.5	84.6	84.7	84.8	84.9	85.0	85.1	85.2	85.3	85.4	85.5	85.6	85.7	85.8	85.9	86.0	86.1	86.2	86.3	86.4	86.5	86.6	86.7	86.8	86.9	87.0	87.1	87.2	87.3	87.4	87.5	87.6	87.7	87.8	87.9	88.0	88.1	88.2	88.3	88.4	88.5	88.6	88.7	88.8	88.9	89.0	89.1	89.2	89.3	89.4	89.5	89.6	89.7	89.8	89.9	90.0	90.1	90.2	90.3	90.4	90.5	90.6	90.7	90.8	90.9	91.0	91.1	91.2	91.3	91.4	91.5	91.6	91.7	91.8	91.9	92.0	92.1	92.2	92.3	92.4	92.5	92.6	92.7	92.8	92.9	93.0	93.1	93.2	93.3	93.4	93.5	93.6	93.7	93.8	93.9	94.0	94.1	94.2	94.3	94.4	94.5	94.6	94.7	94.8	94.9	95.0	95.1	95.2	95.3	95.4	95.5	95.6	95.7	95.8	95.9	96.0	96.1	96.2	96.3	96.4	96.5	96.6	96.7	96.8	96.9	97.0	97.1	97.2	97.3	97.4	97.5	97.6	97.7	97.8	97.9	98.0	98.1	98.2	98.3	98.4	98.5	98.6	98.7	98.8	98.9	99.0	99.1	99.2	99.3	99.4	99.5	99.6	99.7	99.8	99.9	100.0	100.1	100.2	100.3	100.4	100.5	100.6	100.7	100.8	100.9	101.0	101.1	101.2	101.3	101.4	101.5	101.6	101.7	101.8	101.9	102.0	102.1	102.2	102.3	102.4	102.5	102.6	102.7	102.8	102.9	103.0	103.1	103.2	103.3	103.4	103.5	103.6	103.7	103.8	103.9	104.0	104.1	104.2	104.3	104.4	104.5	104.6	104.7	104.8	104.9	105.0	105.1	105.2	105.3	105.4	105.5	105.6	105.7	105.8	105.9	106.0	106.1	106.2	106.3	106.4	106.5	106.6	106.7	106.8	106.9	107.0	107.1	107.2	107.3	107.4	107.5	107.6	107.7	107.8	107.9	108.0	108.1	108.2	108.3	108.4	108.5	108.6	108.7	108.8	108.9	109.0	109.1	109.2	109.3	109.4	109.5	109.6	109.7	109.8	109.9	110.0	110.1	110.2	110.3	110.4	110.5	110.6	110.7	110.8	110.9	111.0	111.1	111.2	111.3	111.4	111.5	111.6	111.7	111.8	111.9	112.0	112.1	112.2	112.3	112.4	112.5	112.6	112.7	112.8	112.9	113.0	113.1	113.2	113.3	113.4	113.5	113.6	113.7	113.8	113.9	114.0	114.1	114.2	114.3	114.4	114.5	114.6	114.7	114.8	114.9	115.0	115.1	115.2	115.3	115.4	115.5	115.6	115.7	115.8	115.9	116.0	116.1	116.2	116.3	116.4	116.5	116.6	116.7	116.8	116.9	117.0	117.1	117.2	117.3	117.4	117.5	117.6	117.7	117.8	117.9	118.0	118.1	118.2	118.3	118.4	118.5	118.6	118.7	118.8	118.9	119.0	119.1	119.2	119.3	119.4	119.5	119.6	119.7	119.8	119.9	120.0	120.1	120.2	120.3	120.4	120.5	120.6	120.7	120.8	120.9	121.0	121.1	121.2	121.3	121.4	121.5	121.6	121.7	121.8	121.9	122.0	122.1	122.2	122.3	122.4	122.5	122.6	122.7	122.8	122.9	123.0	123.1	123.2	123.3	123.4	123.5	123.6	123.7	123.8	123.9	124.0	124.1	124.2	124.3	124.4	124.5	124.6	124.7	124.8	124.9	125.0	125.1	125.2	125.3	125.4	125.5	125.6	125.7	125.8	125.9	126.0	126.1	126.2	126.3	126.4	126.5	126.6	126.7	126.8	126.9	127.0	127.1	127.2	127.3	127.4	127.5	127.6	127.7	127.8	127.9	128.0	128.1	128.2	128.3	128.4	128.5	128.6	128.7	128.8	128.9	129.0	129.1	129.2	129.3	129.4	129.5	129.6	129.7	129.8	129.9	130.0	130.1	130.2	130.3	130.4	130.5	130.6	130.7	130.8	130.9	131.0	131.1	131.2	131.3	131.4	131.5	131.6	131.7	131.8	131.9	132.0	132.1	132.2	132.3	132.4	132.5	132.6	132.7	132.8	132.9	133.0	133.1	133.2	133.3	133.4	133.5	133.6	133.7	133.8	133.9	134.0	134.1	134.2	134.3	134.4	134.5	134.6	134.7	134.8	134.9	135.0	135.1	135.2	135.3	135.4	135.5	135.6	135.7	135.8	135.9	136.0	136.1	136.2	136.3	136.4	136.5	136.6	136.7	136.8	136.9	137.0	137.1	137.2	137.3	137.4	137.5	137.6	137.7	137.8	137.9	13



**TITLE : TECHNICAL SPECIFICATION  
FOR  
CONDENSER ON LOAD TUBE CLEANING  
SYSTEMS (COLTCS) & DEBRIS FILTER (DF)**

**SPEC. NO. PE-TS-381/382-165-N001**

**VOLUME : II B**

**SECTION : B**

**REV. NO. 0**

**DATE : 12.04.2012**

**SHEET 1 of 1**

**PROJECT INFORMATION**

**1 x 300 MW VISHAKHAPATNAM ABHIJEET TPP**

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## CONTENT

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2.00.00	APPROACH TO SITE	V.IIA/S-III : 1
3.00.00	LAND	V.IIA/S-III : 1
4.00.00	SOURCE OF COAL	V.IIA/S-III : 2
5.00.00	SOURCE OF WATER	V.IIA/S-III : 2
6.00.00	ASH DISPOSAL AREA	V.IIA/S-III : 2
7.00.00	SALIENT DESIGN DATA	V.IIA/S-III : 2

**VOLUME: IIA****SECTION-III****PROJECT SYNOPSIS AND GENERAL INFORMATION****1.00.00 INTRODUCTION**

The proposed 1 x 300 MW Kaizen Thermal Power Plant would be set up by Kaizen Power Limited (KPL) at APSEZ, Atchutapuram near Visakhapatnam, in the state of Andhra Pradesh, India.

The Bidder shall acquaint himself by a visit to the site, if felt necessary, with the conditions prevailing at site before submission of the bid. The information given here in under is for general guidance and shall not be contractually binding on the Owner. All relevant site data /information as may be necessary shall have to be obtained /collected by the Bidder.

**2.00.00 APPROACH TO SITE**

The Project site is at APSEZ at Atchutapuram and Rambilli Mandal in Visakhapatnam district in Andhra Pradesh, located near to Latitude: 17° 33' - North and 83° 07' - East adjacent with its Ferroalloy complex, Railway Station at Anakapalli is about 18 KM away from site.

Nearest Airport - Visakhapatnam (40KM) Nearest

Seaport - Gangavaram (about 35 KM) Nearest

Railway Station - Anakapalli (about 18 KM) Nearest

National Highway - NH-5 (about 18 KM)

**3.00.00 LAND**

The total land proposed to be required taking into account the locations of various facilities and plant auxiliaries for Kaizen Thermal Power Plant 1 x 300 MW will be as per Site Location Plan enclosed. The Bidder shall accommodate equipment offered under this specification generally within the spaces allocated for such equipment in the Site Location Plan. Specific approval from Owner/Consultant shall be taken by the Contractor prior to any revision or relocation.

**4.00.00 SOURCE OF COAL**

50% of coal shall be through linkage from Indian mines and balance 50% through imported coal which shall be blended suitably. Imported coal shall be from Indonesia mines by sea passage to Gangavaram Port to Plant by rail/road/conveyor. However, there may be 100% of coal through linkage from Indian mines only.

**5.00.00 SOURCE OF WATER**

The water requirement for the Power station will be met by drawing water from the Bay of Bengal.

The Power station will operate on condenser cooling system using induced draft cooling towers. In addition all water conservation and recycling measures will be adopted to minimize requirement of make up water.

**6.00.00 ASH DISPOSAL AREA**

Land considered for ash disposal area is about 100 Ha about 4 to 5 Kms away from the site.

**7.00.00 SALIENT DESIGN DATA**

7.01.00 Meteorological data of site is given below:-

Maximum Dry Bulb Temperature	42 °C
Minimum Dry Bulb Temperature	32 <sup>D</sup> C
Maximum Wet Bulb Temperature	28°C
Minimum Wet bulb temperature	18°C
Relative Humidity	78 - 82%
Average Annual Rainfall	1200 mm
Wind Velocity	40 - 45 KMPH (at 10 M Height)
Seismic Zone	Zone II as per IS:1893 Part-3
Altitude (Observatory)	+16 above MSL

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SEA WATER ANALYSIS OF VIZAG

Sl. No.	TEST	UNIT	RESULT
1.	Conductivity	$\mu\text{s/cm}$	39000 - 42000
2.	TDS	PPM	33020 - 43446
3.	pH	-	7.6 - 8.9
4.	Suspended Solid	mg/l	200
5.	Total Hardness, as $\text{CaCO}_3$	mg/l	6206 - 6650
6.	Calcium, as $\text{CaCO}_3$	mg/l	700 - 2400
7.	Magnesium, as Mg	mg/l	1800 - 2000
8.	M Alkalinity, as $\text{CaCO}_3$	mg/l	110 - 124
9.	Sulfate, as $\text{SO}_3$	mg/l	2665 - 3058
10.	Silica, as $\text{SiO}_2$	mg/l	2.0 - 4.5
11.	Sodium, as Na	mg/l	12000 - 14500
12.	Potassium	mg/l	500 - 950
13.	Chloride	mg/l	21361 - 21685
14.	Nitrate	mg/l	0.5 - 1.3
15.	Free $\text{CO}_2$	mg/l	0
16.	Bicarbonates, as $\text{CaCO}_3$	mg/l	62.0 - 77.5
17.	Carbonate, as $\text{CaCO}_3$	mg/l	44.3 - 48.7
18.	Turbidity	NTU	0.5 - 4.1
19.	Oil Content	-	Not detectable
20.	Total Sulfide, as $\text{H}_2\text{S}$	mg/l	0.97 - 1.38
21.	Ammoniacal Nitrogen	mg/l	0.6 - 2.1
22.	Iron, as Total Fe	mg/l	1.0 2.5

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## **SECTION – C**

### **SPECIFIC REQUIREMENTS**

- SECTION C1 : CONDENSER ONLOAD TUBE CLEANING  
SYSTEM & DEBRIS FILTER.**
- SECTION C2 : ELECTRICAL SYSTEMS.**
- SECTION C3 : C&I SYSTEMS.**

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## 1.0 GENERAL

The Condenser On load Tube Cleaning Systems and Debris Filter complete with all accessories shall conform to the standard technical specifications (Section-D) and Data Sheet-A enclosed herewith. In addition the requirements of this section C shall also be complied with. However, wherever the details given in Section-D and Data Sheet-A are different, the requirements of Data Sheet-A shall prevail. Similarly in the event of contradictions between Section-C & Section-D/ Data Sheet-A, Section-C shall prevail.

Section C consists of 3 parts viz. Sec. C1, C2 and C3 for Mechanical, Electrical and C&I respectively, the requirements of all 3 sections shall be complied with.

## 2.0 DESCRIPTION OF EQUIPMENTS :

### 2.1 Condenser on load tube cleaning systems (COLTCS) :

The condenser on load tube cleaning system (COLTCS) is intended to prevent formation of various forms of fouling and scaling in the condenser tubes. The cooling water system is of closed circuit type with cooling towers or open circuit type as specified. The water analysis is indicated in project information in section B.

### 2.2 Debris Filter (DF) :

The Debris Filter where specified shall be installed on the on each CW inlet line to condenser to arrest floating matter and prevent clogging of Condenser Tubes. The condenser of each unit shall have two inlet CW lines, the debris filters shall be installed at upstream of COLTCS ball injection. The water analysis is indicated in project information in section B.

## 3.0 SCOPE OF SUPPLY UNDER THE SPECIFICATION IN THE BIDDER'S SCOPE FOR COLTCS & DEBRIS FILTER.

### 3.1 The scope of supply for COLTCS covered under this specification is as under.

The size, MOC's and other particulars of the equipments for various projects are detailed in Data Sheet A annexed with Section – D of the specification.

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SL.NO.	PROJECT	COLTCS
1.	2X600 MW – SCCL, ADILABAD TPP.	4 SETS PER UNIT viz. TOTAL 8 SETS FOR BOTH UNIT.
2.	1 x 300 MW – VISHKHAPATNAM ABHIJEET TPP.	2 SETS PER UNIT viz. TOTAL 2 SETS.

3.2 The scope of supply for Debris Filter covered under this specification is as under.

The size, MOC's and other particulars of the equipments for the project are detailed in Data Sheet A annexed with Section – D of the specification.

SL.NO.	PROJECT	DEBRIS FILTER
1.	1 x 300 MW – VISHKHAPATNAM ABHIJEET TPP.	2 SETS PER UNIT VIZ. TOTAL 2 SETS

### 3.3 SCOPE OF SUPPLY IN THE BIDDER'S SCOPE FOR COLTCS:

3.3.1 Each set of COLTCS for all applicable projects shall comprise of following :

- a) One No. Ball Separator at Condenser CW outlet pipe.
- b) One No. Ball recirculation pump with drive motor.
- c) One No. Ball collector.
- d) One No. Manual ball sorter (Bucket type sorter with sieves to manually sort out the undersized balls by shaking the sieved bucket manually) for each set of COLTCS.
- e) Differential pressure measuring system for ball separator. DP measuring system shall comprise of 2 nos. DPT +1 no. DPG for COLTCS for all Projects. Instrument shall be with *Remote seal* arrangement. Stubs for DPT and DPG shall be independent.
- f) Ball monitoring system comprising of an independent balls recirculation monitor and an independent balls oversize monitor. If bidder is not manufacturing Ball oversize monitor then they can offer other alternatives like automatic ball sorter etc.
- g) Length of Ball separator, Scope of Counter Flange, Nuts and bolts shall be as per Annexure- I of section C1.  
Thickness of body flange and counter flange shall be as per Drg no PE-DG-999-141-MO17 enclosed at enclosures at Annexure-II.

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h) For SCCL, Adilabad TPP Project complete Pipe work, including interconnection piping, valves, flanges, fittings distributors and injection nozzles, support installation materials shall be in Bidder's scope. Bidder shall finalize the pipework to suit the layout at contract stage in such a way that no site welding is required for his pipework otherwise the same shall be carried out by bidder at site.

For Viskhapatnam Abhijit TPP (Sea Water Application) – Only Straight length of Interconnecting Piping is envisaged in Purchaser's scope. However, valves, flanges/Counterflanges for Pipes and Valves, fittings, nuts, bolts, gaskets, injection nozzles & distributors shall be in Bidder's Scope.

i) The Electrical and C&I item / accessory as specified in succeeding clause/ respective sections herein.

j) Power and Control cables between Local Control Panel/starter Panel (Switch Gear) and various drives in bidder's scope of supply for all projects.

k) Scope of LCP & Starter Panel (Switch Gear Panel) shall be as follows:

a) 2 Sets of COLTCS shall have one Common Starter Panel (Switch Gear Panel) for DCS based control system for SCCL, Adilabad TPP.

b) 2 sets of COLTCS shall have one common PLC Control System cum Starter Panel with HMI Screen and one separate LCP/RIO panel with HMI screen for Viskhapatnam Abhijit TPP.

Switch Gear Panel/LCP should have suitable arrangement like Bus Coupler for providing redundancy to incoming supply feeder (1 Working + 1 Standby feeder). Power supply for separate LCP/RIO panel shall be fed from common PLC cum Starter Panel and its cable shall be in scope of bidder.

l) Control cables between field instruments and control panel.

m) All the field instruments stipulated in this specification shall be in Bidder's scope.

n) Commissioning balls and other commissioning spares on "As required basis".

o) Set of mandatory spares as indicated in Data Sheet A.

p) Supporting arrangement complete with foundation plates, anchor bolts, nuts, sleeves, inserts, all installation materials, fixing bolts, clamps and other accessories etc for complete equipment supplied under this package.

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- q) Finish paints for touch up painting of equipment after erection at site, in sealed containers.
- r) Set of special tools and tackles if required for maintenance and erection of the equipment supplied.
- s) Various drawings, data test reports/ certificates instruction manuals for erection operation and maintenance etc. as specified in Data Sheet-C. and cables schedule indicating BOQ for power & control cables.
- t) Local Control Panels & Instruments: Scope and Type as specified in C&I section wherever required.

Any item not specified but required to make COLTCS a complete package shall also be in bidder's scope.

#### 3.4 SCOPE OF SUPPLY OF DEBRIS FILTER INCLUDED IN THE BIDDER'S SCOPE :

##### 3.4.1 Each set of Debris Filter (DF) shall comprise of following :

- a) Flushing pump with drive Motor (if required) - 1 No.
- b) For VISHKHPATNAM ABHIJEET TPP : Only straight pipelength of Debris disposal pipe shall be in Purchaser' scope, However, valves, flanges/ counterflanges of pipe and valves, fittings, nuts, bolts, gaskets, Nozzles, bends in Debris Discharge pipe shall be in Bidder's scope.
- c) Filter body/ housing Vent and drain connections along with their isolating valves.
- d) Length of Debris Filter, Scope of Counter Flange, Nuts and bolts shall be as per Annexure-I of section C1.  
Thickness of body flange and counter flange shall be as per Drg no PE-DG-999-141-MO17 enclosed at enclosures at Annexure-II.
- e) Differential pressure measuring system for DF: DP measuring system shall comprise of 2 Nos.DPT +1 No. DPG for DF for all Projects. Instrument shall be with *Remote seal* arrangement. Stubs for DPT, and DPG shall be independent.
- f) Supporting arrangement complete with foundation plates, anchor bolts, nuts, sleeves, inserts, all installation materials, fixing bolts, clamps and other accessories etc for complete equipment supplied under this package.
- g) Set of commissioning spares, on "As required basis".

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h) The Electrical & C&I items/ accessories as specified in succeeding clause/ respective sections herein.

i) Scope of LCP shall be as follows:

a) 2 sets of Debris Filter shall have one common PLC Control System cum Starter Panel with HMI Screen and one separate LCP/RIO panel with HMI screen for Viskhapatnam Abhijit TPP.

LCP should have suitable arrangement like Bus Coupler for providing redundancy to incoming supply feeder ( 1 Working + 1 Standby feeder).

Power supply for separate LCP/RIO panel shall be fed from common PLC cum Starter Panel and its cable shall in scope of bidder.

j) Power and Control cables between LCP and various drives is in bidder's scope of supply.

k) Control cables between field instruments and junction box / control panel.

l) Set of mandatory spares as indicated in Data Sheet A.

m) All the field instruments stipulated in this specification shall be in Bidder's scope.

n) Finish paints for touch up painting of equipment after erection at site, in sealed containers.

o) Set of special tools and tackles if required for maintenance and erection of the equipment supplied.

p) Various drawings, data test reports/ certificates instruction manuals for erection operation and maintenance etc. as specified in Data Sheet-C. and cables schedule indicating BOQ for power & control cables.

q) Local Control Panels & Instruments: Scope and Type as specified in C&I section wherever required.

Any item not specified but required to make DF a complete package shall also be in bidders scope.

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#### 4.0 SCOPE OF SERVICES INCLUDED IN THE BIDDER'S SCOPE :

The bidder's scope also includes following services at site, for scope under this specification for COLTCS & Debris Filter for respective projects

- a) Installation checks (Erection in BHEL's scope).
- b) Commissioning of equipment.
- c) Trial run for requisite period
- d) Performance Testing

The trial run of equipment shall be generally conducted immediately after commissioning while PG testing shall be conducted at a later date. These activities for different units shall be timed separately.

The no. of visits may be suitably assessed by bidders as per their experience with site stay periods on as required basis.

In the event of order no. of visits as follows shall be made as a minimum with charges included in the bidder's base price itself.

- **For drawings/documents approval**

In the event of order all drawings / documents in soft as well as hard copy shall be submitted within 2 weeks of LOI for approval. Within one week of receipt of BHEL comments, bidder's engineer will visit BHEL Office alongwith revised documents and finalise same herein for further submission to Customer.

Further on receipt of Customer comments, if required bidder's engineer shall visit BHEL/ Customer alongwith soft copy to resolve all issues and incorporate comments in the soft copy for across the table finalisation and Category-I approval.

- **Site Visits :**

- i. No. of site visits for combined activities of erection checks and commissioning for COLTCS/DF as applicable shall be one per unit - for both sets of equipments of one unit. Time duration for erection and commissioning shall be "on as required basis" with equipments run for trial operation thereafter for requisite period to demonstrate satisfactory operation.

However the no. of visits may be suitably assessed by bidders as per their experience with site stay periods on as required basis.

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ii. Bidder shall demonstrate guarantees including balls recovery, life of balls, pressure drops, etc. at site during subsequent visit for COLTCS/DF of each unit.

iii. For trouble shooting on "as required basis".

**5.0 EXCLUSIONS :**

The following are excluded from the bidder's scope .

5.1 Civil foundation works required for installation

5.2 Erection of Equipment at site.

**6.0 DESIGN CONSTRUCTION :**

In addition to the requirements of Section-D the following shall also be complied with for packages/ projects under scope of this specification:

6.1 For COLTCS & DF- Layout Piping Arrangement Drg. are not enclosed in the specifications and same shall be provided during detail engineering.

6.2 Thickness of body flange and counter flange of COLTCS and DF shall be as per Drg no PE-DG-999-141-MO17 enclosed at enclosures at Annexure-II.

6.3 The materials of construction specified in Data Sheet-A are minimum requirements and materials of construction for other components not specified shall be similarly selected by the bidder for the intended duty which shall be subject to purchaser's approval during detailed engineering in the event of order.

6.4 Housing/ body of COLTCS & Debris Filter shall be designed and manufactured as per the applicable codes for pressure vessels and to take care of force and moments as enclosed in the specification. However in no case thickness of housing/ body shall be less than connecting pipe thickness as specified in Data Sheet-A of COLTCS and Debris Filter.

6.5 Adequate provision for future installation of Cathodic Protection for COLTCS (Sacrificial type shall be in - Purchaser Scope) shall be kept by the bidder in the equipment for SCCL, ADILABAD TPP.

6.6 Adequate sacrificial Type Anode cathodic Protection for COLTCS and DF for VISHKHAPATNAM ABHIJEET TPP ( Sea Water Application) shall be provided by the bidder in the equipment.

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6.7 Any flow straightner for streamlining the CW flow in balls collecting strainer if required shall be supplied by the bidder along with mounting arrangement and the fixing details. For Sea water application project - VISHKHAPATNAM ABHIJEET TPP, vendor to ensure that material of guide vane shall be suitable for Sea water ,also suitable paintings on guide vanes plates shall be in Bidder's scope.

6.8 Velocity in the pipe work shall be less than 1.5 m/ sec for pump suction and less than 2.2 m/ sec. in other pipe work. All valves upto 150 NB shall be ball valves. For higher sizes, gate/ globe/ B.F. valves shall be provided. All instrument valves shall be needle valves.

#### 7.0 Performance Guarantee and Testing :

The Tube Cleaning Systems and DF shall be guaranteed to meet the performance requirements specified in Section-D and also for trouble free operation after commissioning. Schedule of performance guarantees (enclosed in Volume III) duly filled and signed shall be furnished with the bid.

The Performance guarantees of equipments shall stand valid till the satisfactory completion of performance testing & its acceptance by BHEL/ Consultant/Customer. If the guarantee period specified in the Commercial Specification is higher, same shall prevail.

#### 8.0 Performance Guarantee and Bid Evaluation criteria for Condenser on Load Tube Cleaning System and Debris Filter.

##### 8.1 Condenser On Load Tube Cleaning Systems

8.1.1 Performance Parameters to be guaranteed by bidders for COLTCS of all projects shall be as under :

- i) Pressure drop in ball separator in clean condition viz. after back washing.
- ii) Percentage recovery of balls (min. 95% recovery)
- iii) Life of Sponge Rubber Ball (Min. 4 weeks)

8.1.2 Bidder to note that bids shall be evaluated on account of pressure drop across ball collecting strainer (in clean condition) and liquidated damages on account of not meeting the same during PG test shall be in accordance with following

#### A) Bid Evaluation Criteria & Liquidated Damages:

The bids received shall be evaluated for Pressure drop across balls collecting strainers:



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- The permissible limit of pressure drop across balls collecting strainers in clean condition shall be 0.15 MWC.
- If the pressure drops quoted are higher than above limit, the bids shall be technically loaded @ Rate as mentioned in Data Sheet-A for respective projects per **0.05 MWC** pressure drop across each balls collecting strainer.
- However no advantage shall be given for pressure drops quoted less than above permissible limit.
- The maximum acceptable limit for pressure drop across balls collecting strainer shall be (with technical loadings) 0.2 MWC.  
The bids will be technically rejected for pressure drops quoted higher than above maximum limit.
- The guaranteed pressure drops shall be demonstrated at site by bidder and if found higher shall be subject to LD @ twice the bid evaluation factor as above.

**8.1.3 Other Guaranteed Parameters to be demonstrated at site :**

- i) Life of sponge rubber balls shall be minimum 4 weeks.
- ii) Percentage recovery of balls shall be minimum 95%.

Any deviation to above balls life and percentage recovery will not be accepted.

Bidder to indicate the life of sponge rubber ball and nos. of balls lost during 1000 hours of plant operation in the Guarantee schedule and shall demonstrate same at site.

In case the successful bidder fails to demonstrate any of these parameters he shall carry out modifications at his own cost, to purchasers approval.

In case bidder fails to demonstrate above parameters to purchaser's satisfaction even after modification carried by him at site, the purchaser has the right to reject the equipment out rightly.

**8.2 Debris Filters :**

**8.2.1 Performance Guarantee Parameters shall be as under :**

- Pressure drop in Debris Filters in clean condition viz. after backwashing.

**8.2.2 Bidder to note that bids shall be evaluated on account of pressure drop across Debris Filters (in clean condition) & liquidated damages on account of not meeting the same shall be in accordance with following :**

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**A) Bid Evaluation Criteria and Liquidated Damages:**

The bids received shall be evaluated for Pressure drop across Debris Filters :

- The permissible limit of pressure drop across Debris Filters in clean condition shall be 0.5 MWC.
- If the pressure drops quoted are higher than above limit, the bids shall be technically loaded @ Rate as mentioned in Data Sheet-A for respective projects per **0.3 MWC** pressure drop.
- However no advantage shall be given for pressure drops quoted less than above permissible limit.
- The maximum acceptance limit for pressure drop across Debris Filter (with technical loading) shall be 0.8 MWC.  
The bids will be technically rejected for pressure drops quoted higher than above maximum limit.
- The guaranteed pressure drops shall be demonstrated at site by vendors and if found higher shall be subject to LD @ twice the bid evaluation factor as above.

**9.0 SPARES :**

**9.1 Recommended Spares :**


The supply of spare parts as necessary recommended by the manufacture for three (3) years of reliable operation and maintenance of COLTCS of respective projects shall be supplied. List of such spares along with the unit price shall not be included in base price but indicated separately in the schedule of prices for recommended spares enclosed in Vol. -III.

**9.2 Mandatory Spares**

Mandatory Spares shall be as per Data Sheet-A or annexure enclosed with data sheet of the respective packages applicable for specific projects, prices for same shall be included by bidder in the equipment base price itself.

**10.0 Quality Plan**

Bidder shall submit QP in the event of order based on the guidelines given in the specification & QP enclosed therein. QP will be subject to BHEL/ Customer approval and customer hold points for inspection/ testing shall be marked in the QP at the contract stage. Inspection/ testing shall be witnessed as per same apart from review of various test certificates/ Inspection records etc. Charges for 3<sup>rd</sup> party inspection (TUV/ equivalent) for imported components wherever required shall be included by bidder in the base price itself. Witness for all the test identified under agency "C" & "N" in Quality plan shall be by third party.

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If BHEL or BHEL customer decides to witness the tests along with third party, the cost of travel of BHEL or BHEL customer shall be borne by BHEL or BHEL customer themselves.

#### 11.0 DELIVERY & DRAWINGS/ DOCUMENTS DISTRIBUTION SCHEDULE :

a. Delivery of Equipment for each project shall be as per NIT.

b. The drawings to be submitted by bidder in event of award of contract for COLTCS & DF, for each project shall be as follows:

- Technical Data Sheets, P&ID, Installation Plan, for COLTCS & DF.
- GA drawings, Details of BR Skid and C& I Document( Part-I & II) of COLTCS & DF as applicable.
- Quality Plan.
- O & M Manual.

c. Drawings submission schedule as follows :

- 1st submission of drawings from date of LOI –
  - Technical Data Sheets, P&ID, GA Drawings, Details of BR Skid and C& I Part-I Document ( Design Phy/ Write-Up)and Quality Plan – 2 weeks
  - Installation Plan – 4 weeks
  - C&I Part-II Document( Detailed docs of Local control Panel) – 6 weeks from the Approval of C&I Part-I document.
- Every revised submission incorporating comments – within 10 days.

12.0 The makes of various bought out items shall be subjected to purchaser's approval in the event of order.

13.0 It is mandatory for the bidders to submit along with the bid the deviations if any whether major or minor in the schedule of deviations only. ***In the absence of deviations listed in the schedule of deviations the offer shall be deemed to be in full conformity with the specification "non-withstanding" any thing else stated elsewhere in bidder's offer, data sheets etc. The implied/ indirect deviations in data sheets etc. Shall not be binding on the purchaser.***

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**14.0** The following documents shall be furnished by the bidder with his offer :

- Compliance certificate duly signed and stamped (Enclosed at Schedules).
- Guarantee schedule duly signed and stamped (Enclosed at Schedules).
- GA drawings of following with empty/ filled-ups.
  - Balls Collecting Strainers (as applicable).
  - Balls recirculating Skids.
  - Debris Flushing pumps (if applicable)
  - Other equipments considered necessary for Layout/ Civil.
- Electrical Load Data (Enclosed at Vol. III of Specification)
- Schedule of Deviation (Enclosed at Schedules).

The bidder to note that load requirement furnished and finalised during tender stage shall only be provided by BHEL and any changes or additional requirement of Electrical load by bidder during contract stage shall be provided by BHEL with cost repercussions to the bidder.

**NOTE:** Apart from above, no other drawing/ document/ data sheet etc. shall be submitted along with the offer. If any drawing/ document etc. is submitted with the offer, same shall be considered as for 'Reference' purpose only and shall not be reviewed/ commented upon and any deviation, exclusion to scope, etc. taken in documents but not highlighted in the deviation schedule shall not be taken cognizance of.

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**ANNEXURE-I**

**COLTCS**

SL.NO.	Projects	Size (NB)	Length of Ball Separator (Including Counter Flange)	Scope of Counter Flange	Scope of nuts and bolts.
1	2X600 MW – SCCL, ADILABAD TPP.	1800 NB	2750 mm	In Bidder's Scope.	In Bidder's Scope
2	1 x 300 MW – VISKHAPATNAM ABHIJEET TPP.	2100 NB	3000 mm (Tentative)	In Bidder's Scope.	In Bidder's Scope

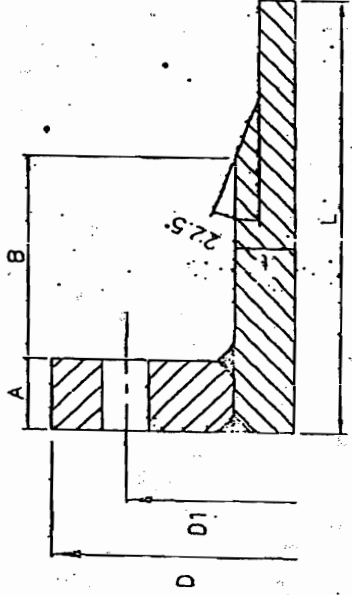
**DEBRIS FILTER**

SL.NO.	Projects	Size (NB)	Length of Debris Filter (Including Counter Flange)	Scope of Counter Flange	Scope of nuts and bolts.
1.	1 x 300 MW – VISKHAPATNAM ABHIJEET TPP,	2100 NB	3200 mm (Tentative)	In Bidder's Scope	In Bidder's Scope

ALL DIMENSIONS ARE IN MM

FIRST ANGLE PROJECTION

110M-141-666-DD-3d SHIYAB



**NOTES:-**

Flange thicknesses listed are for Design pressure=5Kg/cm<sup>2</sup>(g) and Flange dimensions as given in the table. Final thickness of the flange is to be checked for actual OD/Boilng PCD/Neck dimensions.

PIPE SIZE	PIPE THICK.	FLANGE OD 'D'	BOIL PCD 'D1'	WELD NECK FLANGE		SLIP-ON FLANGE THICKNESS
				FLANGE THICK. 'A'	NECK Length 'D' Length 'L'	
1200	10-12	1145	1380	40	24 70	200 90
1400	14	1875	1590	50	24 70	200 100
1600	14	1915	1920	60	32 80	220 110
1800	14-16	2115	2020	70	32 90	250 120
2100 2200	18	2550	2420	80	36 100	300 140
2300	20			90	38 110	325 150

TENTATIVE

STANDARD DRAWING FOR BALI SEPARATOR COUNTER FLANGE

		DEPT. CODE SHARAT HEAVY ELECTRICALS LTD POWER GROUP PROJECTS ENGINEERING MANAGEMENT PPEI, NOIDA	DATE 25.06.07	SCALE 1:1
DRAWING NO. PE-DG-999-141-M017	SHEET NO. OF 01	REV. 00	DESIGNED BY P. H.	CHECKED BY S. H.
TITLE COUNTER FLANGE DETAILS		JOB NO. 999	STATUS DISTRIBUTION	APPD. 999

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R20  
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**TITLE : TECHNICAL SPECIFICATION  
FOR  
CONDENSER ON LOAD TUBE CLEANING  
SYSTEMS (COLTCS) & DEBRIS FILTER (DF)**

**SPEC. NO. PE-TS-381/382-165-N001**

**VOLUME : II B**

**SECTION : D**

**REV. NO. 0**

**DATE : 12.04.2012**

**SHEET . 1 of 1**

**SECTION C2**

**CONDENSER ONLOAD TUBE CLEANING SYSTEMS  
AND DEBRIS FILTER**

**ELECTRICAL DETAILS**

**SPECIFIC ELECTRICAL REQUIREMENT FOR COLTCS/ DF**

SL.NO.	PARAMETERS	UNIT	2 x 600 MW SCCL- ADILABAD TPP	1 x 300 MW VISHAKHAPATNAM ABHIJEET TPP
	<b>MOTOR</b>		MOTORS ARE ENERGY EFFICIENT (TYPE EFF 1) AS PER IS :12615-2004	MOTORS ARE ENERGY EFFICIENT (TYPE EFF 1) AS PER IS :12615-2004
1	DESIGN AMBIENT TEMP	DEG. C	50	50
2	VOLTAGE SUPPLY AND VARIATION	VOLT	415± 10%	415V, ± 10%
3	FREQUENCY WITH VARIATION	Hz	50 (+3% to -5%)	50± 5%
4	COMBINED VOLTAGE & FREQUENCY VARIATION (sum of absolute values)		10%	10%
5	MAX ACCEPTABLE RATING OF MOTOR AT 415 V	KW	200 KW & below	160 KW
6	SYSTEM FAULT LEVEL AND ITS DURATION	KA	50kA, 1sec	50 KA, 1 Sec
7	SUTABILITY OF TERMINAL BOX FOR FAULT LEVEL AND DURATION		50 KA, 0.25 sec	50 KA, 0.2 sec
8	CLASS OF INSULATION & TEMP RISE LIMITED TO		Class-F and temp rise limited to Class-B	Class F insulation limited to class B temperature rise.
9	MIN. STARTING VOLTAGE		85%	80%
10	MOTOR RATING FOR SINGLE PHASE SUPPLY		0.2 kW & Below	0.2 kW & Below
11	MAXIMUM LOCKED ROTOR CURRENT	% OF FLC	600% subject to IS tol.	600% ± IS tol.
12	ACCEPTABLE NOISE LEVEL	DB	85db (A)	As per IS/IEC
13	TYPE OF STARTER PROVIDED IN MCC		DOL	DOL
14	DOP OF ENCLOSURE		Indoor motor: IP 54; Outdoor motor: IP 55; Cable Box- Indoor Area: IP54; Cable box- Outdoor area: IP 55	Indoor motor: IP 54; Outdoor motor: IP 55; Cable Box- Indoor Area: IP54; Cable box- Outdoor area: IP 55
15	SPACE HEATER REQUIREMENT	KW	30KW & ABOVE	30KW & ABOVE
16	PAINT SHADE		RAL 5012 (Blue)	Siemens gray (RAL 7032)
17	SPECIAL REQUIREMENT		Routine & Type tests are to be conducted in presence of customer representative as per IS 325 and required copies of test certificate are to be furnished for approval.	Routine & Type tests are to be conducted in presence of customer representative as per IS 325 and required copies of test certificate are to be furnished for approval.

REV : 0 DATE : 31.10.08

ANNEXURE - I TO SECTION - C : STANDARD ELECTRICAL SCOPE BETWEEN BHEL AND VENDOR  
PACKAGE : COLTCS

PROJECT : 2 x 600 MW SINGARENI COLLIERIES COMPANY LTD.- ADILABAD TPP

S.NO	DETAILS	SCOPE SUPPLY	SCOPE E&C	REMARKS
1	415V MCC	BHEL	BHEL	1. 415 V AC/240 V AC supply shall be provided by BHEL based on load data provided by vendor at contract stage for all equipment supplied by vendor as part of contract including power supply equipment (battery charger etc) required for the PLC/control panel (as applicable) for the system supplied by vendor. 2. Interposing relays (RE 302 of Jyoti make or equivalent), if required for PLC and microprocessor based systems, shall be provided by BHEL in MCCs. Requirement of these relays shall be furnished by vendor during detailed engineering stage.
2	Local Push Button Station (for motors)	Vendor	Vendor	Located near the motor.
3	Power cables, control cables and screened control cables for a) both end equipment in BHEL's scope b) both end equipment in vendor's scope c) one end equipment in vendor's scope	BHEL/Customer Vendor BHEL/Customer	BHEL/Customer Vendor BHEL/Customer	1. Sizes and quantity of cables required shall be informed by vendor at contract stage (based on inputs provided by BHEL). Finalisation of cable sizes shall be done by BHEL. Vendor shall provide lugs & glands accordingly. 2. Laying of cables by BHEL/Customer. 3. Termination at BHEL equipment terminals by BHEL. 4. Termination at Vendor equipment terminals by Vendor.
4	Any special type of cable like compensating, co-axial, prefab, MICC, fibre optical etc.	Vendor	Vendor	
5	Cable trays, accessories & cable trays supporting system	BHEL	BHEL	
6	Cable glands and lugs for equipments supplied by Vendor	Vendor	Vendor	1. Double compression Ni-Cr plated brass cable glands 2. Solder less crimping type heavy duty tinned copper lugs for power cables 3. Solder less crimping type heavy duty copper lugs for control cables.
7	Conduit and conduit accessories for cabling between equipments supplied by vendor	Vendor	Vendor	Conduits shall be medium duty, hot dip galvanised cold rolled mild steel rigid conduit as per IS: 9537. Makes of conduits shall be subject to customer/ BHEL approval at contract stage.
8	Lighting	BHEL/Customer	BHEL/Customer	
9	Equipment grounding & lightning protection	BHEL/Customer	BHEL/Customer	

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**ANNEXURE - I TO SECTION - C : STANDARD ELECTRICAL SCOPE BETWEEN BHEL AND VENDOR  
PACKAGE : COLTCS**

S.NO	DETAILS	SCOPE SUPPLY	SCOPE E&C	REMARKS
10	Below grade grounding	BHEL/Customer	BHEL/Customer	
11	L.T Motors with base plate and foundation hardware	Vendor	Vendor	Makes shall be subject to customer/ BHEL approval at contract stage.
12	Mandatory spares	Vendor	-	Vendor to quote as per specification.
13	Recommended O & M spares, E & C spares, erection & maintenance tools & tackle.	Vendor	-	As per specification
14	Any other equipment/material/service required for completeness of system but not specified above (to ensure trouble free and efficient operation of the system).	Vendor	Vendor	
15	a) Input cable schedules (C & I) b) Cable interconnection details for above c) Cable block diagram	Vendor Vendor Vendor	- - -	Cable listing for C & I systems for vendor supplied equipment shall be furnished during detail engineering by vendor in soft copies in the BHEL cable schedule format.
16	Equipment layout drawings	Vendor	-	For ensuring cabling requirements are met, vendor shall furnish layout drawings (both in print form as well as in AUTOCAD) of the complete plant (including electrical area) indicating location and identification of all equipments requiring cabling, and shall incorporate cable trays routing details marked on the drawing as per PEM interface comments. Electrical equipment layout drawing shall be to BHEL approval.
17	Electrical Equipment GA drawing	Vendor	-	For necessary interface review.

NOTES:

1. Make of all electrical equipments/items supplied shall be reputed make & shall be subject to approval of BHEL/customer after award of contract.
2. All QPs shall be subject to approval of BHEL/customer after award of contract without any commercial implication.
3. For skid mounted system, 2 nos. (1W+1S) supply of 415 V, 3 phase AC shall be provided by BHEL. Complete electrical distribution for the skid including changeover between feeder/starters/LCP/inter-locks/protection devices / any other supply etc. shall be in bidder's scope.

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DATE : 19.04.2012

**ELECTRICAL SCOPE BETWEEN BHEL AND VENDOR**

PACKAGE : COLTCS & DF

PROJECT : 1 x 300 MW VISHAKHAPATNAM ABHIJEET TPP

ANNEXURE-I

S.NO	DETAILS	SCOPE SUPPLY	SCOPE E&C	REMARKS
1	415V MCC	CUSTOMER	CUSTOMER	<ol style="list-style-type: none"> <li>415V, 3 ph power supply feeder shall be provided by CUSTOMER based on vendor's load requirement. Any other voltage level required by vendor shall be drawn by vendor.</li> <li>power supply equipment (battery charger etc) required for the PLC/control panel (as applicable) for the system shall be supplied by vendor.</li> <li>Interposing relays (RE 302 of Jyoti make or equivalent), if required for PLC and microprocessor based systems, shall be provided by CUSTOMER in MCCs. Requirement of these relays shall be furnished by vendor during detailed engineering stage.</li> </ol>
2	Local Push Button Station (for motors)	VENDOR	VENDOR	Located near the motor.
3	Power cables, control cables and screened control cables for a) both end equipment in BHEL/Customer's scope b) both end equipment in vendor's scope c) one end equipment in vendor's scope	CUSTOMER VENDOR CUSTOMER	CUSTOMER VENDOR CUSTOMER	<ol style="list-style-type: none"> <li>Sizes and quantity of cables required shall be informed by vendor at contract stage (based on inputs provided by BHEL). Finalisation of cable sizes shall be done by BHEL. Vendor shall provide lugs &amp; glands accordingly.</li> <li>Laying of cables by BHEL/Customer.</li> <li>Termination at Vendor equipment terminals by Vendor</li> </ol>
4	Any special type of cable like compensating, co-axial, prefab, MICC, fibre optical etc.	VENDOR	VENDOR	
5	Cable trays, accessories & cable trays supporting system where one end equipment is in BHEL / customer's scope	CUSTOMER	CUSTOMER	
6	Cable glands and lugs for equipments supplied by Vendor	VENDOR	VENDOR	<ol style="list-style-type: none"> <li>Double compression Ni-Cr plated brass cable glands</li> <li>Solder less crimping type heavy duty tinned copper lugs for power cables</li> <li>Solder less crimping type heavy duty copper lugs for control cables.</li> </ol>

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DATE : 19.04.2012

## ELECTRICAL SCOPE BETWEEN BHEL AND VENDOR

PACKAGE : COLTCS & DF  
 PROJECT : 1 x 300 MW VISHAKHAPATNAM ABHIJEET TPP

S.NO	DETAILS	SCOPE SUPPLY	SCOPE E&C	REMARKS
				3. Solder less crimping type heavy duty copper lugs for control cables.
7	Conduit and conduit accessories for cabling between equipments supplied by vendor	VENDOR	VENDOR	Conduits shall be medium duty, hot dip galvanized cold rolled mild steel rigid conduit as per IS: 9537. Makes of conduits shall be subject to customer/ BHEL approval at contract stage.
8	Above ground Equipment earthing	BHEL	BHEL	
9	Below grade grounding & lightning protection	CUSTOMER	CUSTOMER	
10	LT Motors with base plate and foundation hardware	VENDOR	VENDOR	Makes shall be subject to customer/ BHEL approval at contract stage.
11	a) Input cable schedules (C & I) b) Cable interconnection details for above c) Cable block diagram	VENDOR VENDOR VENDOR	- - -	Cable listing for C & I systems for vendor supplied equipment shall be furnished during detail engineering by vendor in soft copies in the BHEL cable schedule format.
12	Equipment layout drawings	VENDOR	-	For ensuring cabling requirements are met, vendor shall furnish layout drawings (both in print form as well as in AUTOCAD) of the complete plant (including electrical area) indicating location and identification of all equipments requiring cabling, and shall incorporate cable routing details marked on the drawing as per PEM interface comments. Electrical equipment layout drawing shall be to BHEL approval.
13	Electrical Equipment GA drawing	VENDOR	-	For necessary interface review.

**NOTES:**

1. Make of all electrical equipments/items supplied shall be reputed make & shall be subject to approval of BHEL/CUSTOMER after award of contract.
2. All QPs shall be subject to approval of BHEL/CUSTOMER after award of contract without any commercial implication.
3. For skid mounted system, 2 nos. (1W+1S) supply of 415 V, 3 phase AC shall be provided by BHEL. Complete electrical distribution for the skid including changeover between feeder/starters/LCP/inter-locks/protection devices / any other supply etc. shall be in bidder's scope.

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**TECHNICAL SPECIFICATION FOR  
COLTCS & DF  
(ELECTRICAL PORTION)**

SPECIFICATION NO.  
VOLUME II B  
SECTION-C  
REV 0                      DATE 19.04.12.  
PAGE 1 OF 1

**SPECIFIC TECHNICAL REQUIREMENTS: ELECTRICAL**

**1.0 EQUIPMENT & SERVICES TO BE PROVIDED BY BIDDER/ PURCHASER**

- 1.1 Scope for supply, and erection & commissioning of various equipment forming part of electrical system for this package shall be as per Annexure-I to Section - C [Scope of Work (Electrical)].
- 1.2 Make of various equipment/ items in the scope of bidder shall be to approval of owner during detailed engineering stage without any commercial implications.
- 1.3 Bidder shall furnish all AC as well as DC loads required for the system at different voltage levels (e.g. 415V AC, 240 V AC, 220 V DC etc.) of all types, such as motor feeders, supply feeders in PEM format along with the offer.
- 1.4 All electrical equipment shall be suitable for the power supplies, fault levels and climatic conditions indicated in project information enclosed with the specification.
- 1.5 All drawings, data sheets, Quality Plan, calculations, test reports, test certificates, etc. shall be submitted during detailed engineering stage as per formats enclosed. The same shall be subject to approval without any commercial implications.
- 1.6 Technical requirements shall be as per specifications listed in Clause 4.1, 4.2 & 4.3 below.

**3.0 DOCUMENTS TO BE SUBMITTED ALONG WITH BID**

- 3.1 Bidder shall confirm total compliance to the electrical specification without any deviation from the technical/ quality assurance requirements stipulated. In line with this, the bidder as technical offer shall furnish two signed and stamped copies of the following:
  - a) A copy of this sheet "Electrical Equipment Specification for COLTCS & DF" and sheet "Electrical Scope between BHEL and Vendor" with bidder's signature and company stamp.
  - b) List of Erection and Commissioning spares.
  - c) List of Erection & Maintenance tools & tackles.
  - d) Electrical load requirement in the load data format.
  - e) Motor data sheets A & C
  - f) QPs
- 3.2 No technical submittal such as copies of data sheets, drawings, write-up, quality plans, type test certificates, technical literature, etc, is required during tender stage. Any such submission even if made, shall not be considered as part of offer.

**4.0 LIST OF ENCLOSURES**

- 4.1 Electrical scope between BHEL & vendor (Annexure-I).
- 4.2 Technical specification no. PE-SS-999-506-E101, Data Sheets (A & C) for 415V Electric Motors.
- 4.3 Quality Plan for motors.
- 4.4 Load data format (Annexure-II).

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**TITLE : TECHNICAL SPECIFICATION  
FOR  
CONDENSER ON LOAD TUBE CLEANING  
SYSTEMS (COLTCS) & DEBRIS FILTER (DF)**

**SPEC. NO. PE-TS-381/382-165-N001**

**VOLUME : II B**

**SECTION : D**

**REV. NO. 0**

**DATE : 12.04.2012**

**SHEET . 1 of 1**

### **SECTION C3**

## **CONDENSER ONLOAD TUBE CLEANING SYSTEMS AND DEBRIS FILTER**

### **C&I DETAILS**

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**CONDENSER ON LOAD TUBE CLEANING SYSTEM & DEBRIS FILTER - C&I REQUIREMENTS**

S.NO.	PROJECT	VISHAKHAPATNAM ABHIJEET TPP		SINGAREN 2X660MW SCCL, ADILABAD TPP.
		COLTCS	DF	COLTCS
1.00	SYSTEM	COLTCS	DF	COLTCS
2.00	COMMON / PER UNIT	REFER NOTE -06	REFER NOTE -06	REFER NOTE -05
3.00	CONTROL SYSTEM	PLC	PLC	DCS (STN C&I)
3.10	PROCESSOR CONFIGURATION FOR PLC SYSTEM	REDUNDANT WITH HOT STAND BY	REDUNDANT WITH HOT STAND BY.	NA
4.00	LOCATION OF CONTROL SYSTEM	LOCAL TO COLTCS	LOCAL TO COLTCS	CCR
4.10	CONTROL SYSTEM SCOPE (BIDDER/ BHEL/ CUSTOMER)	BIDDER	BIDDER	BHEL
5.00	HARDWIRED INTERFACE WITH DCS (Y/N)	N	N	NA
5.10	PURPOSE OF HARDWIRED INTERFACE WITH DCS	NA	NA	NA
5.11	a) COMMAND FROM DCS (Y/N)	N	N	NA
5.12	b) STATUS FEEDBACK TO DCS (Y/N)	N	N	NA
5.13	c) GROUP FAULT ALARM TO DCS (Y/N)	Y	Y	NA
6.00	SOFTLINK TO DCS (Y/N)	Y	Y	NA
6.10	PURPOSE OF SOFTLINK TO DCS	MONITORING	MONITORING	NA
6.11	a) COMMAND INTERFACE WITH DCS (Y/N)	N	N	NA
6.12	b) STATUS MONITORING IN DCS (Y/N)	Y	Y	NA
7.00	PROTECTION CLASS FOR PLC / RIO PANEL	IP65	IP65	IP-55 for Starter Panel

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**CONDENSER ON LOAD TUBE CLEANING SYSTEM & DEBRIS FILTER - C&I REQUIREMENTS**

S.NO.	PROJECT	VISHAKHAPATNAM ABHIJEET TPP		SINGAREM 2X500MW SCCL, ADILABAD TPP.
		PB's ON LCP & OWS	PB's ON LCP & OWS	
8.00	CONTROL FROM PB's ON LCP/OWS	PB's ON LCP & OWS	PB's ON LCP & OWS	NA
9.00	ANNUNCIATION ON LCP (Y/N) - IF Y, MIN NO. OF HARDWIRED ALARMS / INDICATIONS	YES- BIDDER TO PROPOSE MIN NO OF ALARMS/INDICATIONS	YES- BIDDER TO PROPOSE MIN NO OF ALARMS/INDICATIONS	NA
9.10	MINIC ON LCP (Y/N)	Y	Y	NA
10.00	CONTROL FROM DCS IN OLR (Y/N)	N	N	Y
11.00	TYPE OF SOFTLINK (TPI/OPC)	TP	TP	NA
11.10	COMMUNICATION CABLE SCOPE (BIDDER/ BHEL)	BHEL	BHEL	NA
11.20	REDUNDANT CABLE (Y/N)	Y	Y	NA
11.30	PROTOCOL	MODBUS	MODBUS	NA
12.00	RIO / RPU (Y/N)	Y	Y	NA
13.00	# NO. OF OWS / LAPTOP	1 NO. 21" TFT MONITOR FOR OPERN. & MONITORING OF COLTCS 1 NO. LAPTOP LOADED WITH ENGG. SW.	1 NO. 21" TFT MONITOR FOR OPERN. & MONITORING OF DF 1 NO. LAPTOP LOADED WITH ENGG. SW.	NA
13.10	SIZE OF OWS/ CRT OR LCD	NA	NA	NA
14.00	NO. OF PRINTER	NIL	NA	NA
14.10	PRINTER SIZE AND TYPE	NA	NA	NA
15.00	POWER SUPPLY AVAILABLE FOR BALL MONITOR (24V DC / 110 V AC UPS / 230 V AC UPS)	TO BE DERIVED FROM PLC PANEL	TO BE DERIVED FROM PLC PANEL	TO BE DERIVED FROM PLC PANEL
15.10	POWER SUPPLY AVAILABLE FOR PLC PANEL (3PHASE, 415 V AC/ 1PHASE, 110 V UPS/ 1PHASE, 230 V UPS)	3 PHASE, 415 V AC AT SINGLE POINT	3 PHASE, 415 V AC AT SINGLE POINT	3 PHASE, 415 V AC AT SINGLE POINT
15.20	REDUNDANT FEEDERS (R) / NON-REDUNDANT (NR) FEEDERS FOR POWER SUPPLY	R	R	R
15.30	** UPS BATTERY CONFIGURATION (1X100% / 2X100%)	2 X 100 %	2 X 100 %	NA
15.40	BATTERY TYPE (LEAD ACID/ NI-Cd)	Ni-Cd	Ni-Cd	NA
15.50	BATTERY BACK-UP TIME (In minutes)	60	60	NA
16.00	ACTUATOR WITH INTEGRAL STARTER (Y/N)	Y	Y	Y

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**CONDENSER ON LOAD TUBE CLEANING SYSTEM & DEBRIS FILTER - C&I REQUIREMENTS**

S.NO.	PROJECT	VISHAKHAPATNAM ABHIJEET TPP		SINGARENI 2X600MW SCCL, ADILABAD TPP
17.00	PG/ DPG/ PSI/ DPS/ PT/ DPT per Balls Collecting Strainer/DF/SCS	DPT = 2 nos. DPI = 1 no. (ACROSS EACH BALL SEPARATOR)	{1) DPT = 2 nos. DPI = 1 no. (ACROSS EACH DF),	DPT = 2 no, DPG= 1 no. (ACROSS EACH COLTCS)
19.00	PROJECT SPECIFIC INFO	NA	NA	NA
20.00	REMARKS			MANDATORY SPARES FOR INSTRUMENTS (Total for 2x600 MW): 1. DPT - 2 Nos. 2. DPG- 1 Nos. 3. PI- 2 Nos
21.00	NOTES:			
	1. ** THE UPS FOR PLC SHALL BE IN BIDDER'S SCOPE. ITS CONFIGURATION SHALL BE 2X100% CHARGERS / INVERTERS.			
	2. IN CASE OF DCS CONTROLLED SYSTEMS, BIDDER TO TERMINATE ALL INSTRUMENTATION AND CONTROL ELEMENTS IN JUNCTION BOXES FOR FURTHER CABLING TO DCS BY BHEL/CUSTOMER. BIDDER TO PROVIDE INPUT/OUTPUT LIST, DRIVES LIST, JUNCTION BOX SCHEDULE AND TERMINATION DETAILS, RECOMMENDED CONTROL LOGICS / WRITE-UP ETC. DURING DETAILED ENGINEERING			
	3. IN CASE OF PLC CONTROLLED SYSTEMS, ALL CABLES & CABLE ENGINEERING SHALL BE IN BIDDER'S SCOPE.			
	4. ## FOR PLC BASED CONTROL SYSTEM WHERE OWS IS PROVIDED, THE OWS SHALL HAVE PROGRAMMING & CONFIGURATION FACILITY.			
	5. FOR THE PROJECTS IN WHICH CONTROL ARE ENVISAGED WITH DCS CONTROL SYSTEM FOR COLTCS/DEBRIS FILTER - 2 SETS OF COLTCS/DEBRIS FILTER SHALL HAVE ONE COMMON STARTER PANEL (SWITCH GEAR PANEL).			
	6. FOR THE PROJECTS IN WHICH CONTROL ARE ENVISAGED WITH PLC BASED CONTROL SYSTEM FOR COLTCS/DEBRIS FILTER - 2 SETS OF COLTCS/DEBRIS FILTER SHALL HAVE ONE COMMON PLC SYSTEM CUM STARTER PANEL WITH HMI SCREEN AND ONE SEPARATE LCP/RIO PANEL WITH HMI SCREEN.			
	7. COLOUR OF STARTER PANEL /PLC PANEL SHALL BE DECIDED DURING DETAIL ENGINEERING			
	8. INSTRUMENT RACK AND JUNCTION BOXES (IF APPLICABLE) SHALL BE IN BIDDER'S SCOPE OF SUPPLY.			
	9. BIDDER TO FURNISH ELECTRICAL LOAD DATA DURING DETAILED ENGINEERING.			
	10. ALARM FACIA SHALL BE UNDER BIDDER'S SCOPE. NO. OF FACIA SHALL BE DECIDED DURING DETAILED ENGINEERING.			
	LEGEND:			
	DCS- DISTRIBUTED CONTROL SYSTEM			
	PLC- PROGRAMMABLE LOGIC CONTROLLER			
	RPU - REMOTE PROCESSING UNIT			

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**TITLE : TECHNICAL SPECIFICATION  
FOR  
CONDENSER ON LOAD TUBE CLEANING  
SYSTEMS (COLTCS) & DEBRIS FILTER (DF)**

**SPEC. NO. PE-TS-381/382-165-N001**

**VOLUME : II B**

**SECTION : D**

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**DATE :12.04.2012**

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## **SECTION – D**

### **STANDARD TECHNICAL SPECIFICATION**

- SECTION D1 : CONDENSER ONLOAD TUBE CLEANING  
SYSTEM**
- SECTION D2 : DEBRIS FILTER**
- SECTION D3 : ELECTRICAL SYSTEMS**
- SECTION D4 : C & I SYSTEMS.**

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**TITLE : TECHNICAL SPECIFICATION  
FOR  
CONDENSER ON LOAD TUBE CLEANING  
SYSTEMS (COLTCS) & DEBRIS FILTER (DF)**

**SPEC. NO. PE-TS-381/382-165-N001**

**VOLUME : II B**

**SECTION : D**

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**DATE :12.04.2012**

**SHEET. 1 of 1**

**SECTION D1**

**STANDARD TECHNICAL SPECIFICATION  
FOR  
CONDENSER ONLOAD TUBE CLEANING SYSTEMS**

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**TITLE :**  
**STANDARD TECHNICAL SPECIFICATION**  
**CONDENSER ON - LOAD TUBE CLEANING**  
**SYSTEM ( Sponge Rubber Ball Type )**

**SPECIFICATION NO. PE-TS-999-165-N001**  
**VOLUME : II B**  
**SECTION : D**  
**REV. NO. 00**      **DATE : 27.09.07**  
**SHEET 1 OF 14**

**1.00.00      GENERAL**

This specification covers the design, performance and operational requirements, configuration and constructional features, manufacture, assembly, inspection and testing at the manufacturer's and/or his sub-contractor's works and painting for delivery of condenser on-load tube cleaning system (sponge rubber balls type) complete with all accessories as specified hereinafter. Each half of the condenser shall be provided with an independent tube cleaning system.

**2.00.00      CODES AND STANDARDS**

**2.01.00**      The design, materials, manufacture, inspection and testing of the condenser on-load tube cleaning system complete with all accessories, shall comply with the requirements of the latest versions of the following appropriate codes and standards.

**2.01.01**      IS/BS/DIN/US Standards regarding pressure vessels, pumps, piping, flanges and others as necessary.

**2.01.02**      IS/BS/DIN/ASTM Standards for materials specification and testing procedures.

**2.01.03**      IS/BS/DIN/AWWA Standards for valves and the testing.

**2.02.00**      In case of any conflict between the above codes/standards and this specification, the later shall prevail and in case of any further conflict in the matter, the interpretation of the specification by the Engineer shall be final and binding.

**3.00.00      DESIGN AND CONSTRUCTION**

**3.01.00**      General Requirements

**3.01.01**      Unless otherwise necessary, manufacturer's standard and proven models of the tube cleaning system shall be supplied.

**3.01.02**      The tube cleaning system shall be capable of safe, continuous and trouble-free operation for removal of fouling and scaling materials from condenser tubes. Vibration, noise, mechanical stresses shall be kept within allowable limits specified by relevant codes/standards. In design, due attention shall be given to ease of maintenance, repair and cleaning.

**3.01.03**      Suitable Corrosion allowance shall be provided whenever necessary. Adequate provision for future installation of cathodic protection shall be provided.

**3.01.04**      The tube cleaning system shall consist of ball separator at condenser outlet, recirculating pump, ball collector, differential pressure measuring system for ball separator, ball monitoring system, cleaning balls, piping valves, distributors, injection nozzles, instrumentations, control panel, interconnecting cables and others as necessary. The configuration of the tube cleaning system shall be as described in section C and / or as per the scheme enclosed.

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**TITLE :**  
**STANDARD TECHNICAL SPECIFICATION  
CONDENSER ON - LOAD TUBE CLEANING  
SYSTEM ( Sponge Rubber Ball Type )**

**SPECIFICATION NO. PE-TS-999-165-N001**

**VOLUME : II B**

**SECTION : D**

**REV. NO. 00**

**DATE :27.09.07**

**SHEET 2 OF 14**

**3.02.00 Performance Requirements.**

**3.02.01** The tube cleaning system with all accessories shall be designed and guaranteed to meet the following requirements :

The tube cleaning system shall perform satisfactorily under the flow and pressure drop conditions ( in the condenser) specified in Data Sheet - A and shall be capable of removing the various forms of fouling and scaling from condenser tubes.

**3.02.02** The ball separator at the condenser outlet, shall be designed such that the pressure drop across the ball separator under clean conditions shall not be more than that specified in Data Sheet - A. The performance of the ball separator shall be continuous with minimum number of backwashing operations.

**3.02.03** The power consumption by ball recirculation pump during various operations shall be minimum possible.

The quantity of cleaning balls worn out and / or lost, shall be minimum possible.

**3.03.00 Operational Requirements.**

The tube cleaning system and other accessories shall be designed for the following operation modes:

**3.03.01** Complete automatic start-up of tube cleaning system initiated by pressing the push button (manual command).

**3.03.02** Complete automatic shut-down of tube cleaning system with ball collection, effected by the following :

- ◆ Push button (manual command).
- ◆ Adjustable timer (after a defined cleaning period).
- ◆ Ball monitoring system (when the number of oversized balls falls below a set value).

**3.03.02** Complete automatic backwashing of ball separator with ball collection, effected by the following :

- ◆ Differential pressure measuring system at a pre-determined differential across the ball separating strainer/ screen.
- ◆ Adjustable timer
- ◆ Push button

**3.03.04** Complete automatic emergency backwashing of ball separator with alarm indication, effected by differential pressure measuring system.

**3.03.05** Manual operation for start-up, shut-down with ball collection backwashing of ball separator, flushing of differential pressure measuring system etc., in case of failure of control system.

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**3..04.00 Ball Separator**

3.04.01 Ball separator body shall be of rigid construction and shall be designed and manufactured as per the applicable codes for pressure vessels. It shall house the ball separating screen / strainer and shall have flanged inlet, outlet, ball extraction opening and pressure measuring tappings etc. Body shall be designed and manufactured as per the applicable codes for pressure vessels and to take care of forces and moments as enclosed in the specification. However in no case thickness of housing/body shall be less than the connecting pipe thickness as specified in data sheet A

3.04.02 The ball separator shall be provided with manhole with bolted cover and sight glass to observe its internals.

3.04.03 If specified in Data Sheet -A, ball separator body shall be Epoxy lined.

3.04.04 The ball separating screen / strainer shall be designed for the maximum differential pressure across the separator and shall be securely mounted in the body. Screen / strainer shaft shall be sized adequately considering the overloading of screens / strainer due to debris accumulation.

3.04.05 The ball separating strainers / screens shall have electric actuators for swivelling to allow for their backwashing. Also suitable handwheels shall be provided to enable manual swivelling of strainers / screens.

**3.05.00 Ball Recirculating Pump**

3.05.01 The ball recirculating pump shall be horizontal centrifugal type. The casing shall be designed to withstand 1.5 times the shut-off pressure or twice the operating pressure, whichever is higher.

3.05.02 The impeller shall be non-clog type and shall be contoured suitably to avoid damage to the cleaning balls. The impeller shall be secured suitably to the shaft and shall be retained against circumferential movement by keys, pins or lock rings. Loctite compound shall be applied after tightening of locknuts to prevent dislocation of impeller.

3.05.03 Replaceable type wearing ring shall be provided to prevent damage to the casing and impeller.

3.05.04 Pumps shall be provided with mechanical seals to the extent feasible. If Gland packing is provided it should be of good quality to be provided to prevent leakage of water from pump glands.

3.05.05 Shaft size selected shall take into Consideration the critical speed which shall be away from the operating speed as recommended in applicable codes / standards. Renewable type fine finished shaft sleeves shall be integral with water thrower plates at the end and the length must extend beyond the outer faces of gland packing so as to distinguish between the leakage between shaft and the shaft sleeve and that past the seals / glands.



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- 3.05.06 Bearings of adequate design shall be provided for taking the entire pump load arising from all probable conditions of continuous operation through its range of operation. The bearings shall be designed on the basis of 20,000 working hours minimum for the load corresponding to the duty point. Proper lubricating element does not contaminate the liquid being pumped. Bearings shall be easily accessible without disturbing the pump assembly
- 3.05.07 Stuffing box of suitable design to permit replacement of packing without removing any part other than the gland shall be provided. The stuffing boxes shall be sealed / cooled by the fluid being pumped.
- 3.05.08 Pumps shall be of self-lubricated, self - sealed and self-cooled type. All pipework, fitters etc., for sealing, cooling and lubricating purpose shall be supplied and no external cooling/lubricating/sealing water will be supplied. Pump capacity shall take into account the cooling/lubricating/sealing water requirement.
- 3.05.09 All rotating components shall be statically and dynamically balanced.
- 3.05.10 The pump shall be designed such that pump impellers and other accessories of the pump, are not damaged due to flow reversal.
- 3.05.11 The pump shall be capable of developing the required total head at rated capacity for continuous operation. Also the pumps shall be capable of being operated to give satisfactory performance at any point on the head Vs. flow characteristic curve over a range or 40% of rated flow to 120 -130 % of rated flow.
- 3.05.12 The pump shall preferably be non-overloading type. The total head Vs. capacity curve shall be continuously rising from the maximum flow point towards shut-off without any zone of instability.
- 3.05.13 The pump shall run smoothly without undue noise and vibration. Peak to peak vibration limits and noise level shall be within the acceptable values of applicable codes/standards.
- 3.05.14 The pump and motor shafts shall be connected through a pin and rubber bush flexible type of couplings. Suitable coupling guards shall be provided for the couplings.
- 3.05.15 The pump shall be capable of being started with discharge valve fully opened. Motor rating shall be adequate for this condition. The output KW rating of the pump drive motor shall not be less than the larger of the following :
- a) Maximum power input to the pump over the entire range for maximum flow to shut-off condition.
  - b) 125% of power input to the pump at duty point corresponding to 103% of the rated speed.
- 3.06.00 **Ball Collector**
- 3.06.01 The body of the ball collector shall be designed to withstand 2.0 times the operating pressure or 1.5 times the recirculating pump shut-off pressure, whichever is higher.



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The ball collector shall be designed and manufactured as per the applicable codes for pressure vessels.

3.06.02 Ball collector shall be provided with an inspection window/sight glass for visual inspection of the cleaning balls.

3.06.03 Ball collector shall be provided with suitable ports with covers for ball feeding and removal.

3.06.04 The ball collector shall be provided with vent and drain connections with isolating valves.

3.06.05 Provision shall be made in the ball collector for separating the undersized balls and ball collector shall have a separate chamber for collecting the undersized balls.

3.06.06 If specified in Data Sheet -A, ball collector body shall be lined with suitable resilient material.

3.06.07 The differential pressure measuring system shall be provided with D.P. transmitter, DPS & DPG of remote seal arrangement.

3.07.00 **Differential Pressure Measuring System.**

3.07.01 The ball separator shall be provided with a measuring system for differential pressure across the ball separating strainer/screen, to check debris accumulation and to initiate ball catching and backwashing operations. This shall consist of a differential pressure switch/transmitter for automatic backwashing operation, a differential pressure gauge for manual observation with adequate number of tappings with isolating valves.

3.07.02 The contacts for differential pressure switch/transmitter and for differential pressure gauge shall be independent so that in the event of failure of one, the other is available.

3.07.03 The differential pressure measuring system shall be with remote seal arrangement .

3.08.00 **Ball Monitoring System**

3.08.01 Ball monitoring system shall be provided for continuously monitoring the quantity and size of the cleaning balls in circulation. The monitoring system shall perform the following functions :

- a) Continuously counting the oversize balls in circulation and giving an alarm calling for investigation of ball losses, when the number of oversize circulating balls falls below a set valve.
- b) Continuously measuring the size of the balls in circulation and initiating the shut-down of the tube cleaning system with alarm calling-for replacement of balls when the number of oversized balls falls below a set valve.
- c) Bidder's if not manufacturing ball oversized monitor, can supply automatic ball sorter in lieu of same for automatic sorting of the undersized balls.

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3.08.02 The monitoring system shall be of proven and reliable design and shall be complete with necessary transducers, amplifiers, transmission lines, power cables and electronic processor etc.

3.08.03 The electronic processor of the ball monitoring system shall be housed in the control panel and shall consist the following :-

- a) Indicators for
  - ◆ required basic ball charge.
  - ◆ recirculating ball quantity.
  - ◆ oversized ball quantity.
- b) Time counters for
  - ◆ total cleaning system operating hours.
  - ◆ cleaning system operating hours with sufficient number of oversized balls.
- c) Recorder for ball consumption.

3.08.04 The ball monitoring system shall have provisions for self-testing and self-calibration.

3.09.00 **Cleaning Balls**

3.09.01 The sponge rubber cleaning balls shall be slightly oversized to the internal diameter of condenser tubes and should be able to remove all fouling and scaling deposits in the condenser tubes.

3.09.02 The specific gravity of the cleaning balls shall be such that good distribution of balls across the tube sheet and cleaning of all tubes are ensured.

3.09.03 The composition of the cleaning balls shall be based on natural rubber and shall be suitable for temperature upto 100°C. Hardness of the cleaning balls shall be compatible to tube material and corrosion/fouling behaviour. If cleaning balls consist of abrasive coated balls, the abrasive material shall also be compatible for use with the tube material.

3.09.04 Calculations and basis for selection of cleaning balls circulation quantity, type, size, hardness, cleaning frequency etc., shall be furnished during contract stage.

3.10.00 **Piping, Valves, Distributors and Injection Nozzles.**

3.10.01 Interconnecting piping, valves, injection nozzles and other fittings shall be designed to withstand 2.0 times the operating pressure or 1.5 times the pump shut-off pressure whichever is higher.

3.10.02 Interconnecting piping shall be sized and routed optimally. Velocity in the pipe work shall be less than 1.5 m/s for pump suction and less than 2.2 m/s in other pipe work.

3.10.03 Necessary isolation valves, vent and drain valves for various equipments shall be provided. Valves shall conform to appropriate standards. Valves provided in ball transport piping shall be ball type. Gland packing of all valve shall be of superior quality to avoid leakage. All valves upto 150 Nb shall be ball valves. For higher sizes ,

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gate / globe /B.F. valves shall be provided. All instrument valves shall be needle valves.

3.10.04 Adequate number of ball injection nozzles shall be provided for proper distribution of cleaning balls in condenser inlet. Ball injection nozzles shall be flanged type and shall have two sets of flanges, one for connecting to ball transport pipe and other for connecting to the stub on condenser inlet pipe for ease of removal during repairs or checking.

3.10.05 Distributors ( if applicable) with sight glass shall be provided wherever ball transport piping branching out or joining together for proper guidance of cleaning balls.

3.10.6 Type of valves shall be ball valves, no diaphragm type valve shall be used.

3.11.00 **Actuators**

3.11.00 Tube cleaning system shall be provided with actuators wherever necessary for various automatic operations. The actuators shall be electric motor operated and shall meet the requirements of the enclosed specification. The actuator shall be provided with auxiliary handwheel for manual operation in the event of control system failure.

3.12.00 **Electric Motors**

The drive motors for recirculating pump and differential pressure measuring system flushing pump shall conform to the requirements of the enclosed specification.

3.13.00 **Instrumentation and Control System.**

3.13.01 Complete instrumentation and control system for automatic operation of tube cleaning system, protection, interlocking, indication / annunciation of differential pressure and other malfunctions etc., shall be provided. This shall consist of adequate operational hardware, local control panel ( As applicable ) and interconnecting control and power cabling between the control panel and various equipments in the tube cleaning system.

3.13.02 The control panel shall house all necessary instruments, indicating / annunciation lamps, alarms, differential pressure indicator, timer, function selection switches, ball monitoring system processor, relays, protection and interlocking systems, start / stop push button etc., and shall be complete with internal wiring. The control panel shall meet the requirements of the enclosed specification.

3.13.03 Pressure guages shall be provided at recirculating pump suction and discharge. All instrumentation shall be of reputed make and shall meet the requirements of the enclosed specifications.

3.14.00 **Other Accessories.**

3.14.01 Counter flanges, complete with gaskets, bolts and nuts etc., shall be supplied for ball separator inlet, outlet connections and all other terminal points Fabrication, dimensions and drilling of the flanges shall conform to the codes/standards specified in

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3.14.02 Ball recirculating pump, ball collector with interconnecting piping and valves, shall be mounted on a frame. For fixing the frame, necessary foundation plates, bolts, nuts etc. shall be provided.

3.14.03 Suitable lifting arrangement shall be provided for various equipments of the tube cleaning system, for handling during erection and maintenance.

3.15.00 **Materials of Construction**

Materials of various equipments in the tube cleaning system shall be corrosion resistant and consistent with the fluid handled. However, material specification for various components shall be equal to or superior to those specified in Data Sheet-A.

4.00.00 **PAINTING**

4.01.00 The surface preparation of the various equipments / components of the tube cleaning system shall be done as per the standard mentioned in Data Sheet - A and shall include the following :

- a) Removal of oil, grease, dirt and swarf etc.
- b) Removal of rust and scale etc.
- c) Sand blasting / shot blasting.

4.02.00 All internal surfaces of the various equipments / components of the tube cleaning system, which are subjected to immersion or water spray and which are not made of stainless steel or other corrosion resistant materials after surface preparation, shall be coated with epoxy paint of approved make and quality over a coat of zinc chromite primer, unless otherwise specified in Data Sheet - A.

4.03.00 The external surfaces of the various equipments / components of the tube cleaning system after surface preparation, shall be coated with synthetic enamel paint of approved make and quality over two coats of red oxide primer, unless otherwise specified in Data Sheet -A.

5.00:00 **SHOP INSPECTION AND TESTS**

5.01.01 **General**

5.01.01 Manufacturer shall conduct all tests and stage inspections as per the approved

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quality plan to ensure that the various equipments and other accessories of the tube cleaning system shall conform to the requirements of this specification and of the applicable codes / standards.

5.01.02 All materials used for manufacture /fabrication of the various equipments of the tube cleaning system , shall be of tested quality. Relevant test certificates for chemical analysis, mechanical tests and heat treatment shall be made available before the final shop inspection. In case the relevant test certificates are not available, the manufacturer shall arrange to carry out the necessary tests as per the approved quality plan and applicable codes at his cost for which samples shall be identified by BHEL's representative.

5.01.03 All shop tests shall be conducted as per approved quality plan and test certificates / reports for the same shall be furnished to BHEL for approval.

5.01.04 Qualification of welding procedures and welders shall be as per ASME B&PV code, Section - IX / applicable codes.

5.2.00 **Ball Separator**

5.02.01 Chemical analysis, mechanical tests shall be carried out on materials used for body, strainer / screen, strainer / screen shaft and other appurtenances as per the applicable material specification standards.

5.02.02 All butt welded joints shall be subjected to radiographic/ ultrasonic testing as per applicable codes. However, all welded joints shall be subjected to 100% magnetic particle / penetrant testing to ensure freedom from defects.

5.02.03 Strainer / screen shaft shall be subjected to ultrasonic test as per ASTM-A388 for subsurface defects with acceptance norms as per ASME B&PV code, Section VIII, Division 1.

5.03.00 **Ball Recirculating Pump**

5.03.01 Chemical analysis, mechanical tests shall be carried out on materials used for casing, impeller, shaft, sleeves, wear rings etc., as per the applicable material specification standards.

5.03.02 The casting used for pump casing and impeller shall be sound, clean and free from porosity, blow holes, hard spots, cold shuts, distortion and other harmful defects. All accessible surfaces of the impeller shall be subjected to penetrant test as per ASTM-E165 for surface defects with acceptance norms as per ASME B&PV code, Section VIII, Division 1. No welding or repairs shall be carried out without prior permission of BHEL.

5.03.03 Pump shaft and sleeves shall be subjected to ultrasonic test as per ASTM - A388 for sub-surface defects and penetrant test after finish machining as per ASTM-E165 for surface defects.

5.03.04 Wear rings shall be subjected to penetrant test as per ASTM-E165.

5.03.05 Pump impellers and rotor assembly shall be statically and dynamically balanced as

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5.04.00 **Ball Collector**

5.04.01 Chemical analysis, mechanical tests shall be carried out on materials used for body and other appurtenances / accessories as per the applicable material specification standards.

5.04.02 All but welded joints shall be subjected to radiographic / ultrasonic testing as per applicable codes. However, all welded joints shall be subjected to 100% magnetic particle / penetrant testing to ensure freedom from defects.

5.05.00 **Piping, Valves, Distributors, and Injection Nozzles.**

5.05.01 Chemical analysis, mechanical tests shall be carried out for materials used for piping, fittings, valves, distributors and injection nozzles.

5.05.02 All welded joints of distributors & injection nozzles shall be subjected to penetrant test as per ASTM-E165 for surface defects with acceptance norms as per ASME B&PV code, Section VIII, Division 1.

5.05.03 Inspection and testing of valves including leakage test shall be carried out as per the requirements of the applicable standards. Valve stem and ball shall be subjected to penetrant test as per ASTM-E165.

5.05.04 All materials for various nozzles, stubs, gaskets, nuts, bolts etc. shall be of tested quality and correlating test certificates for chemical and mechanical properties shall be furnished.

5.06.00 **Rubber Lining (as applicable)**

Rubber lining shall be subjected to surface crack test, 100% spark and hardness tests and shall be checked for layer thickness, defects etc.

5.07.00 **Flanges**

5.07.01 Chemical and mechanical test certificates shall be furnished for flange materials.

5.07.02 In case of fabricated flanges, all the welds shall be subjected to 100% radiography as per ASME B&PV code, Section VIII, Division 1.

5.07.03 In case of forged flanges, ultrasonic testing shall be carried out as per ASTM-A 388.

5.07.04 If the thickness of the plate used for flanges is 40mm or more, the same shall be checked ultrasonically as per ASTM-A435 to demonstrate the absence of lamination and lack of fusion etc.

5.07.05 Flanges shall be checked for edge preparation, fit up and satisfactory working with matching parts.

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5.08.00      **Dimensional Checks.**

Dimensional checks for various equipments/components of the tube cleaning system shall be carried out as per assembly drawing approved by BHEL. Alignment and fit up of movable parts shall be checked.

5.09.00      **Hydrostatic Test**

Hydrostatic test shall be conducted on various assemblies / equipments / components of the tube cleaning system at a pressure of 1.5 times and design pressure. The duration of the test shall be minimum 30 minutes.

5.10.00      **Leakage Test**

Leakage test shall be conducted at the design pressure on all assemblies of the tube cleaning system to demonstrate that the assemblies are leak tight and no water seepage shall take place at various nozzles and valve connections.

5.11.00      **Performance Test on Recirculating Pump**

Performance test on recirculating pump with drive motor shall be conducted as per BS-599 / ASME PTC 8.0. Performance curves i.e., discharge flow Vs head, discharge flow Vs power consumption and discharge flow Vs efficiency shall be plotted and acceptance norms shall be as per BS-599 / ASME PTC 8.0. Vibration and noise shall be measure and acceptance norms shall be as per Hydraulic Institute (USA) standard.

5.12.00      **Functional Tests**

Various assemblies / equipments / components of the tube cleaning system shall be subjected to functional tests and the following shall be checked.

5.12.01

Smooth and free operation of all movable parts.

5.12.02

Interlock and sequential operation.

5.12.03

Satisfactory operations of ball monitoring system.

5.12.04

Satisfactory operations of actuators torque switches, limit switches etc.

6.00.00      **TESTING AT SITE**

After completion of installation at site, the tube cleaning system will be tested to check that the tube cleaning system performance meets the requirements of this specification. Rectification of all defects shall have to be done by the supplier at no extra cost to the owner / purchaser. However, the owner / purchaser reserves the right to reject the equipments / parts not meeting the requirement if the deficiency still persists.

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**7.0.0 Performance Guarantee and Bid Evaluation criteria for Condenser on Load Tube Cleaning System.**

The Tube Cleaning Systems shall be guaranteed to meet the performance requirements specified in Section-D , Data Sheet A and Guarantee schedule and also for trouble free operation after commissioning. Schedule of performance guarantees (enclosed in Volume III) duly filled and signed shall be furnished with the bid.

The Performance guarantees of equipments shall stand valid till the satisfactory completion of performance testing & its acceptance by BHEL/ Customer. If the guarantee period specified in the Commercial Specification is higher, same shall prevail.

**7.01.00 Performance Parameters to be guaranteed by bidders shall be as under :**

- i) Pressure drop in ball separator in clean condition viz. after back washing.
- ii) Percentage recovery of balls (min. 95% recovery)
- iii) Life of Sponge Rubber Ball (Min. 4 weeks)

**7.02.00 Bidder to note that bids shall be evaluated on account of pressure drop across ball collecting strainer (in clean condition) and liquidated damages on account of not meeting the same during PG test shall be in accordance with following :**

**A) Bid Evaluation Criteria & Liquidated Damages:**

The bids received shall be evaluated for Pressure drop across balls collecting strainers :

- The permissible limit of pressure drop across balls collecting strainers in clean condition shall be 0.15 MWC.
- If the pressure drops quoted are higher than above limit, the bids shall be technically loaded @ indicated in Data Sheet A .
- However no advantage shall be given for pressure drops quoted less than above permissible limit.
- The maximum acceptable limit for pressure drop across balls collecting strainer shall be (with technical loadings) 0.2 MWC.

The bids will be technically rejected for pressure drops quoted higher than above maximum limit.

- The guaranteed pressure drops shall be demonstrated at site by bidder and if found higher shall be subject to LD @ twice the bid evaluation factor as above.

**7.03.00 Other Guaranteed Parameters to be demonstrated at site**

- i) Life of sponge rubber balls shall be minimum 4 weeks.
- ii) Percentage recovery of balls shall be minimum 95%.

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Any deviation to above balls life and percentage recovery will not be accepted.

Bidder to indicate the life of sponge rubber ball and nos. of balls lost during 1000 hours of plant operation in the Guarantee schedule and shall demonstrate same at site.

In case the successful bidder fails to demonstrate any of these parameters he shall carry out modifications at his own cost, to purchasers approval.

In case bidder fails to demonstrate above parameters to purchaser's satisfaction even after modification carried by him at site, the purchaser has the right to reject the equipment out rightly.

**8.00.00 QUALITY ASSURANCE & QUALITY PLAN**

8.01.00 The tube cleaning system and other accessories to be supplied, shall have assured quality and workmanship.

8.02.00 Typical quality plans are enclosed herewith this specification for bidder's guidance. The bidder shall furnish his own quality plan based on materials, equipments and components of the tube cleaning system being offered.

**9.00.00 NAME PLATE AND TAG NUMBERS**

9.01.00 Ball separator, recirculating pump, ball collector shall be provided with a permanently attached brass or stainless steel plate indicating the following details :-

- a) Design and maximum flow rates.
- b) Design and test pressures.
- c) Design temperature.
- d) Empty and operating weights.

9.02.00 Each valve in the tube cleaning system shall be provided with a name plate indicating the following :-

- a) Service.
- b) Design and test pressures.
- c) Maximum flow and flow direction.
- d) Size.
- e) Tag Number.

Tag Numbers will be indicated on the drawings submitted for approval during contractstage.

9.03.00 Each motor shall be provided with a name plate indicating the following details :

- a) Supply conditions.
- b) KW Rating.
- c) Make.

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**DRAWING, DATA & INFORMATION TO BE SUBMITTED AFTER THE AWARD OF CONTRACT.**

The drawings, data and other documents as required in Data Sheet-C shall be furnished after the award of contract.

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**DATA SHEET - C**  
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- 1.00.00 **DRAWING, DATA & INFORMATION TO BE SUBMITTED AFTER THE AWARD OF CONTRACT.**
- After the award of contract, the following drawings, data and information is to be submitted for review / approval of BHEL as per the distribution schedule given in Section - C.
- 1.01.00 Within 2 (two) weeks of the date of LOI, the following shall be submitted,
- 1.01.01 Data sheet (s) - B.
- 1.01.02 Final versions of the following drawings to enable BHEL to finalise the layout and to design foundations and structures :-
- a) General arrangement / installation drawings of ball separator, ball recirculating unit, control panel each complete with all accessories, incorporating the principal dimensions and weights of equipment offered, size and location of various nozzle connection, supporting arrangement (wherever applicable) and scope of supply etc.
  - b) Foundation arrangement drawings (wherever applicable) showing load data on supports, size and location of anchor bolts etc.
  - c) General arrangement drawing indicating the layout of the equipments and interconnecting piping with pipe supports.
- 1.01.03 Bar chart and inspection schedule.
- 1.02.00 Within the stipulated time period as per Vendor's drawing /document list, the following shall be submitted.
- 1.02.01 Cross Sectional/ detailed drawing of ball separator, recirculating pump, ball collector, differential pressure measuring system, ball monitoring system distributors, injection nozzles actuators, motors, control panel etc, indicating bill of quantities and materials of construction.
- 1.02.02 Final versions of calculations and basis for selection of cleaning balls circulation quantity, type, size, hardness, cleaning frequency etc.
- 12.2.03 Flow and control logic diagrams for various operations of the tube cleaning system.
- 1.02.04 Detailed schedule of valves indicating Tag numbers, type, make size, pressure and temperature ratings, materials etc.
- 1.02.05 Detailed schedule of instruments indicating tag numbers, type, make, materials , of construction, range and accuracy etc.
- 1.2.6 Detailed schedule of piping and fittings indicating sizes, materials, maximum working pressure and temperatures etc.
- 1.02.07 Control panel layout and list of instruments provided on control panel.

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**TITLE :**

**DATA SHEET - C**  
**CONDENSER ON - LOAD TUBE CLEANING**  
**SYSTEM ( Sponge Rubber Ball Type )**

**SPECIFICATION NO. PE-TS-999-165-N001**

**VOLUME : II B**

**SECTION : D**

**REV. NO. 05**

**DATE :29.07.2007**

**SHEET2 OF 2**

- 1.02.08 List of annunciations, protections and interlocks provided.
- 1.02.09 Detailed drawings of flanges.
- 1.02.10 Ball recirculating pump performance characteristic curves.
- 1.02.11 Write-up and instruction manuals for erection, operation and maintenance.
- 1.02.12 Storage instructions.
- 1.02.13 Vendor to send 3 sets of final documents (O&M manual, GA drg, P&ID) direct to site under intimation to PEM.

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TITLE : STANDARD TECHNICAL SPECIFICATION  
DATA SHEET-A

CONDENSER ON - LOAD TUBE CLEANING  
SYSTEM (Sponge Rubber Ball Type)

VISHAKHAPATNAM ABHIJEET TPP (1X300MW)

SPEC. NO. PE-TS-381/382-165-N001

VOLUME: IIB

SECTION-D

REV. NO. 0 DATE: 12.04.2012

2X600 MW SCCL TPP-BTG Package

Sl. No	PROJECT	UNIT
1	<b>GENERAL</b>	
1.1	NOS. of tube cleaning systems sets required for station	NOS.
1.2	Liquid handled	
1.3	Size of COLTCS	Nb
2.0	<b>DESIGN</b>	
2.1	Operating pressure at Condenser inlet flange	kg/cm <sup>2</sup> (g)
2.2	Design Pressure for ball separator	kg/cm <sup>2</sup> (g)
2.3	Design Mechanical Temperature	Deg. C
2.4	Condenser Details	
	a) Type of condenser	
	b) No. of Condenser sections	Nos.
	c) No. of passes per condenser section (viz. condenser half)	Nos.
	d) No. of tubes per condenser	Nos.
	• Top two rows	
	• Remaining	
	e) Tube Dia. OD x Thickness	
	• Top two rows	mm x mm
	• Remaining	mm x mm
	f) Length of tubes between ends.	mm
	g) Tube material	
	h) Pressure drop across condenser	MWC
	- At Normal flow (between Inlet and Outlet flanges of condenser).	
	- At CW flow rate through each ball separator	
	- Normal	cu.m/hr
	- Maximum	cu.m/hr
2.5	Design differential pressure for ball separator strainer/screen	Kg/cm <sup>2</sup> (g)
2.6	Pressure drop across ball separator i.e. between inlet & outlet flanges in clean condition at normal flow.	MWC

Two (02) Nos. for one Unit viz. One independent set for each half of condenser	Two (02) Nos. for 2 units viz. One independent set for each half of condenser. 4 sets per unit (There are 2 no. of condenser per unit)
Clarified Sea Water as per Analysis Attached along with project information in section B.	Clarified Water as per Analysis Attached along with project information in section B.
2100 NB	1800 NB
Approx 1.5 to 2.0	Approx 1.5 to 2.0
5.0 kg/cm <sup>2</sup> (g) & vacuum 0.1 kg/cm <sup>2</sup> (abs)	5.0 kg/cm <sup>2</sup> (g) & vacuum 0.1 kg/cm <sup>2</sup> (abs)
50	60
Double pass	Double pass
2 (Two)	2 (Two)
2 (Two)	2 (Two)
14900	17286
280	2628
13187	14638
31.75 x 0.7112	28.575 x 0.889
31.75 x 0.56	28.575 x 0.7112
13000	13000
Welded Titanium Gr 2	SA 249 WELDED SS 304
5.5 MWC	4.19 MWC
(However the actual value can vary +/-10% of the design value)	(However the actual value can vary +/-10% of the design value)
22025	15825
26430	20580
0.2	0.2
0.15	0.15

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**TITLE : STANDARD TECHNICAL SPECIFICATION**  
**DATA SHEET-A**  
**CONDENSER ON - LOAD TUBE CLEANING**  
**SYSTEM ( Sponge Rubber Ball Type )**  
**VISHAKHAPATNAM ABHIJEET TPP (1X300MW)**

**SPEC. NO. PE-TS- 381/382-165-N001**  
**VOLUME : II B**  
**SECTION-D**  
**REV. NO. 0**      **DATE: 12.04.2012**  
**2X600 MW SCCL TPP-BTG Package**

L.NO	PROJECT	UNIT		
2.8	Pressure drop across ball separator in choked condition when strainer backwashing starts	MWC	Not to exceed 0.30	Not to exceed 0.30
2.9	No. of balls required for COLTCS per condenser section	Nos.	Minimum 10% of number of tubes	Minimum 10% of number of tubes
3	<b>CONNECTING PIPE DETAILS</b>			
3.1	Condenser inlet pipe	mm x mm	2140 x 20.0	Carbon Steel to IS - 2062 Gr. B 1829 x 16.0
3.2	Condenser outlet pipe	CS	2140 x 20.0	Carbon Steel to IS - 2062 Gr. B 1829 x 16.0
3.3	Manhole		Yes, 600 NB size	Yes, 600 NB size
4.0	<b>MATERIALS OF CONSTRUCTION</b>			
4.1	BALL SEPARATOR			
	a) Body / housing		Fabricated Carbon steel-IS 2062 Rubber Lined (with minimum housing thickness same as connecting pipe thickness)	Carbon Steel : IS-2062 Gr. B with Epoxy painted inside (with minimum housing thickness same as connecting pipe thickness)
	b) Screen / Strainer		Duplex UNS 32205	SS - 316
	c) Strainer shaft		Duplex UNS 32205	SS - 316
	e) Internal Hardware including nuts, bolts , etc.		Duplex UNS 32205	SS - 316
	f) Site Glass provision		Yes	Yes
4.2	BALL RECIRCULATING PUMP			
	a) Casing		ASTM A890 Gr. CD4MCuN (Duplex steel)	Non Clog type 2.5 % NiCl to IS 210 FG - 280
	b) Impeller		ASTM A890 Gr. CD4MCuN (Duplex steel)	SS 316
	c) Shaft		SS 317L / Duplex steel	SS-410
4.3	BALL COLLECTOR			
	a) Body / housing		Fabricated Carbon steel-IS 2062 Rubber Lined	Carbon Steel to IS-2062 Gr B with epoxy painted inside.
	b) Screen / Strainer		Duplex UNS 32205	SS-316
	c) Site Glass Provision		Yes	Yes
4.4	Differential pressure measuring system		Hastelloy C / Monel	SS-316
4.5	Injection nozzle		Duplex UNS 32205	SS-316
4.6	Valves			
4.6.1	Check Valves (all sizes)		For size 50 NB and below-Piston type For sizes 65 NB and above-Swing check type or dual plate type.	For size 50 NB and below-Piston type For sizes 65 NB and above-Swing check type or dual plate type.

(Signature)

PROJECT		UNIT	TITLE : STANDARD TECHNICAL SPECIFICATION DATA SHEET-A CONDENSER ON - LOAD TUBE CLEANING SYSTEM ( Sponge Rubber Ball Type ) VISHAKHAPATNAM ABHIJEET TPP (1X300MW)	
SPEC. NO. PE-TS-381/382-165-N001		VOLUME : II B		
SECTION-D		DATE: 12.04.2012		
REV. NO. 0		2X600 MW SCCL TPP-BTG Package		
a)	Body & Bonnet		ASTM-A-439, D2-NI	For sizes 65 NB & above : CI, IS 210, Gr.FG 260 For sizes 50 NB & below : Gunmetal IS 318 Gr.2
b)	Seating surface & rings		Duplex SS	13% Chromium Steel
c)	Disc for Check Valve		ASTM-A-439, D2-NI	65 NB and above: CI, IS 210, Gr.FG 260 Below 50 NB: A 351 CF 8
d)	Hinge Pin for Check Valve		Duplex SS	AISI - 316
e)	Backseat for check valve		Duplex SS	13% Chromium Steel
4.6.2	Globe Valves 50 Nb & Below Body, Bonnet & trim		ASTM-A-439, D2-NI	SA 351 CF8M (SS)
4.6.3	> BF/Gate Valves (65 Nb & above)		ASTM-A-439, D2-NI	2% NiCl as per IS 210, FG 260, epoxy coated
	> Body & Disc		Duplex stainless steel	SS 410
	> Shaft		Buna-N	Nitrite Rubber
	> Seal		ASTM-A-439, D2-NI	18 - 8 SS
	> Sealing, Retaining segment & Internals		Self lubricating	Self lubricating
	> Bearings		UNS 32205 Duplex steel	IS 2062, Gr. B
	> Companion Flange			
C)	Ball valves			
i)	Body			SA 351 CF8M
ii)	Ball			SA 351-CF8M
iii)	Stern			SS 316
4.7	Interconnecting Piping Material		By Purchaser GRP	a) upto 150NB - Carbon steel ERW, IS:1239 (Heavy Grade) By Bidder
5	COUNTER FLANGES for Ball Separator			
a)	Flanges			Carbon Steel to IS 2062 Gr. B or eq for thickness, drilling etc refer Annexure II in section C1 (In Bidder's scope)
b)	Fasteners		A 193 & A 194	A 193 & A 194
c)	Gaskets		Min 4 mm thick rubber	Min 4 mm thick rubber

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**TITLE : STANDARD TECHNICAL SPECIFICATION  
DATA SHEET-A**

**CONDENSER ON - LOAD TUBE CLEANING  
SYSTEM ( Sponge Rubber Ball Type )**

**VISHAKHAPATNAM ABHIJEET TPP (1X300MW)**

**SPEC. NO. PE-TS-381/382-165-N001**

**VOLUME : II B**

**SECTION-D**

**REV. NO. 0 DATE: 12.04.2012**

**2X600 MW SCLL TPP-BTG Package**

NO	PROJECT	UNIT	
6	<b>OTHER COUNTER-FLANGES</b> (for interconnecting piping)		In Bidder's scope
3.1	<b>MATERIALS</b>		Carbon Steel to IS 2062 Gr. B
	a) Flanges		A 193 & A 194
	b) Fastners		Min 4 mm thick rubber
	c) Gaskets		Suitable for intended sea water, duty and compatible with MOC of connecting pipes and shall be subject to Purchasers approval during detailed engg. In the event of order.
8.0	<b>PAINTING</b>		
8.1	<b>INTERNAL SURFACE</b>		SA - 2.5 of Swedish Specn. SIS-05-59-00-1967
	a) Surface preparation		Adequate primer
	b) Primer		One coat of Epoxy resin based primer
	c) Final paint		Rubber lining (with 5 mm thick)
8.2	<b>EXTERNAL SURFACE</b>		SA-2.5 of Swedish Specn. SIS-05-5900-1967
	a) Surface preparation		Two coat of Epoxy polyamide resin based red oxide - zinc phosphate primer(50 micron per coat)
	b) Primer		One coat of two pack air drying high build epoxy resin based paint with MIO(80 micron per coat)
	a) Intermediate		Two coat of two pack air drying epoxy polyamide enamel suitably pigmented.(30 Micron per coat)
	d) Final paint		(Sacrificial type anode in bidder's scope) YES
9.0	Adequate provision for future installation of cathodic protection (Sacrificial type anodic protection by Purchaser)		If required as per bidder's design - the same to be incorporated by bidder in its constructional feature.
10.0	Flow straightener for streamlining the CW flow in ball collecting strainer.		
11.0	Performance Guarantee & Bid Evaluation		
11.1	Performance Parameters to be Guaranteed		
	◆ Pressure drop in ball separator in clean condition		As per Guarantee schedule of bidder
	◆ Percentage recovery of balls		Min. 95 % recovery
	◆ Life of sponge Rubber Balls		Min. 4 weeks

MS



**TITLE : STANDARD TECHNICAL SPECIFICATION  
DATA SHEET-A**

**CONDENSER ON - LOAD TUBE CLEANING  
SYSTEM (Sponge Rubber Ball Type)**

**VISHAKHAPATNAM ABHIJEET TPP (1X300MW)**

**SPEC. NO. PE-TS-381/382-165-N001**

**VOLUME : II B**

**SECTION-D**


**REV. NO. 0 DATE: 12.04.2012**

**2X600 MW SCCL TPP-BTG Package**

PROJECT	UNIT		
1			
2	Bid evaluation Criteria & Liquidated damages	As per clause no 8.00.00 of Section C1	As per clause no 8.00.00 of Section C1
3	Bid evaluation rate	@ Rs. 16 Lacs per 0.05 MWC pr. drop across each balls collecting strainer	@ Rs. 5.83 Lacs per 0.05 MWC pr. drop across each balls collecting strainer
4	Liquidated damages	Twice the bid evaluation rate	Twice the bid evaluation rate
5	The tube cleaning system shall be designed for following operation modes:		
	a) Automatic start up initiated by push button	YES	YES
	b) Automatic shut down with ball collection effected by : i. Push button ii. Adjustable timer iii. Ball monitoring system	YES	YES
	c) Automatic backwashing of ball separator with ball collection effected by : a. Push button b. Adjustable timer c. Diff. Pressure measuring system	YES	YES
	d) Automatic emergency backwashing of ball separator effected by diff. Pressure measuring system	YES	YES
	e) Automatic ball sorting initiated by push button	YES	YES
	f) Provision for manual operation of complete tube cleaning system in case of control system failure	YES	YES
	g) Whether the contacts for DPG, DPS and DPT are independent	YES	YES
	h) Timer for Backwashing	YES	YES

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	<b>TITLE : STANDARD TECHNICAL SPECIFICATION</b> <b>DATA SHEET-A</b>		<b>SPEC. NO. PE-TS- 381/382-165-N001</b>
	<b>PROJECT</b>	<b>UNIT</b>	<b>VOLUME : II B</b>
	<b>CONDENSER ON - LOAD TUBE CLEANING SYSTEM ( Sponge Rubber Ball Type )</b>	<b>VISHAKHAPATNAM ABHIJEET TPP (1X300MW)</b>	<b>SECTION-D</b>
	<b>NO</b>	<b>REV. NO. 0</b>	<b>DATE: 12.04.2012</b>

<p>i) Whether the ball monitoring system is designed to perform the following functions :</p> <p>i. Continuously counting the balls in circulation and giving an alarm calling for investigation of ball losses when the number of balls falls below a set value</p> <p>ii. Continuously measuring the size of the balls in circulation and initiating the shutdown of the tube cleaning system with alarm calling for replacement of balls when the no. of oversized balls falls below a set value</p>	<p>YES</p>	<p>YES</p>
<p>j) Whether the electronic processor of the ball monitoring system is provided with the following :</p> <p>i. Indicators for required basic ball charge</p> <p>ii. Indicators for recirculating ball quantity</p> <p>iii. Indicators for oversized ball quantity</p> <p>iv. Time counters for total cleaning system operating hours</p> <p>v. Time counters for cleaning system operating hours with sufficient no. of oversized balls</p> <p>vi. Recorders for ball consumption</p>	<p>YES</p>	<p>YES</p>

<p>k) Whether provision for self testing and self calibration are made</p>	<p>YES</p>	<p>YES</p>
<p>3.0 Mandatory Spares to be supplied under this specification.</p>	<p>NA</p>	<p>1. DPT- 2 Nos. 2. DPG- 1 No. 3. PI - 2 Nos.</p>
<p>4.0 Documents enclosed for bidder's reference</p>	<p>Indicated in project information in Section B.</p>	<p>Indicated in project information in Section B.</p>
<p>♦ Water Analysis ♦ GA of CW piping in TG hall</p>	<p>During detailed engineering</p>	<p>During detailed engineering</p>

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MODEL QUALITY PLAN FOR BALL SEPARATOR

Sl. No.	Component/Operation	Characteristics Checked	Class	Type of Check	Quantity of Checks	Referen Documents	Acceptance Norms	Format of Record	Agency	Remarks
									D M C N	
1	Ball Separator									
1.1a	Raw Material Inspection and Screen No	Chemical & Physical Properties	Major	Chemical Check	Sample Heat	Approved Grp Data sheet at 247	Approved Grp Data sheet	Inspection Report	X P V V	Material T.C. required
1.1b	Nozzle faces, Main flange, Screen sheet	Surface defects	Major	GO	DO	Approved Grp Data sheet at 247	Approved Grp Data sheet	Inspection Report	X P V V	Material T.C. required
1.1c	Ball End Join Nozzle Pipes	Leakage Tightness	Major	Hydro Test	100%	DO	DO	DV	X P V V	Material T.C. required
1.2	In process welds, procedure qualification and welder performance qualification	Weld Soundness	Crit-Cell	Visual & R.T.	100%	EN-287-1	EN-287-1	EN-287-1	X P V V	Qualified welder, second procedure to be used for welding
1.2.2	Final tests (complete equipments) after assembly	Dimensional, Original workman-ship & finish	Major	Visual measure	100%	G.A. Grp	G.A. Grp	IR	X P V V	
		Dimensional assembly	Crit-Cell	All dimension precision for 1/2 HR	100%	G.A. Grp	No Leakage	IR	X P W W	
		Body function test	Crit-Cell	Operational test for (a) smooth 7 thr operation of all moveable parts (b) Interlocks and sequential operation (c) Secondary operation of ball monitoring system (d) Satisfactory operation of calculator torque switches, limit switches etc.	100%	Approved (G.A. Grp) Specn.	Approved Specn.	IR	X P W W	

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MODEL QUALITY PLAN FOR BALL VESSEL		Package - COTCS	
2.1	Ball vessel		
2.2	Ball materials		
2.3	Chemical & Mechanical Properties	Chem. & Mech. Properties	Approved. Dwg. (see sheet)
2.4	Weld Quality	1. Specific Conditions	Approved. Dwg. (see sheet)
2.5	Pressure Test	10% of test joint weld	ASME Sec. VIII Div. 1 Appendix-4 UWA2
2.6	Fabricated shell	Chem. & Mech. Properties	Approved. Dwg. (see sheet)
2.7	Welding	100% of test joint weld	ASME Sec. VIII Div. 1 Appendix-4 UWA2
2.8	Hydro Test	Critical Leakage test	100% Approved. Dwg. (see sheet)
2.9	Material	Material	Approved. Dwg. (see sheet)
2.10	Design	Design	Approved. Dwg. (see sheet)
2.11	Construction	Construction	Approved. Dwg. (see sheet)
2.12	Inspection	Inspection	Approved. Dwg. (see sheet)
2.13	Final Acceptance	Final Acceptance	Approved. Dwg. (see sheet)
2.14	Documentation	Documentation	Approved. Dwg. (see sheet)
2.15	Quality Control	Quality Control	Approved. Dwg. (see sheet)
2.16	Material	Material	Approved. Dwg. (see sheet)
2.17	Welding	Welding	Approved. Dwg. (see sheet)
2.18	Hydro Test	Hydro Test	Approved. Dwg. (see sheet)
2.19	Material	Material	Approved. Dwg. (see sheet)
2.20	Design	Design	Approved. Dwg. (see sheet)
2.21	Construction	Construction	Approved. Dwg. (see sheet)
2.22	Inspection	Inspection	Approved. Dwg. (see sheet)
2.23	Final Acceptance	Final Acceptance	Approved. Dwg. (see sheet)
2.24	Documentation	Documentation	Approved. Dwg. (see sheet)
2.25	Quality Control	Quality Control	Approved. Dwg. (see sheet)
2.26	Material	Material	Approved. Dwg. (see sheet)
2.27	Welding	Welding	Approved. Dwg. (see sheet)
2.28	Hydro Test	Hydro Test	Approved. Dwg. (see sheet)
2.29	Material	Material	Approved. Dwg. (see sheet)
2.30	Design	Design	Approved. Dwg. (see sheet)
2.31	Construction	Construction	Approved. Dwg. (see sheet)
2.32	Inspection	Inspection	Approved. Dwg. (see sheet)
2.33	Final Acceptance	Final Acceptance	Approved. Dwg. (see sheet)
2.34	Documentation	Documentation	Approved. Dwg. (see sheet)
2.35	Quality Control	Quality Control	Approved. Dwg. (see sheet)
2.36	Material	Material	Approved. Dwg. (see sheet)
2.37	Welding	Welding	Approved. Dwg. (see sheet)
2.38	Hydro Test	Hydro Test	Approved. Dwg. (see sheet)
2.39	Material	Material	Approved. Dwg. (see sheet)
2.40	Design	Design	Approved. Dwg. (see sheet)
2.41	Construction	Construction	Approved. Dwg. (see sheet)
2.42	Inspection	Inspection	Approved. Dwg. (see sheet)
2.43	Final Acceptance	Final Acceptance	Approved. Dwg. (see sheet)
2.44	Documentation	Documentation	Approved. Dwg. (see sheet)
2.45	Quality Control	Quality Control	Approved. Dwg. (see sheet)
2.46	Material	Material	Approved. Dwg. (see sheet)
2.47	Welding	Welding	Approved. Dwg. (see sheet)
2.48	Hydro Test	Hydro Test	Approved. Dwg. (see sheet)
2.49	Material	Material	Approved. Dwg. (see sheet)
2.50	Design	Design	Approved. Dwg. (see sheet)
2.51	Construction	Construction	Approved. Dwg. (see sheet)
2.52	Inspection	Inspection	Approved. Dwg. (see sheet)
2.53	Final Acceptance	Final Acceptance	Approved. Dwg. (see sheet)
2.54	Documentation	Documentation	Approved. Dwg. (see sheet)
2.55	Quality Control	Quality Control	Approved. Dwg. (see sheet)
2.56	Material	Material	Approved. Dwg. (see sheet)
2.57	Welding	Welding	Approved. Dwg. (see sheet)
2.58	Hydro Test	Hydro Test	Approved. Dwg. (see sheet)
2.59	Material	Material	Approved. Dwg. (see sheet)
2.60	Design	Design	Approved. Dwg. (see sheet)
2.61	Construction	Construction	Approved. Dwg. (see sheet)
2.62	Inspection	Inspection	Approved. Dwg. (see sheet)
2.63	Final Acceptance	Final Acceptance	Approved. Dwg. (see sheet)
2.64	Documentation	Documentation	Approved. Dwg. (see sheet)
2.65	Quality Control	Quality Control	Approved. Dwg. (see sheet)
2.66	Material	Material	Approved. Dwg. (see sheet)
2.67	Welding	Welding	Approved. Dwg. (see sheet)
2.68	Hydro Test	Hydro Test	Approved. Dwg. (see sheet)
2.69	Material	Material	Approved. Dwg. (see sheet)
2.70	Design	Design	Approved. Dwg. (see sheet)
2.71	Construction	Construction	Approved. Dwg. (see sheet)
2.72	Inspection	Inspection	Approved. Dwg. (see sheet)
2.73	Final Acceptance	Final Acceptance	Approved. Dwg. (see sheet)
2.74	Documentation	Documentation	Approved. Dwg. (see sheet)
2.75	Quality Control	Quality Control	Approved. Dwg. (see sheet)
2.76	Material	Material	Approved. Dwg. (see sheet)
2.77	Welding	Welding	Approved. Dwg. (see sheet)
2.78	Hydro Test	Hydro Test	Approved. Dwg. (see sheet)
2.79	Material	Material	Approved. Dwg. (see sheet)
2.80	Design	Design	Approved. Dwg. (see sheet)
2.81	Construction	Construction	Approved. Dwg. (see sheet)
2.82	Inspection	Inspection	Approved. Dwg. (see sheet)
2.83	Final Acceptance	Final Acceptance	Approved. Dwg. (see sheet)
2.84	Documentation	Documentation	Approved. Dwg. (see sheet)
2.85	Quality Control	Quality Control	Approved. Dwg. (see sheet)
2.86	Material	Material	Approved. Dwg. (see sheet)
2.87	Welding	Welding	Approved. Dwg. (see sheet)
2.88	Hydro Test	Hydro Test	Approved. Dwg. (see sheet)
2.89	Material	Material	Approved. Dwg. (see sheet)
2.90	Design	Design	Approved. Dwg. (see sheet)
2.91	Construction	Construction	Approved. Dwg. (see sheet)
2.92	Inspection	Inspection	Approved. Dwg. (see sheet)
2.93	Final Acceptance	Final Acceptance	Approved. Dwg. (see sheet)
2.94	Documentation	Documentation	Approved. Dwg. (see sheet)
2.95	Quality Control	Quality Control	Approved. Dwg. (see sheet)
2.96	Material	Material	Approved. Dwg. (see sheet)
2.97	Welding	Welding	Approved. Dwg. (see sheet)
2.98	Hydro Test	Hydro Test	Approved. Dwg. (see sheet)
2.99	Material	Material	Approved. Dwg. (see sheet)
2.100	Design	Design	Approved. Dwg. (see sheet)

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MODEL QUALITY PLAN FOR RECIRCULATING PUMP FOR COTGS, DF AND SCS

S.No.	Component/Operation	Characteristics checked	Class	Type of Check	Quantum of check	Reference Documents	Acceptance Norms	Format of Record	Agency			
									D	M	C	N
	Raw material, castings, gaskets, bearings, tools, slabs, stand, sheet	Chemical & Mechanical properties	Minor	For each item	Approved sheet	Approved sheet	Approved sheet	TA	X	P	V	V
	Final inspection on assembled pump	Performance, Q, VI Head, V, Efficiency, Corrosion, Vibration tests	Major	Performance check	100%	Approved sheet	Approved sheet	Approved sheet	X	P	V	V
	Visual gms. Workmanship		Minor	Visual	100%							

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**TITLE : TECHNICAL SPECIFICATION  
FOR  
CONDENSER ON LOAD TUBE CLEANING  
SYSTEMS (COLTCS) & DEBRIS FILTER (DF)**

**SPEC. NO. PE-TS-381/382-165-N001**

**VOLUME : II B**

**SECTION : D**

**REV. NO. 0**

**DATE :12.04.2012**

**SHEET ,1of 1**

**SECTION D2**

**STANDARD TECHNICAL SPECIFICATION  
FOR  
DEBRIS FILTER**



**TITLE :**  
**STANDARD TECHNICAL SPECIFICATION**  
**DEBRIS FILTER**  
**( Backwash Type )**

**SPECIFICATION NO. PE-TS- 999-165-N003**

**VOLUME : II B**

**SECTION : D**

**REV. NO. 03**

**DATE : 29.07.2007**

**SHEET 1 OF 10**

**1.00.00 GENERAL**

This specification covers the Design, Performance and Operational Requirements, Constructional Features, Manufacture, Assembly. Inspection and Testing at the Manufacturer's and/or his Sub-contractor's works and Painting for delivery of Debris Filter (Backwash Type) complete with all accessories as specified hereinafter.

**2.00.00 CODES AND STANDARDS**

2.01.00 The design, materials manufacture, inspection and testing of the Debris Filter complete with all accessories, shall comply with the requirements of the latest revisions of the following appropriate codes and standards :

2.01.01 IS / BS / DIN / US Standards regarding pressure vessels, pipes, flanges and others as necessary.

2.01.02 IS / BS / DIN / ASTM Standards for materials specification and testing procedures.

2.01.03 IS / BS / DIN / AWWA Standards for valves and their testing.

2.02.00 In case of any conflict between the above codes / standards and this specification, the later shall prevail and in case of any further conflict in the matter, the interpretation of the specification by the Engineer shall be final and binding.

**3.00.00 DESIGN AND CONSTRUCTION**

**3.01.00 General Requirements**

3.01.01 Unless otherwise necessary manufacturer's standard and proven models of the Debris Filter shall be supplied.

3.01.02 The Debris Filter shall be capable of safe, proper and continuous operation. Vibration, noise, mechanical stresses shall be kept within allowable limits specified by relevant codes / standards, In design due attention shall be given to ease of maintenance, repair and cleaning.

3.01.03 Suitable corrosion allowance shall be provided wherever necessary.

3.01.04 The Debris Filter shall be designed to suit installation in on-line or off-line arrangement as specified in Data Sheet-A.

In the on-line arrangement, the inlet and outlet pipes of the debris filter shall be in line with each other on the same axis without any off-set between the centre lines of inlet and outlet pipes.

In the off-line arrangement, the debris filter inlet and outlet pipes shall be at right angle (90°) to each other.



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**3.02.00 Performance Requirements**

The Debris Filter with all accessories shall be designed and guaranteed to meet the following requirements :-

**3.02.01** The Debris Filter shall perform satisfactorily under the flow and pressure conditions specified in Data Sheet -A and shall be capable of housing the various forms of debris / sludge i.e., suspended particles / matter, mussels, grass, leaves, wood pieces etc. The performance of the Debris Filter shall be continuous with minimum number of flushing / backwashing operations.

**3.02.02** The Debris Filter shall be designed such that the pressure drop across the Debris Filter (i.e., between inlet and outlet connections) under clean conditions and partially (50%) choked conditions shall not be more than those specified in Data Sheet -A.

**3.02.03** Unless otherwise specified in Data Sheet -A, debris discharge / wash water flow rate during flushing/back washing operation shall be limited to 10% of the total flow rate and flushing / backwashing operation shall be completed within a period of maximum three (3) minutes. The pressure drop across the debris filter during flushing/backwashing operation shall not be more than the pressure drop under partially (50%) choked condition.

**3.02.04** The coarse particles and floating matter accumulating at the filter section/screen are flushed out of the system by the system by the debris flushing / backwash unit such that the pressure drop across the filter after flushing / backwashing, shall not be more than 1.1 times the pressure drop under clean conditions.

**3.03.00 Operational Requirement**

The Debris Filter and other accessories shall be designed for the following flushing/backwashing operation modes :

**3.03.01** Complete automatic flushing/backwashing operation effected by the following :-

- ◆ differential pressure measuring system at a pre-determined differential pressure across the filter screen.
- ◆ adjustable timer (0-24 hours)
- ◆ push button (for manual initiation of sequential flushing / backwashing)

**3.03.02** Manual operation in the event of failure of control system.

**3.04.00 Filter Housing / Body**

**3.04.01** The Debris Filter housing/body shall be designed and manufactured as per the applicable codes for pressure vessels. It shall house the filter section / screen assembly and shall have flanged inlet, outlet, flushing / debris discharge openings and pressure measuring tappings etc.



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- 3.04.02 In design of Debris Filter housing / body due attention shall be given for easy removal and replacement of filter section / screen assembly.
- 3.04.03 The Debris Filter shall be provided with inspection hole with bolted cover.
- 3.04.04 The Debris Filter body / housing shall be provided with vent and drain connections with isolating valves. It shall be possible to drain unfiltered and filtered water.
- 3.04.05 If specified in Data Sheet-A, filter body/housing shall be epoxy painted.
- 3.05.00 **Filter Section / Screen assembly.**
- 3.05.01 The Debris Filter section/screen shall be designed for the maximum differential pressure across the filter and shall be securely positioned by a supporting cage and shall be securely mounted in the housing or body.
- 3.05.02 The perforation/mesh size of the Debris Filter section shall not be more than that specified in Data Sheet-A.
- 3.05.03 The arrangement of the Debris Filter section shall be such that the forced accumulation of debris on the filter screen / section shall be minimum.
- 3.06.00 **Differential Pressure Measuring System**
- 3.06.01 The Debris Filter shall be provided with a measuring system for differential pressure across the filter section/screen, to check debris accumulation and to initiate flushing / backwashing operation. This shall consist of a differential pressure switch / transmitter for automatic flushing operation, a differential pressure gauge for manual observation with adequate number of tapping with isolating valves and equalising valves.
- 3.06.02 The contacts for differential pressure switch / transmitter and for differential pressure gauge shall be independent so that in the event of failure of one, the other is available .
- 3.06.03 The differential pressure measuring system shall be provided with D.P. transmitter ,DPS & DPG of remote seal arrangement..
- 3.07.00 **Flushing / Backwash Unit. :**
- 3.07.01 The Debris Filter shall be provided with suitable flushing/backwash unit (to be installed at ground floor) and debris discharge/backwash outlet valve with associated actuator to flush out the accumulated debris / sludge.
- 3.07.02 The flushing pump shall be provided with mechanical seals to the extent possible. If gland packing is provided it should be of good quality to prevent leakage of water from pump glands.



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3.07.03 The flushing arrangement shall be either fixed type with flushing valves or a rotating debris extractor.

3.07.04 If any water is to be injected for backwashing the filter section/screen, water shall be taken from down-stream side of the filter section/ screen. Necessary pump, valves and piping for water injection shall be supplied.

3.07.05 View glass to be provided in debris outlet pipe to monitor the flushing of debris.

3.08.00 **Valves**

The flushing valves (if any,) the debris discharge/backwash outlet valve, isolation, vent and drain valves shall conform to appropriate codes / standards. The debris discharge/backwash outlet valve shall be larger than the debris discharge/back wash outlet pipe.

3.09.00 **Instrumentation and Control System**

3.09.01 Complete instrumentation and control system for automatic flushing / backwashing operation, protection, interlocking, indication/annunciation of high differential pressure and other malfunctions etc. shall be provided. This shall consist of adequate operational hardware, local control panel and interconnecting control and power cabling between the control panel and the self-cleaning filter and its associated electrical devices.

3.09.02 The control panel shall house all necessary instruments, indicating/ annunciation lamps, alarms, differential pressure indicator, timer, function selector switches, relays, protection and interlocking systems, start/stop push buttons, counter to register number of flushing operations etc., and shall be complete with internal wiring. In addition to the above, the control panel shall meet the requirements of the enclosed specification.

3.09.03 All instrumentation shall be of reputed make and shall meet the requirement of the enclosed specification.

3.10.00 **Actuators :**

The actuators for flushing arrangement and debris discharge valve shall be electric motor operated and shall meet the requirements of the enclosed specification. The actuators shall be provided with auxiliary handwheel for manual operation in the event of power failure.

3.11.00 **Electric Motors :**

The drive motors for differential pressure measuring system flushing pump and water injected pump (if applicable) shall conform to the requirements of the enclosed specification.



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**3.12.00 Other Accessories.**

3.12.01 Counter flanges, flat faced slip on type, complete with gaskets, bolts and nuts etc., shall be supplied for the filter inlet, outlet connections and all other terminal points. Fabrication, dimensions and drilling of the flanges shall conform to the codes/standards specified in Data Sheet-A.

3.12.02 Debris Filter shall be provided with suitable lifting arrangement for handling during erection and maintenance.

3.12.03 Necessary supporting arrangement (wherever applicable) complete with foundation plates, bolts, nuts etc., shall be provided.

**3.13.00 Material of Construction**

Material of Debris Filter and other accessories shall be corrosion resistant and consistent with the fluid handled. However material specification for various components shall be equal or superior to those specified in Data Sheet-A.

**4.00.00 PAINTING**

4.01.00 The surface preparation of the filter housing / body and other parts shall be done as per the standard mentioned in Data Sheet-A and shall include the following :

- a) Removal of oil, grease, dirt and swarf etc.
- b) Removal of rust and scale etc.
- c) Sand blasting/shot blasting.

4.02.00 All internal surfaces of the filter which are subject to immersion or water spray and which are not made of stainless steel or other corrosion resistant materials after surface preparation, shall be coated with four coats (minimum 500 microns thick) of epoxy paint of approved make and quality over a coat of zinc chromite primer, unless otherwise specified in Data sheet-A.

4.03.00 The external surfaces of the filter and other accessories after surface preparation, shall be coated with two coats (minimum 250 microns thick) of synthetic enamel paint of approved make and quality over two coats of red oxide primer, unless otherwise specified in Data Sheet-A.



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**5.00.00 SHOP INSPECTION AND TESTS**

**5.01.00 General :**

**5.01.01** Manufacturer shall conduct all tests and stage inspections as per the approved quality plan to ensure that the Debris Filter and other accessories shall conform to the requirements of this specification and of the applicable codes/ standards.

**5.01.02** All materials used for manufacture/fabrication of the Debris Filter shall be of tested quality. Relevant test certificates for chemical analysis, mechanical tests and heat treatment shall be made available before the final shop inspection. In case the relevant test certificates are not available, the manufacturer shall arrange to carry out the necessary tests as per approved quality plan and applicable codes at his cost, for which samples shall be identified by BHEL's representative.

**5.01.03** All shop tests shall be conducted in the presence of BHEL's representative and test certificates / reports for the same shall be furnished to BHEL for approval.

**5.01.04** Qualification of welding procedures and welders shall be as per ASME B&PV Code, Section-IX / applicable codes.

**5.02.00 Filter Housing / Body**

**5.02.01** Chemical analysis, mechanical tests shall be carried out on housing/body material.

**5.02.02** All butt welded joints shall be subjected to radiographic / ultrasonic testing as per applicable codes. However all welded joints shall be subjected to 100% magnetic particle / penetrant testing to ensure freedom from defects.

**5.03.00 Rubber Lining (as applicable)**

Rubber lining shall be subjected to surface crack test, 100% spark and hardness tests and shall be checked for layer thickness, defects etc.

**5.04.00 Filter Section/Screen assembly**

Supporting cage and filter section/screen materials shall be tested for chemical properties. Checks shall be carried out for perforation/mesh size, defects etc.

**5.05.00 Flushing / Backwash Unit**

**5.05.01** Material of various components of the flushing/Backwash Unit shall be tested for chemical and mechanical properties.

**5.05.02** Hollow shaft of backwash rotor shall be ultrasonically tested as per ASTM-A 388 for internal flaws. Penetrant test shall be carried out for surface flaws.



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**5.06.00 Valves**

Inspection and testing of valves including leakage test shall be carried out as per the requirements of the applicable standards. Correlating test certificates for materials of the valve components shall be furnished.

**5.07.00 Flanges**

**5.07.01** In case of fabricated flanges, all the welds shall be subjected to 100% radiography as per ASME B&PV code, section VIII, Division-1.

**5.07.02** In case of forged flanges, ultrasonic testing shall be carried out as per ASTM-E 388.

**5.07.03** If the thickness of the plate used for flanged is 40mm or more the same shall be checked ultrasonically as per ASTM-A 435 to demonstrate the absence of lamination and lack of fusion etc.

**5.07.04** Chemical and mechanical test certificates shall be furnished for flange materials.

**5.07.05** Flanges shall be checked for edge preparation, fit up and satisfactory working with matching parts.

**5.08.00** All materials for various nozzles, seals, pipes, gaskets, nuts bolts etc., shall be of tested quality and correlating test certificates for chemical and mechanical properties shall be furnished.

**5.09.00 Dimensional Checks**

Dimensional checks of various components of the Debris Filter shall be carried out as per the drawings approved by BHEL.

**5.10.00 Hydrostatic Test**

Hydrostatic test shall be conducted on the Debris Filter housing/body at a pressure of 1.5 times the design pressure. The duration of the test shall be minimum 30 minutes.

**5.11.00 Leakage Test**

Leakage test shall be conducted at the design pressure to demonstrate that the filter assembly is leak tight and no water seepage shall take place at various nozzle and valve connections.



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**5.12.00 Functional Tests**

The Debris Filter assembly complete with valves, actuators and other accessories shall be subjected to functional tests and the following shall be checked :-

5.12.01 Smooth and free operation of all movable parts.

5.12.02 Interlocks and sequential operation.

5.12.03 Satisfactory operation of actuator torque switches, limit switches etc.

5.13.0 Performance Test :

Performance Test shall be conducted to ensure that the Debris Filter meets the specified performance requirements.

**6.00.00 TESTING AT SITE**

After completion of installation at site, the Debris Filter with complete accessories, will be tested to check that the filter performance meets the requirements of its specification, Rectification of all defects shall have to be done by the supplier at no extra cost to the Owner / Purchaser. However the Owner / Purchaser reserves the right to reject the equipment / parts not meeting the requirement if the deficiency still persists.

**7.00.00 PERFORMANCE GUARANTEE & Bid evaluation criteria**

The Debris Filter shall be guaranteed to meet the performance requirements specified in Section-D , Data Sheet A and Guarantee schedule and also for trouble free operation after commissioning. Schedule of performance guarantees (enclosed in Volume III) duly filled and signed shall be furnished with the bid.

The Performance guarantees of equipments shall stand valid till the satisfactory completion of performance testing & its acceptance by BHEL/ Customer. If the guarantee period specified in the Commercial Specification is higher, same shall prevail.

7.01.00 Performance Guarantee Parameters shall be as under :

- Pressure drop in Debris Filters in clean condition viz. after backwashing.

7.02.01 Bidder to note that bids shall be evaluated on account of pressure drop across Debris Filters (in clean condition) & liquidated damages on account of not meeting the same shall be in accordance with following :

**A) Bid Evaluation Criteria and Liquidated Damages:**

The bids received shall be evaluated for Pressure drop across Debris Filter:



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- The permissible limit of pressure drop across Debris Filter in clean condition shall be 0.5 MWC.
- If the pressure drops quoted are higher than above limit, the bids shall be technically loaded @ Rate as mentioned in Data Sheet-A-for respective projects per 1 MWC pressure drop (viz. per unit).
- However no advantage shall be given for pressure drops quoted less than above permissible limit.

The bids will be technically rejected for pressure drops quoted higher than above maximum limit.

- The guaranteed pressure drops shall be demonstrated at site by vendors and if found higher shall be subject to LD @ twice the bid evaluation factor as above.

**8.00.00 QUALITY ASSURANCE & QUALITY PLAN**

**8.01.00** The Debris Filter and other accessories to be supplied shall have assured quality and workmanship.

**8.02.00** Typical quality plans are enclosed herewith this specification for bidder's guidance. The bidder shall comply with these minimum requirements and shall furnishing own quality plan based on materials and components of the filter being offered.

**9.00.00 NAME PLATE AND TAG NUMBERS**

**9.01.00** The Debris Filter shall be provided with a permanently attached brass or stainless steel plate indicating the following details:-

- a) Design flow
- b) Design and test pressures
- c) Design temperature
- d) Filter section/screen mesh size
- e) Empty and operating weights
- f) Revolving speed of backwash rotor

**9.02.00** Each valve shall be provided with a name plate indicating the following :-

- a) Service
- b) Design and test pressures
- c) Maximum flow and flow direction
- d) Size
- e) Engineer's Tag Number

Tag numbers will be indicated on the drawing submitted for approval during contract stage.

**9.03.00** Each motor / actuator shall be provided with a name plate indicating the following details :



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- a) Supply conditions.
- b) KW Rating
- c) Make

**10.00.00 DRAWINGS, DATA & INFORMATION TO BE SUBMITTED WITH THE BID**

The bidder shall furnish the following drawings, data and information along with the bid without which the offer will be deemed incomplete.

10.01.00 Data sheet-B with all particulars / data duly filled in.

10.02.00 General arrangement / installation drawings of the Debris Filter with all accessories, incorporating the principal dimensions and weights of equipment offered, size and location of various nozzle connections, supporting arrangement (if applicable) and scope of supply etc.

10.03.00 Cross-sectional / detailed drawings of filter housing / body, filter section / screen assemblies, flushing / backwashing unit, differential pressure measuring system, actuators, motors, control panel etc., indicating bill of quantities and materials of construction.

10.04.00 Flow and control logic diagrams for complete filter during normal and flushing / backwashing operations.

10.05.00 Performance evaluation procedure at site.

10.06.00 Control panel layout and list of instruments provided on control panel.

10.07.00 List of annunciations, protections and interlocks provided.

10.08.00 Write-up on operation, control, monitoring, interlocks and protection of filter.

10.09.00 Manufacturer's descriptive and illustrative literature on the equipments / components being offered.

10.10.00 A detailed experience list about the successful installations of similar equipment of equal or higher inlet / outlet sizes and flow capacities for similar application.

10.11.00 A comprehensive write-up on the testing facilities, tests to be conducted inspection methods and QA system adopted by the manufacturer.

10.12.00 Quality plan for the Debris Filter and for all its accessories.

**11.00.00 DRAWINGS, DATA & INFORMATION TO BE SUBMITTED AFTER THE AWARD OF CONTRACT :**

The drawings, data and other documents as required in Data Sheet-C shall be furnished after the award of contract.



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1.00.00 **DRAWINGS, DATA AND INFORMATION TO BE SUBMITTED AFTER THE AWARD OF CONTRACT :**

After the award of contract, the following drawings, data and information is to be submitted for review / approval of BHEL as per the distribution schedule given in Section -C.

1.01.00 Within 3(three) weeks of the data of LOI, the following shall be submitted :

1.01.01 Data Sheet -B duly revised conforming to accepted bid.

1.01.02 Final versions of the following drawings to enable BHEL to finalise the layout and to design foundations and structures.

a) General arrangement / Installation drawings of the Debris Filter with all accessories, indicating the principal dimensions and weights of equipment offered, size and location of various nozzle connections, withdrawal space and scope of supply etc.

b) Foundation arrangement drawings (wherever applicable) showing load data on supports, size and location of anchor bolts etc.

1.02.00 **With in the stipulated time period as per vendor's drawing/document list, the following shall be submitted :**

1.02.01 Cross-sectional/detailed drawings of filter housing/body, filter screen/section assembly, flushing / backwash unit, differential pressure measuring system, actuators, motors, control panel etc. indicating bill of quantities and materials of construction.

1.02.02 Flow and control logic diagrams for complete filter during normal and flushing operation and system write-up covering all modes of operation.

1.02.03 Final version of performance evaluation procedures at site.

1.02.04 Detailed schedule of valves indicating tag numbers, type, make, size, pressure & temperature ratings, materials etc.

1.02.05 Detailed schedule of power & control cable.

1.02.06 Detailed schedule of piping and fittings indicating sizes, materials, maximum working pressure & temperatures etc.

1.02.07 Control panel layout and list of instruments provided on control panel and internal wiring diagrams.

1.02.08 List of annunciations, protections and interlocks provided.



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- 1.02.09 Detailed drawings of flanges.
- 1.02.10 Quality Plan
- 1.02.11 Material test certificates.
- 1.02.12 Shop tests reports and certificates.
- 1.02.13 Write-up and instruction manuals for erection, operation and maintenance.
- 1.02.14 Storage instructions.
- 1.02.15 Vendor to send 3 sets of final documents (O&M Manual, GA drg, P&ID) direct to site under intimation to PEM.

S. No.		DESCRIPTION	UNITS	TITLE :	
1.0		GENERAL		DATA SHEET - A FOR DEBRIS FILTER (DF)	
1.1		Type of Strainers/ Filters	-	SPECIFICATION NO. PE-TS- 381/382-165-N001	
1.2		No. of Strainers/ Filters required	Nos.	VOLUME : II B	
1.3		Inlet connection (Nb)	mm	BOOK: I	
1.3		Outlet connection (Nb)	mm	REV. NO. 00 DATE -12.04.2012	
1.4		Filter type/ duty	-	Page 1 of 8	
1.5		Location	-	1X300MW VISHAKHAPATNAM ABHIJEET TPP	
1.6		Liquid handled	-		
2.0		DESIGN DATA			
2.1		Operating pressure	Bar (g)	Total Two (2) Sets. for 1 Unit	
2.2		Design pressure	Kg/cm <sup>2</sup>	2040x 20	
2.3		Design temperature	Deg. C	2040x 20	
2.4		Flow rate through filter		On line / continuous	
		a) Normal		Condenser Inlet	
		b) Maximum		Clarified Sea Water as per Analysis Attached along with project information in section B	
				1.5 to 2	
				5.0 Kg/cm <sup>2</sup> (g) & Vacuum 0.1Kg/cm <sup>2</sup> (abs)	
				50	
				22025 CUB.M/HR	
				26430 CUB.M/HR	

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TITLE :

DATA SHEET - A FOR  
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1X300MW VISHAKHAPATNAM ABHIJEET TPP


S. No.	DESCRIPTION	UNITS	
2.5	Design differential pressure for filter section/ screen	Bar (g)	1.5 (Min.)
2.6	Type of suspended matter likely to enter the filter	-	Typical debris encountered in circuit of CW system.
2.7	Differential pressure measuring system set pressure <ul style="list-style-type: none"> <li>For initiating flushing/ backwashing</li> <li>For alarm/ annunciation</li> </ul>	mbar mbar	80 160
2.8	Filter section/ screen perforation size	mm	5 mm (Max)
2.9	Free flow area in the screen basket	-	Atleast 110 % of pipe inlet area
3.0			
3.1	Pressure drop across the filter (i.e. between inlet and outlet connection) at normal flow	-	

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TITLE :		SPECIFICATION NO. PE-TS- 381/382-165-N001	
DATA SHEET - A FOR DEBRIS FILTER (DF)		VOLUME: II B	BOOK: I
		REV. NO. 00	DATE -12.04.2012
		Page 3 of 8	
S. No.	DESCRIPTION	UNITS	1X300MW VISHAKHAPATNAM ABHIJEET TPP
	a) Clean condition	mbar	Refer Section - C of specification
	b) Partially (50%) choked condition	mbar	Not to exceed 80
3.2	Debris discharge flow during flushing period	Cub im/ Hr.	Not to exceed 5% of total flow rate
4.0	<b>MATERIALS OF CONSTRUCTION</b>		
4.1	Filter body/ housing	-	Fabricated Carbon Steel IS 2062 Rubber Lined(minimum 5 mm thick)
4.2	Filter screen/ section	-	Duplex Steel UNS 32205
4.3	Shaft	-	Duplex Steel UNS 32205
4.4	Supporting cage	-	Duplex Steel UNS 32205
4.5	Differential measuring system	-	Hastelloy C/ Monel
4.6	Flushing/ backwashing unit	-	Duplex Steel UNS 32205
4.7	Backwash rotor shoes	-	Neoprene
4.8	Any other internal hardware /pipes etc.	-	Duplex Steel UNS 32205

		<b>TITLE :</b> <b>DATA SHEET - A FOR DEBRIS FILTER (DF)</b>		<b>SPECIFICATION NO. PE-TS- 381/382-165-N001</b>	
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		<b>Page 4 of 8</b>			
		<b>1X300MW VISHAKHAPATNAM ABHIJEET TPP</b>			
S. No.	DESCRIPTION	UNITS			
4.9	Flushing Pump (if applicable)				
a)	Casing		ASTM A890Gr.CD4MCuN (Duplex Steel)		
b)	Impeller		ASTM A890Gr.CD4MCuN (Duplex Steel)		
c)	Shaft		SS317L / Duplex Steel		

4.10	Valves	-			
4.10.1	Check Valves (all sizes)				
	a) Body & Bonnet	-	ASTM-A-439, D2-Ni		
	b) Seating surface & rings	-	Duplex SS		
	c) Disc for Check Valve	-	ASTM-A-439, D2-Ni		
	d) Hinge Pin for Check Valve	-	Duplex SS		
	e) Backseat for check valve		Duplex SS		
4.10.2	Globe Valves 50 Nb & Below				
	Body, Bonnet & Disc		ASTM-A-439, D2-Ni		
	Stem		ASTM-A-439, D2-Ni		
4.10.3	➤ BF/Gate Valves (65 Nb & above)				

		<b>TITLE :</b> <b>DATA SHEET - A FOR DEBRIS FILTER (DF)</b>		<b>SPECIFICATION NO. PE-TS- 381/382-165-N001</b>	
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		<b>Page 5 of 8</b>			
		<b>1X300MW VISHAKHAPATNAM ABHIJEET TPP</b>			
S. No.	DESCRIPTION	UNITS			
>	Body & Disc		ASTM-A-439; D2-Ni		
>	Shaft		Duplex stainless steel		
>	Seal		Buna-N		
>	Seat ring		Duplex stainless steel		
>	Bearings		Self Lubricating		
>	Companion Flange		UNS 32205 Duplex Steel (compatible with purchaser's debris discharge pipe)		
<b>C) Ball valves</b>			For size < 65NB, Duplex stainless steel & For size > = 65NB, ASTM A 439 , D-2 Ni (internals epoxy painted)		
	i) Body		-----Do-----		
	ii) Ball		Duplex SS		
	iii) Stem		By Purchaser		
4.11	Debris Discharge Piping	-	• GRP		
	MOC of debris discharge pipe		Required, 600 NB		
4.12	Inspection hole	-	By Bidder		
5.0	COUNTER FLANGES for main Debris Filter shell				

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TITLE :

DATA SHEET - A FOR  
DEBRIS FILTER (DF)

SPECIFICATION NO. PE-TS- 381/382-165-N001

VOLUME : II, B  
BOOK: I

REV. NO. 00 DATE -12.04.2012


Page 6 of 8

1X300MW VISHAKHAPATNAM ABHIJEET TPP

S. No.	DESCRIPTION	UNITS
5.1	MATERIAL	
	Carbon steel (IS:2062), Rolled & Welded conforming to IS:3589 with rubber lining for the portion which is in contact with the sea water.	
5.2	Drilling Standard	-
6.0	OTHER COUNTER FLANGES	By Bidder
6.1	MOC of Flange/ Counter flange	
	Carbon steel (IS:2062), Rolled & Welded conforming to IS:3589 with rubber lining for the portion which is in contact with the sea water.	
7.0	PAINTING	
7.1	External Surface	-
	a) Surface preparation	SA-2.5 of Swedish Specn. SIS-05-5900-1967.
	b) Primer	Two coat of Epoxy polyamide resin based red oxide - zinc phosphate primer (50 micron per coat)
	c) Intermediate	One coat of two pack air drying high build epoxy resin based paint with MIO (80 micron per coat)
	d) Final paint	Two coat of two pack air drying epoxy polyamide enamel suitably pigmented. (30 Micron per coat)
7.2	Internal Surface	
	a) Surface preparation	SA - 2.5 of Swedish Specn. SIS-05-59-00-1967
	b) Primer	Adequate Primer

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		<b>TITLE :</b> <b>DATA SHEET - A FOR DEBRIS FILTER (DF)</b>		<b>SPECIFICATION NO. PE-TS- 381/382-165-N001</b>	
				<b>VOLUME : II B</b> <b>BOOK: I</b>	
		<b>REV. NO. 00</b>		<b>DATE -12.04.2012</b>	
		Page 8 of 8			
<b>S. No.</b>		<b>DESCRIPTION</b>	<b>UNITS</b>	<b>1X300MW VISHAKHAPATNAM ABHIJEET TPP</b>	
11.3	Bid evaluation rate.			@ Rs 95 Lacs per 0.3 MWC pt. Drop across each DF	
11.4	Liquidated damages			Twice the bid evaluation rate	
12.0	Whether automatic flushing/ back- washing operation effected by the following :				
	i. Differential pressure			Yes	
	ii. Adjustable timer			Yes	
	iii. Push button			Yes	
13.0	Whether provision for manual flushing / backwashing operation is made in the event of control system failure.			Yes	
14.0	Whether built in flushing arrangement complete with flushing pump, valves, and associated piping, is provided.			YES (If required)	
15.0	Mandatory Spare to be supplied under this specification			NA	

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MODEL QUALITY PLAN OF CONTROL PANEL FOR COTCO, DESIGNS ELEC AND SOG

Line	Component/Operation	Characteristics Checked	Class	Type of Check	Quantity of Samples	Return to Supplier	Assurance	Format of Report	Agency	Remarks
1	General Examination Final Packing	Visual measurement	Major	Visual	100%	Approved G.A. Do	Approved G.A. Do	Inspection Records (I.R.)	X P W W	SHIP
2	Excess cable termination	Visual	Do	Do	Approved Do	Approved Do	No issue Do	Do	X P W W	SHIP
3	IP-IV-R	Electrical	Critical	Electrical	100%	Approved G.A. Do	Approved G.A. Do	(I.R.)	X P W W	
4	Type test Enclosure Test	Design of Protection	Minor	Environment	Type	Approved G.A.	Approved G.A.		X P V V	Type test certificate verification
5	Functional check (Continuity check)	Interlock Resonance of coil	Critical	Electrical	100%	Approved G.A.	Approved G.A.	(I.R.)	X P W W	SHIP
6	Operation of Instruments	Operation Function	Critical	Do	Do	Do	Do	Do	X P W W	
<p>Note: 'L.C' panel functional test shall include system integration test along with PC Printer if any.</p> <p>Crags marked under col-9 shall be essentially include by contractor in O.A. documentation</p> <p>M - Manufacturer C-SHEL OR nominated inspection agency</p> <p>N - Customer</p> <p>P - Perform W - Witness V - Verification</p>										



**TITLE : TECHNICAL SPECIFICATION  
FOR  
CONDENSER ON LOAD TUBE CLEANING  
SYSTEMS (COLTCS) & DEBRIS FILTER (DF)**

**SPEC. NO. PE-TS-381/382-165-N001**

**VOLUME : II B**

**SECTION : D**

**REV. NO. 0**

**DATE : 12.04.2012**

**SHEET . 1 of 1**

**SECTION D3**

**STANDARD TECHNICAL SPECIFICATION  
FOR  
ELECTRICAL SYSTEMS**

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TITLE :  
**GENERAL TECHNICAL REQUIREMENTS**  
  
**FOR**  
  
**LV MOTORS**

SPECIFICATION NO.	PE-SS-999-506-E101
VOLUME NO. :	II-B
SECTION :	D
REV NO. : 00	DATE : 24/05/2005
SHEET :	1 OF 1

**GENERAL TECHNICAL REQUIREMENTS**

**FOR**

**LV MOTORS**

**SPECIFICATION NO.: PE-SS-999-506-E101 Rev 00**

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TITLE :  
**GENERAL TECHNICAL REQUIREMENTS**  
  
**FOR**  
  
**LV MOTORS**

SPECIFICATION NO.  
PE-SS-999-506-E101  
VOLUME NO. : **II-B**  
SECTION : **D**  
REV NO. : **00** DATE : 24/05/2005  
SHEET : 1 OF 4

**1.0 INTENT OF SPECIFICATION**

The specification covers the design, materials, constructional features, manufacture, inspection and testing at manufacturer's work, and packing of Low voltage (LV) squirrel cage induction motors along with all accessories for driving auxiliaries in thermal power station.

Motors having a voltage rating of below 1000V are referred to as low voltage (LV) motors.

**2.0 CODES AND STANDARDS**

Motors shall fully comply with latest edition, including all amendments and revision, of following codes and standards:

- |           |  |
|-----------|--|
| IS:325    | Three phase Induction motors   |
| IS : 900  | Code of practice for installation and maintenance of induction motors  |
| IS: 996   | Single phase small AC and universal motors   |
| IS: 4722  | Rotating Electrical machines   |
| IS: 4691  | Degree of Protection provided by enclosures for rotating electrical machines                                 |
| IS: 4728  | Terminal marking and direction of rotation rotating electrical machines                                      |
| IS: 1231  | Dimensions of three phase foot mounted induction motors  |
| IS: 8789  | Values of performance characteristics for three phase induction motors                                       |
| IS: 13555 | Guide for selection and application of 3-phase A.C. induction motors for different types of driven equipment |
| IS: 2148  | Flame proof enclosures for electrical appliance  |
| IS: 5571  | Guide for selection of electrical equipment for hazardous areas  |
| IS: 12824 | Type of duty and classes of rating assigned  |
| IS: 12802 | Temperature rise measurement of rotating electrical machines   |
| IS: 12065 | Permissible limits of noise level for rotating electrical machines   |
| IS: 12075 | Mechanical vibration of rotating electrical machines   |

In case of imported motors, motors as per IEC-34 shall also be acceptable.

**3.0 DESIGN REQUIREMENTS**

**3.1** Motors and accessories shall be designed to operate satisfactorily under conditions specified in data sheet-A and Project Information, including voltage & frequency variation of supply system as defined in Data sheet-A

**3.2** Motors shall be continuously rated at the design ambient temperature specified in Data Sheet-A and other site conditions specified under Project Information  
Motor ratings shall have at least a 15% margin over the continuous maximum demand of the driven equipment, under entire operating range including voltage & frequency variation specified above.

**3.3 Starting Requirements**

**3.3.1** Motor characteristics such as speed, starting torque, break away torque and starting time shall be properly co-ordinated with the requirements of driven equipment. The accelerating torque at any speed with the minimum starting voltage shall be at least 10% higher than that of the driven equipment.

**3.3.2** Motors shall be capable of starting and accelerating the load with direct on line starting without exceeding acceptable winding temperature.

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TITLE :  
**GENERAL TECHNICAL REQUIREMENTS**  
  
**FOR**  
  
**LV MOTORS**

SPECIFICATION NO.  
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The limiting value of voltage at rated frequency under which a motor will successfully start and accelerate to rated speed with load shall be taken to be a constant value as per Data Sheet - A during the starting period of motors.

3.3.3 The following frequency of starts shall apply

- i) Two starts in succession with the motor being initially at a temperature not exceeding the rated load temperature.
- ii) Three equally spread starts in an hour the motor being initially at a temperature not exceeding the rated load operating temperature. (not to be repeated in the second successive hour)
- iii) Motors for coal conveyor and coal crusher application shall be suitable for three consecutive hot starts followed by one hour interval with maximum twenty starts per day and shall be suitable for minimum 20,000 starts during the life time of the motor

3.4 **Running Requirements**

3.4.1 Motors shall run satisfactorily at a supply voltage of 75% of rated voltage for 5 minutes with full load without injurious heating to the motor.

3.4.2 Motor shall not stall due to voltage dip in the system causing momentary drop in voltage upto 70% of the rated voltage for duration of 2 secs.

3.5 **Stress During bus Transfer**

3.5.1 Motors shall withstand the voltage, heavy inrush transient current, mechanical and torque stress developed due to the application of 150% of the rated voltage for at least 1 sec. caused due to vector difference between the motor residual voltage and the incoming supply voltage during occasional auto bus transfer.

3.5.2 Motor and driven equipment shafts shall be adequately sized to satisfactorily withstand transient torque under above condition.

3.6 Maximum noise level measured at distance of 1.0 metres from the outline of motor shall not exceed the values specified in IS 12065.

3.7 The max. vibration velocity or double amplitude of motors vibration as measured at motor bearings shall be within the limits specified in IS: 12075.

4.0 **CONSTRUCTIONAL FEATURES**

4.1 Indoor motors shall conform to degree of protection IP: 54 as per IS: 4691. Outdoor or semi-indoor motors shall conform to degree of protection IP: 55 as per IS: 4691 and shall be of weather-proof construction. Outdoor motors shall be installed under a suitable canopy

4.2 Motors upto 160KW shall have Totally Enclosed Fan Cooled (TEFC) enclosures, the method of cooling conforming to IC-0141 or IC-0151 of IS: 6362.

Motors rated above 160 KW shall be Closed Air Circuit Air (CACA) cooled

4.3 Motors shall be designed with cooling fans suitable for both directions of rotation.

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- 4.4. Motors shall not be provided with any electric or pneumatic operated external fan for cooling the motors.
- 4.5. Frames shall be designed to avoid collection of moisture and all enclosures shall be provided with facility for drainage at the lowest point.
- 4.6. In case Class 'F' insulation is provided for LV motors, temperature rise shall be limited to the limits applicable to Class 'B' insulation.  
In case of continuous operation at extreme voltage limits the temperature limits specified in table-1 of IS:325 shall not exceed by more than 10°C.
- 4.7. **Terminals and Terminal Boxes**
- 4.7.1 Terminals, terminal leads, terminal boxes, windings tails and associated equipment shall be suitable for connection to a supply system having a short circuit level, specified in the Data Sheet-A.  
  
Unless otherwise stated in Data Sheet-A, motors of rating 110 kW and above will be controlled by circuit breaker and below 110 kW by switch fuse-contactor. The terminal box of motors shall be designed for the fault current mentioned in data sheet "A".
- 4.7.2 Unless otherwise specified or approved, phase terminal boxes of horizontal motors shall be positioned on the left hand side of the motor when viewed from the non-driving end.
- 4.7.3 Connections shall be such that when the supply leads R, Y & B are connected to motor terminals A B & C or U, V & W respectively, motor shall rotate in an anticlockwise direction when viewed from the non-driving end. Where such motors require clockwise rotation, the supply leads R, Y, B will be connected to motor terminals A, C, B or V W & V respectively.
- 4.7.4 Permanently attached diagram and instruction plate made preferably of stainless steel shall be mounted inside terminal box cover giving the connection diagram for the desired direction of rotation and reverse rotation.
- 4.7.5 Motor terminals and terminal leads shall be fully insulated with no bar live parts. Adequate space shall be available inside the terminal box so that no difficulty is encountered for terminating the cable specified in Data Sheet-A.
- 4.7.6 Degree of protection for terminal boxes shall be IP 55 as per IS 4691.
- 4.7.7 Separate terminal boxes shall be provided for space heaters.. If this is not possible in case of LV motors, the space heater terminals shall be adequately segregated from the main terminals in the main terminal box. Detachable gland plates with double compression brass glands shall be provided in terminal boxes.
- 4.7.8. Phase terminal boxes shall be suitable for 360 degree of rotation in steps of 90 degree for LV motors.
- 4.7.9 Cable glands and cable lugs as per cable sizes specified in Data Sheet-A shall be included. Cable lugs shall be of tinned Copper, crimping type.
- 4.8 Two separate earthing terminals suitable for connecting G.I. or MS strip grounding conductor of size given in Data Sheet-A shall be provided on opposite sides of motor frame. Each terminal box shall have a grounding terminal.

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GENERAL TECHNICAL REQUIREMENTS

FOR  
LV MOTORS

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VOLUME NO. : II-B

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REV NO. : 00 DATE : 24/05/2005

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#### 4.9 General

4.9.1 Motors provided for similar drives shall be interchangeable.

4.9.2 Suitable foundation bolts are to be supplied alongwith the motors.

4.9.3 Motors shall be provided with eye bolts, or other means to facilitate safe lifting if the weight is 20Kgs. and above.

4.9.4 Necessary fitments and accessories shall be provided on motors in accordance with the latest Indian Electricity rules 1956.

4.9.5 All motors rated above 30 kW shall be provided with space heaters to maintain the motor internal air temperature above the dew point. Unless otherwise specified, space heaters shall be suitable for a supply of 240V AC, single phase, 50 Hz.

4.9.6 Name plate with all particulars as per IS: 325 shall be provided

4.9.7 Unless otherwise specified, the colour of finish shall be grey to Shade No. 631 and 632 as per IS:5 for motors installed indoor and outdoor respectively. The paint shall be epoxy based and shall be suitable for withstanding specified site conditions.

#### 5.0 INSPECTION AND TESTING

5.1 All materials, components and equipments covered under this specification shall be procured, manufactured, as per the BHEL standard quality plan No. PED-506-00-Q-006/0 and PED-506-00-Q-007/2 enclosed with this specification and which shall be complied.

5.2 LV motors of type-tested design shall be provided. Valid type test reports not more than 5 year shall be furnished. In the absence of these, type tests shall have to be conducted by manufacturer without any commercial implication to purchaser.

5.3 All motors shall be subjected to routine tests as per IS: 325 and as per BHEL standard quality plan.

5.4 Motors shall also be subjected to additional tests, if any, as mentioned in Data Sheet A.

#### 6.0 DRAWINGS TO BE SUBMITTED AFTER AWARD OF CONTRACT

- a) OGA drawing showing the position of terminal boxes, earthing connections etc.
- b) Arrangement drawing of terminal boxes.
- c) Characteristic curves:  
(To be given for motor above 55 kW unless otherwise specified in Data Sheet).

- i) Current vs. time at rated voltage and minimum starting voltage.
- ii) Speed vs. time at rated voltage and minimum starting voltage.
- iii) Torque vs. speed at rated voltage and minimum voltage.

For the motors with solid coupling the above curves i), ii), iii) to be furnished for the motors coupled with driven equipment. In case motor is coupled with mechanical equipment by fluid coupling, the above curves shall be furnished with and without coupling.


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iv) Thermal withstand curve under hot and cold conditions at rated voltage and max. permissible voltage.

	TITLE	SPECIFICATION NO.
	<b>MOTOR</b>  <b>DATA SHEET - C</b>	VOLUME II B
		SECTION D
		REV NO. 00 DATE 29/08/2005
		SHEET 1 OF 2

S. No.	Description	Data to be filled by successful bidder
<b>A.</b>	<b>General</b>	
1	Manufacturer & country of origin	
2	Motor type	
3	Type of starting	
4	Name of the equipment driven by motor & Quantity	
5	Maximum Power requirement of driven equipment	
6	Rated speed of Driven Equipment	
7	Design ambient temperature	
<b>B.</b>	<b>Design and Performance Data</b>	
1	Frame size & type designation	
2	Type of duty	
3	Rated Voltage	
4	Permissible variation for	
5	a) Voltage	
6	b) Frequency	
7	c) Combined voltage & frequency	
8	Rated output at design ambient temp (by resistance method)	
9	Synchronous speed & Rated slip	
10	Minimum permissible starting voltage	
11	Starting time in sec with mechanism coupled	
12	a) At rated voltage	
13	b) At min starting voltage	
14	Locked rotor current as percentage of FLC (including IS tolerance)	
15	Torque	
	a) Starting	
	b) Maximum	
16	Permissible temp rise at rated output over ambient temp & method	
17	Noise level at 1.0 m (dB)	
18	Amplitude of vibration	
19	Efficiency & P.F. at rated voltage & frequency	
	a) At 100% load	
	c) At 75% load	

NAME OF VENDOR			SEAL	REV.	
NAME	SIGNATURE	DATE			

	TITLE	SPECIFICATION NO.
	<b>MOTOR</b>  <b>DATA SHEET - C</b>	VOLUME II B
		SECTION D
		REV NO. 00 DATE 29/08/2005
		SHEET 2 OF 2

S. No.	Description	Data to be filled by successful bidder
	c) At starting	
<b>C.</b>	<b>Constructional Features</b>	
1	Method of connection of motor driven equipment	
2	Applicable Standard	
3	DOP of Enclosure	
4	Method of cooling	
5	Class of insulation	
6	Main terminal box	
	a) Type	
	b) Power Cable details (Conductor, size, armour/unarmour)	
	c) Cable Gland & lugs details (Size, type & material)	
	d) Permissible Fault level ( kArms & duration in sec)	
7	Space heater details (Voltage & watts)	
8	Flame proof motor details (if applicable)	
	a) Enclosure	
	b) suitability for hazardous area	
	i Zone	O / I / II
	ii Group	IIA / IIB / IIC
9	No. of Stator winding	
10	Winding connection	
11	Kind of rotor winding	
12	Kind of bearings	
13	Direction of rotation when viewed from NDE	
14	Paint Shade & type	
15	Net weight of motor	
16	Outline mounting drawing No (To be enclosed as annexure)	
<b>D.</b>	<b>Characteristic curves/ drawings</b> (To be enclosed for motors of rating $\geq 55KW$ )	
	a) Torque speed characteristic	
	b) Thermal withstand characteristic	
	c) Current vs time	
	d) Speed vs time	

NAME OF VENDOR			SEAL	REV.
NAME	SIGNATURE	DATE		

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CLAUSE NO.	TECHNICAL REQUIREMENTS			
<p>5.00.00</p> <p>6.00.00</p> <p>6.01.00</p> <p>6.01.01</p> <p>6.01.02</p> <p>6.01.03</p> <p>6.01.04</p> <p>6.02.00</p> <p>6.02.01</p> <p>6.02.02</p>	<p>shall be at least 10% above the maximum load demand of the driven equipment under entire operating range including voltage and frequency variations.</p> <p>(c) For BFP motor the starting MVA shall be restricted to 80 MVA.</p>	<p><b>TEMPERATURE RISE</b></p>		
	<p><b>Air cooled motors</b></p>	<p>70 deg. C by resistance method for both thermal class 130(B) &amp; 155(F) insulation.</p>		
	<p><b>Water cooled</b></p>	<p>80 deg. C over inlet cooling water temperature mentioned elsewhere, by resistance method for both thermal class 130(B) &amp; 155(F) insulation.</p>		
	<p>41 deg.C over inlet cooling water maximum temperature of 39 deg.C for thermal class Y wet wound Boiler circulation pump motor.</p>	<p><b>OPERATIONAL REQUIREMENTS</b></p>		
	<p><b>Starting Time</b></p>	<p>For motors with starting time upto 20 secs. at minimum permissible voltage during starting, the locked rotor withstand time under hot condition at highest voltage limit shall be at least 2.5 secs. more than starting time.</p>		
	<p>For motors with starting time more than 20 secs. and upto 45 secs. at minimum permissible voltage during starting, the locked rotor withstand time under hot condition at highest voltage limit shall be at least 5 secs. more than starting time.</p>	<p>For motors with starting time more than 45 secs. at minimum permissible voltage during starting, the locked rotor withstand time under hot condition at highest voltage limit shall be more than starting time by at least 10% of the starting time.</p>		
	<p>Speed switches mounted on the motor shaft shall be provided in cases where above requirements are not met.</p>	<p><b>Torque Requirements</b></p>		
	<p>Accelerating torque at any speed with the lowest permissible starting voltage shall be at least 10% motor full load torque.</p>	<p>Pull out torque at rated voltage shall not be less than 205% of full load torque. It shall be 275% for crane duty motors.</p>		
	<p>Pull out torque at rated voltage shall not be less than 205% of full load torque. It shall be 275% for crane duty motors.</p>			
	<p>SINGARENI THERMAL POWER PROJECT (2X600 MW) BOILER TURBINE GENERATOR PACKAGE</p>	<p>TECHNICAL SPECIFICATIONS SECTION - VI PART-B</p>	<p>SUB-SECTION-B-08 MOTORS</p>	<p>PAGE 3 OF 9</p>

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CLAUSE NO.	TECHNICAL REQUIREMENTS		
6.03.00	<p><b>Starting voltage requirement</b></p> <p>(a) 85% up to 1500KW (except for AOP motor which is 80%)</p> <p>(b) 80% from 1501 KW to 4000KW</p> <p>(c) 75% &gt; 4000KW</p>		
7.00.00	<p><b>DESIGN AND CONSTRUCTIONAL FEATURES</b></p>		
7.01.00	<p>Suitable single phase space heaters shall be provided on motors rated 30KW and above to maintain windings in dry condition when motor is standstill. Separate terminal box for space heaters &amp; RTDs shall be provided. However for flame proof motors, space heater terminals inside the main terminal box may be acceptable.</p>		
7.02.00	<p>All motors shall be either Totally enclosed fan cooled (TEFC) or totally enclosed tube ventilated (TETV) or Closed air circuit air cooled (CACA) type. However, motors rated 3000KW or above can be Closed air circuit water cooled (CACW). CW motors can be screen protected drip proof (SPDP) type. Motors located in hazardous areas shall have flame proof enclosures conforming to IS:2148 as detailed below</p> <p>(a) Fuel oil area : Group – IIB</p> <p>(b) Hydrogen generation plant area : Group - IIC (or Group-I, Div-II as per NEC)</p>		
7.03.00	<p><b>Winding and Insulation</b></p> <p>(a) Type : Non-hygroscopic, oil resistant, flame resistant</p> <p>(b) Starting duty : Two hot starts in succession, with motor initially at normal running temperature. However the conveyor motor shall be suitable for 3 consecutive hot starts.</p> <p>(c) 11kV &amp; 3.3 kV AC motors : Thermal class 155 (F) insulation. The winding insulation process shall be total Vacuum Pressure Impregnated i.e resin poor method. The lightning Impulse &amp; interturn insulation surge withstand level shall be as per IEC-60034 part-15</p> <p>(d) 240VAC, 415V AC &amp; 220V DC motors : Thermal Class( B ) or better</p>		
7.04.00	<p>Motors rated above 1000KW shall have insulated bearings to prevent flow of shaft currents.</p>		
<p>SINGARENI THERMAL POWER PROJECT (2X600 MW) BOILER TURBINE GENERATOR PACKAGE</p>	<p>TECHNICAL SPECIFICATIONS SECTION - VI PART-B</p>	<p>SUB-SECTION-B-08 MOTORS</p>	<p>PAGE 4 OF 9</p>

CLAUSE NO.	TECHNICAL REQUIREMENTS		
7.05.00	Motors with heat exchangers shall have dial type thermometer with adjustable alarm contacts to indicate inlet and outlet primary air temperature.		
7.06.00	Noise level for all the motors shall be limited to 85dB(A) except for BFP motor for which the maximum limit shall be 90dB(A). Vibration shall be limited within the limits prescribed in IS:12075 / IEC 60034-14 . Motors shall withstand vibrations produced by driven equipment. HT motor bearing housings shall have flat surfaces, in both X and Y directions, suitable for mounting 80mmX80mm vibration pads.		
7.07.00	In HT motors, at least four numbers simplex / two numbers duplex platinum resistance type temperature detectors shall be provided in each phase stator winding. Each bearing of HT motor shall be provided with dial type thermometer with adjustable alarm contact and preferably 2 numbers duplex platinum resistance type temperature detectors.		
7.08.00	Motor body shall have two earthing points on opposite sides.		
7.09.00	HT motors can be offered with either elastimould termination or dust tight phase separated double walled (metallic as well as insulated barrier) cable boxes. In case elastimould terminations are offered, then protective cover and trifurcating sleeves shall also be provided. In case cable box is offered, then Bidder shall provide termination kit. Removable gland plates of thickness 3 mm (hot/cold rolled sheet steel) or 4 mm (non magnetic material for single core cables) shall be provided in case of cable boxes.		
7.10.00	The spacing between gland plate & centre of terminal stud shall be as per Table-I.		
7.11.00	All motors shall be so designed that maximum inrush currents and locked rotor and pullout torque developed by them at extreme voltage and frequency variations do not endanger the motor and driven equipment.		
7.12.00	The motors shall be suitable for bus transfer schemes provided on the 11kV, 3.3 kV /415V systems without any injurious effect on its life.		
7.13.00	For motors rated 2000 KW & above, neutral current transformers of PS class shall be provided on each phase in a separate neutral terminal box.		
7.14.00	11kV and 3.3 kV motor Terminal Box shall be suitable for fault level of 750MVA for 0.12 sec and 250 MVA for 0.12 sec respectively. Elastimould termination kit shall be suitable for fault level of 25 KA for 0.17 seconds.		
7.15.00	The size and number of cables (for HT and LT motors) to be intimated to the successful bidder during detailed engineering and the contractor shall provide terminal box suitable for the same.		
8.00.00	The ratio of locked rotor KVA at rated voltage to rated KW shall not exceed the following (without any further tolerance) except for BFP Motor.		
SINGARENI THERMAL POWER PROJECT (2X600 MW) BOILER TURBINE GENERATOR PACKAGE	TECHNICAL SPECIFICATIONS SECTION - VI PART-B	SUB-SECTION-B-08 MOTORS	PAGE 5 OF 9

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CLAUSE NO.	TECHNICAL REQUIREMENTS		
	(a) Upto 110KW	:	11.0 (For AOP motor it shall be 8.0)
	(b) Above 110KW & upto 1500KW	:	10.0
	(c) Above 1500KW & upto 4000KW	:	9.0
	(d) Above 4000KW	:	6 to 6.5
9.00.00	CW Motor shall be designed with minimum power factor of 0.8 at design point.		
10.00.00	<b>TYPE TEST</b>		
10.01.00	<b>HT MOTORS</b>		
10.01.01	The contractor shall carry out the type tests as listed in this specification on the equipment to be supplied under this contract. The bidder shall indicate the charges for each of these type tests separately in the relevant schedule of Section - VII-(BPS) and the same shall be considered for the evaluation of the bids. The type tests charges shall be paid only for the test(s) actually conducted successfully under this contract and upon certification by the employer's engineer.		
10.01.02	The type tests shall be carried out in presence of the employer's representative, for which minimum 15 days notice shall be given by the contractor. The contractor shall obtain the employer's approval for the type test procedure before conducting the type test. The type test procedure shall clearly specify the test set-up, instruments to be used, procedure, acceptance norms, recording of different parameters, interval of recording, precautions to be taken etc. for the type test(s) to be carried out.		
10.01.03	In case the contractor has conducted such specified type test(s) within last ten years as on the date of bid opening, he may submit during detailed engineering the type test reports to the owner for waiver of conductance of such test(s). These reports should be for the tests conducted on the equipment similar to those proposed to be supplied under this contract and test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client. The owner reserves the right to waive conducting of any or all the specified type test(s) under this contract. In case type tests are waived, the type test charges shall not be payable to the contractor.		
10.01.04	Further the Contractor shall only submit the reports of the type tests as listed in "LIST OF TESTS FOR WHICH REPORTS HAVE TO BE SUBMITTED" and carried out within last ten years from the date of bid opening. These reports should be for the test conducted on the equipment similar to those proposed to be supplied under this contract and the test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client. However if the contractor is not able to submit report of the type test(s) conducted within last ten years from the date of bid opening, or in the case of type test report(s) are not found to be meeting the specification requirements, the contractor shall conduct all such tests under this		
SINGARENI THERMAL POWER PROJECT (2X600 MW) BOILER TURBINE GENERATOR PACKAGE	TECHNICAL SPECIFICATIONS SECTION - VI PART-B	SUB-SECTION-B-08 MOTORS	PAGE 6 OF 9

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CLAUSE NO.	TECHNICAL REQUIREMENTS		
10.01.05	<p>contract at no additional cost to the owner either at third party lab or in presence of client/owners representative and submit the reports for approval.</p> <p><b>LIST OF TYPE TESTS TO BE CONDUCTED</b></p> <p>The following type tests shall be conducted on each type and rating of HT motor</p> <ul style="list-style-type: none"> <li>(a) No load saturation and loss curves upto approximately 115% of rated voltage</li> <li>(b) Measurement of noise at no load.</li> <li>(c) Momentary excess torque test (subject to test bed constraint).</li> <li>(d) Full load test(subject to test bed constraint)</li> <li>(e) Temperature rise test at rated conditions. During heat run test, bearing temp., winding temp., coolant flow and its temp. shall also be measured. In case the temperature rise test is carried at load other than rated load, specific approval for the test method and procedure is required to be obtained. Wherever ETD's are provided, the temperature shall be measured by ETD's also for the record purpose.</li> <li>(f) Lightning Impulse withstand test on the sample coil shall be as per IEC-60034, part-15</li> <li>(g) Surge-withstand test on interturn insulation shall be as per clause no. 5.1.2 of IEC 60034, part-15</li> </ul>		
10.01.06	<p><b>LIST OF TESTS FOR WHICH REPORTS HAVE TO BE SUBMITTED</b></p> <p>The following type test reports shall be submitted for each type and rating of HT motor</p> <ul style="list-style-type: none"> <li>(a) Degree of protection test for the enclosure followed by IR, HV and no load run test.</li> <li>(b) Terminal box-fault level withstand test for each type of terminal box of HT motors only.</li> </ul>		
10.02.00	<p><b>LT Motors</b></p>		
10.02.01	<p>LT Motors supplied shall be of type tested design. During detailed engineering, the contractor shall submit for Owner's approval the reports of all the type tests as listed in this specification and carried out within last ten years from the date of bid opening.</p>		
<p>SINGARENI THERMAL POWER PROJECT (2X600 MW) BOILER TURBINE GENERATOR PACKAGE</p>	<p>TECHNICAL SPECIFICATIONS SECTION - VI PART-B</p>	<p>SUB-SECTION-B-08 MOTORS</p>	<p>PAGE 7 OF 9</p>

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CLAUSE NO.	TECHNICAL REQUIREMENTS		
	<p>These reports should be for the test conducted on the equipment similar to those proposed to be supplied under this contract and the test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client.</p>		
10.02.02	<p>However if the contractor is not able to submit report of the type test(s) conducted within last ten years from the date of bid opening, or in the case of type test report(s) are not found to be meeting the specification requirements, the contractor shall conduct all such tests under this contract at no additional cost to the owner either at third party lab or in presence of client/owners representative and submit the reports for approval.</p>		
10.02.03	<p><b>LIST OF TESTS FOR WHICH REPORTS HAVE TO BE SUBMITTED</b></p>		
	<p><b>The following type test reports shall be submitted for each type and rating of LT motor of above 50 KW only</b></p>		
	<ol style="list-style-type: none"> <li>1. Measurement of resistance of windings of stator and wound rotor.</li> <li>2. No load test at rated voltage to determine input current power and speed</li> <li>3. Open circuit voltage ratio of wound rotor motors ( in case of Slip ring motors)</li> <li>4. Full load test to determine efficiency power factor and slip .</li> <li>5. Temperature rise test .</li> <li>6. Momentary excess torque test.</li> <li>7. High voltage test .</li> <li>8. Test for vibration severity of motor.</li> <li>9. Test for noise levels of motor(Shall be limited as per clause no 7.06.00 of this section)</li> <li>10. Test for degree of protection and</li> <li>11. Overspeed test.</li> </ol>		
10.03.00	<p>All acceptance and routine tests as per the specification and relevant standards shall be carried out. Charges for these shall be deemed to be included in the equipment price.</p>		
10.04.00	<p>The type test reports once approved for any projects shall be treated as reference. For subsequent projects of SCCL, an endorsement sheet will be furnished by the manufacturer confirming similarity and "No design Change". Minor changes if any shall be highlighted on the endorsement sheet.</p>		
<p>SINGARENI THERMAL POWER PROJECT (2X600 MW) BOILER TURBINE GENERATOR PACKAGE</p>	<p>TECHNICAL SPECIFICATIONS SECTION - VI PART-B</p>	<p>SUB-SECTION-B-08 MOTORS</p>	<p>PAGE 8 OF 9</p>

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CLAUSE NO.	TECHNICAL REQUIREMENTS																														
	<p style="text-align: center;"><b>TABLE - I</b></p> <p style="text-align: center;"><b>DIMENSIONS OF TERMINAL BOXES FOR LV MOTORS</b></p> <table border="0" style="width: 100%;"> <thead> <tr> <th style="text-align: left;">Motor MCR in KW</th> <th style="text-align: right;">Minimum distance between centre of stud and gland plate in mm</th> </tr> </thead> <tbody> <tr> <td colspan="2"><b>UP to 3 KW</b></td> </tr> <tr> <td>Above 3 KW - upto 7 KW</td> <td style="text-align: right;">85</td> </tr> <tr> <td>Above 7 KW - upto 13 KW</td> <td style="text-align: right;">115</td> </tr> <tr> <td>Above 13 KW - upto 24 KW</td> <td style="text-align: right;">167</td> </tr> <tr> <td>Above 24 KW - upto 37 KW</td> <td style="text-align: right;">196</td> </tr> <tr> <td>Above 37 KW - upto 55 KW</td> <td style="text-align: right;">249</td> </tr> <tr> <td>Above 55 KW - upto 90 KW</td> <td style="text-align: right;">277</td> </tr> <tr> <td>Above 90 KW - upto 125 KW</td> <td style="text-align: right;">331</td> </tr> <tr> <td>Above 125 KW-upto 200 KW</td> <td style="text-align: right;">203</td> </tr> </tbody> </table> <p>For HT motors the distance between gland plate and the terminal studs shall not be less than 500 mm.</p> <p><b>PHASE TO PHASE/ PHASE TO EARTH AIR CLEARANCE:</b></p> <p>NOTE: Minimum inter-phase and phase-earth air clearances for LT motors with lugs installed shall be as follows:</p> <table border="0" style="width: 100%;"> <thead> <tr> <th style="text-align: left;">Motor MCR in KW</th> <th style="text-align: right;">Clearance</th> </tr> </thead> <tbody> <tr> <td>UP to 110 KW</td> <td style="text-align: right;">10mm</td> </tr> <tr> <td>Above 110 KW and upto 150 KW</td> <td style="text-align: right;">12.5mm</td> </tr> <tr> <td>Above 150 KW</td> <td style="text-align: right;">19mm</td> </tr> </tbody> </table>			Motor MCR in KW	Minimum distance between centre of stud and gland plate in mm	<b>UP to 3 KW</b>		Above 3 KW - upto 7 KW	85	Above 7 KW - upto 13 KW	115	Above 13 KW - upto 24 KW	167	Above 24 KW - upto 37 KW	196	Above 37 KW - upto 55 KW	249	Above 55 KW - upto 90 KW	277	Above 90 KW - upto 125 KW	331	Above 125 KW-upto 200 KW	203	Motor MCR in KW	Clearance	UP to 110 KW	10mm	Above 110 KW and upto 150 KW	12.5mm	Above 150 KW	19mm
Motor MCR in KW	Minimum distance between centre of stud and gland plate in mm																														
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SINGARENI THERMAL POWER PROJECT (2X600 MW) BOILER TURBINE GENERATOR PACKAGE	TECHNICAL SPECIFICATIONS SECTION - VI PART-B	SUB-SECTION-B-08 MOTORS	PAGE 9 OF 9																												

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SL. NO.	COMPONENT/OPERATION	QUALITY PLAN				CUSTOMER :				PROJECT				SPECIFICATION :			
		SHEET 1 OF 2				BIDDER/ VENDOR				TITLE				NUMBER :			
		CHARACTERISTICS CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY	SECTION	VOLUME	REMARKS					
									P	W	V						
1	2	3	4	5	6	7	8	9	10							11	
1.0	FABRICATION	1. DIMENTION 2. ALIGNMENT 3. FINISH SURFACE DEFECT	MA MA MA	MEASUREMENT MEASUREMENT & VISUAL VISUAL	100% 100% 100%	APPD. DRG. -DO- -DO-	APPD. DRG. -DO- -DO-	INSPC. -DO- -DO-	2 2 2	- - -	- - -	- - -	- - -	- - -	- - -	- - -	
2.0	SURFACE PREPARATION & PRE-TREATMENT	1. PROCESS PARAMETERS SOLUTION STRENGTH TEMPERATURE DIPPING TIME ETC. 2. SURFACE CONDITION	CR MA	PROCESS VISUAL	PERIODIC 100%	MFR.STD./ BHEL SPEC. RELV. IS -DO-	MFR. STD./ BHEL SPEC RELV. IS -DO-	LOG BOOK -DO-	2 2	- -	- -	- -	- -	- -	- -	- -	
3.0	PRIMER & PAINTING (SPRAYED & STOVED)	1. SURFACE FINISH & COVERAGE 2. FILM THICKNESS 3. SHADE 4. ADHESION	MA MA MA MA	VISUAL VISUAL MEASUREMENT VISUAL CROSSOUT TYPE	100% 100% SAMPLE -DO- -DO-	-DO- -DO- -DO- -DO- -DO-	-DO- -DO- -DO- -DO- -DO-	-DO- -DO- -DO- -DO- -DO-	2 2 2 2 2	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -
BHEL																	
PARTICULARS																	
NAME																	
SIGNATURE																	
DATE																	
BIDDER'S/VENDOR'S COMPANY SEAL																	

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SL. NO.	COMPONENT/OPERATION	QUALITY PLAN	CUSTOMER	PROJECT	SCCL TPP, ABHIJEET TPP	SPECIFICATION :					
						BIDDER/ VENDOR SYSTEM	TITLE	NUMBER :			
SHEET 2 OF 2			NUMBER PED-508-00-Q-003/01			SPECIFICATION :					
CHARACTERISTICS CHECK			TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	SECTION AGENCY	VOLUME IIB REMARKS		
1	2	3	4	5	6	7	8	9	10	11	
4.0	MOUNTING OF VARIOUS ITEMS	1. RIGIDITY 2. THICKNESS 3. CORRECTNESS & COMPLETENESS 4. ACCESSIBILITY	MA MA MA MA	VISUAL VISUAL VISUAL VISUAL	100% 100% 100% 100%	MANUFACTURE DRAWING -DO- APPD. DRG. -DO-	MANUFACTURE DRAWING -DO- APPD. DRG. -DO-	LOG BOOK -DO- -DO- -DO-	2 2 2 2		
5.0	MARKING/LABELLING	1. CORRECTNESS 2. ADHESION/ FIXING	MA MA	VISUAL VISUAL	100% 100%	-DO- -DO-	-DO- -DO-	-DO- -DO-	2 2		
6.0	PRE-FINAL INSPECTION	1. ALIGNMENT 2. PERFORMANCE 3. IR & HV	MA MA MA	VISUAL ELECTRICAL ELECTRICAL	100% 100% 100%	BHEL SPEC. & RELV. STD. -DO- -DO-	BHEL SPEC. & RELV. STD. -DO- -DO-	TEST CERT. -DO- -DO-	2 2 2		
BHEL			PARTICULARS			BIDDER/VENDOR					
			NAME								
			SIGNATURE								
			DATE								
										BIDDER/SVENDORS COMPANY SEAL	

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SL. NO.	COMPONENT/OPERATION	QUALITY PLAN	CUSTOMER :			PROJECT TITLE	SCCL TPP ABHIJEET TPP	SPECIFICATION :					
			BIDDER/ VENDOR	SYSTEM CAT.	CHARACTERISTIC CHECK			EXTENT OF CHECK	TYPE/ METHOD OF CHECK	ACCEPTANCE NORM	FORMAT OF RECORD	SECTION AGENCY	NUMBER :
SHEET 1 OF 9		QUALITY PLAN			TITLE			VOLUME IIB REMARKS					
		1. SURFACE CONDITION			100%			LOG BOOK			3		
		2. DIMENSIONS			MEASUREMENT SAMPLE			-DO-			3		
		3. PROOF LOAD TEST (EYE BOLT)			MECH. TEST			-DO-			3		
		1. SURFACE CONDITION			VISUAL			100%			-DO-		
		2. PROPERTY CLASS			VISUAL			SAMPLES			RELEVENT IS/SPEC.		
		1. SURFACE CONDITION			VISUAL			100%			LOG BOOK		
		2. CHEM. & PHY. PROP.			CHEM & MECH TEST			1 HEAT NO.			SUPPLIER'S TC		
		3. DIMENSIONS			MEASUREMENT			100%			LOG BOOK		
		1. MAKE, SHADE, SHELF LIFE & TYPE			VISUAL			100% CONTINUOUS			LOG BOOK		
		BHEEL			PARTICULARS			BIDDER/VENDOR					
		NAME			SIGNATURE			DATE			BIDDER'S/VENDORS COMPANY SEAL		
1	RAW MATERIAL & BROUGHT CONTROL	2	4	5	6	7	8	9	10	11			
1.0		MA		VISUAL	100%		FREE FROM BLINKS, CRACKS, WAVINESS ETC	LOG BOOK	3				
1.1		MA		MEASUREMENT	SAMPLE	MANFR'S DRG./SPEC	MANFR'S DRG./SPEC	-DO-	3				
1.2		MA		MECH. TEST	-DO-	-DO-	INSPEC. REPORT		3				
1.2		MA		VISUAL	100%		FREE FROM CRACKS, UNEVENNESS ETC.	-DO-	3				
1.3		MA		VISUAL	SAMPLES	MANFR'S DRG./SPEC BOOK	RELEVENT IS/SPEC.	SUPPLIERS TC & LOG	3				PROPERTY CLASS MARKING SHALL BE CHECKED BY THE VENDOR
1.3		MA		VISUAL	100%		FREE FROM CRACKS, BLOW HOLES ETC.	LOG BOOK	3				
1.4		MA		CHEM & MECH TEST	1 HEAT NO.	MANFR'S DRG./SPEC	RELEVENT IS/	SUPPLIER'S TC	3				HEAT NO. SHALL BE VERIFIED
1.4		MA		MEASUREMENT	100%	MANFR'S DRG.	MANFR'S DRG.	LOG BOOK	3				
1.4		MA		VISUAL	100% CONTINUOUS	MANFR'S DRG./SPEC	MANFR'S DRG./SPEC	LOG BOOK	3				

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SL. NO.	COMPONENT/OPERATION	CAT.	BIDDER/VENDOR SYSTEM	CUSTOMER :			PROJECT TITLE			SPECIFICATION :														
				TYPE/METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	SECTION	AGENCY	NUMBER	TITLE	REMARKS											
QUALITY PLAN				SHEET 2 OF 9			NUMBER PED-506-00-Q-007/2			VOLUME IIB														
CHARACTERISTIC CHECK				METHOD OF CHECK			DOCUMENT			ACCEPTANCE NORM			FORMAT OF RECORD			SECTION			AGENCY			REMARKS		
1	2	3	4	5	6	7	8	9	10	11														
1.5	SHAFT (FORGED OR ROLLED)	1. SURFACE COND. 2. CHEM. & PHYSICAL PROPERTIES 3. DIMENSIONS 4. INTERNAL FLOWS	MA	VISUAL	100%	-	FREE FROM VISUAL DEFECTS	-DO-	3	-	-	VENDOR'S APPROVAL IDENTIFICATION SHALL BE MAINTAINED												
			MA	CHEM. & PHYSICAL TESTS	1/HEAT NO. OR HEAT TREATMENT BATCH NO	MFG. DRG. SPEC.	RELEVANT IS	SUPPLIER'S TC	3	-	2													
			MA	MEASUREMENT	100%	-DO-	MANUFRR DRG.	LOG BOOK	3	-	-													
			CR	UT	-DO-	ASTM-A388	MANUFRR SPEC. BHEL SPEC.	-DO-	3	2	1	FOR DIA OF 55 MM & ABOVE												
1.6	SPACE HEATERS, CONNECTORS, TERMINAL BLOCKS, CABLES, CABLE LUGS, CARBON BRUSH TEMP. DETECTORS, RTD, BTD'S	1. MAKE & RATING 2. PHYSICAL COND. 3. DIMENSIONS (WHEREVER APPLICABLE) 4. PERFORMANCE/CALIBRATION	MA	VISUAL	-DO-	MANUFRR DRG. SPEC.	MANUFRR DRG. SPEC.	-DO-	3	-	-													
			MA	-DO-	-DO-	-	NO BREAKAGE ON OTHER PHY. DESIGN	-DO-	3	-	-													
			MA	MEASUREMENT	SAMPLE	MANUFRR DRG./ SPEC.	MANUFRR DRG./ SPEC.	-DO-	3	-	-													
			MA	TEST	100%	-DO-	-DO-	INSP. REPORT	3	-	-													
BHEL				PARTICULARS			BIDDER/VENDOR																	
				NAME																				
				SIGNATURE																				
				DATE																				
										BIDDER'S/VENDORS COMPANY SEAL														

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CUSTOMER :		PROJECT :		SPECIFICATION :				
BIDDER/ VENDOR		TITLE		NUMBER :				
SYSTEM		QUALITY PLAN		SPECIFICATION :				
CAT.		ITEM: AC ELECT. MOTORS 75KW & ABOVE (LV & MV)		TITLE				
CHARACTERISTIC CHECK		REFERENCE DOCUMENT		SECTION				
SHEET 3 OF 9		ACCEPTANCE NORM		AGENCY				
COMPONENT/OPERATION		EXTENT OF CHECK		VOLUME IIB				
2		5		REMARKS				
3		6		P				
4		7		W				
5		8		V				
6		9		10				
7		11		11				
1.7	OTHER INSULATING MATERIALS LIKE SLEEVES, BINDING CORDS, PAPERS, PRESS BOARDS ETC.	1. SURFACE COND. 2. OTHER CHARACTERISTICS	100% SAMPLE	NO VISUAL DEFECTS MANUF'S SPEC.	INSPT. REPORT LOG BOOK AND OR SUPPLIER'S TC	3 3 3	- 2 -	
1.8	SHEET STAMPING (PUNCHED)	1. SURFACE COND. 2. DIMENSIONS INCLUDING BURS HEIGHT 3. ACCEPTANCE TESTS	100% SAMPLE	NO VISUAL DEFECTS (FREE FROM BURS) MANUF'S DRG.	LOG BOOK -DO- SUPPLIER'S TC	3 3 3	- 2 -	FOR MV MOTOR INSULATION/VARNISH THICKNESS SHALL BE MORE THAN THE BURS HEIGHT
1.9	CONDUCTORS	1. SURFACE FINISH 2. ELECT. PROP. & MECH. PROP	100% SAMPLES	FREE FROM VISUAL DEFECTS RELEVANT IS/BS OR OTHER STANDARDS	LOG BOOK SUPPLIER'S TC & VENDOR'S INSPN. REPORTS	3 3/2	- 2	
BHEL		PARTICULARS		BIDDER/VENDOR				
		NAME						
		SIGNATURE						
		DATE						
								BIDDER'S/VENDOR'S COMPANY SEAL

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SL. NO.	COMPONENT/OPERATION	CAT.	TYPE/METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	SECTION	SPECIFICATION :		
									AGENCY	W	V
CUSTOMER :		PROJECT TITLE		SCCL TPP ABHIJEET TPP		SPECIFICATION :		NUMBER :			
BIDDER/VENDOR SYSTEM		QUALITY PLAN		NUMBER PED-508-00-Q-007/2		SPECIFICATION :		TITLE			
SHEET 4 OF 9		ITEM: AC ELECT. MOTORS 75KW & ABOVE (LV & MV)		VOLUME IIB		REMARKS					
1	2	3	4	5	6	7	8	9	10	11	
1.10	BEARINGS	3.DIMENSIONS 1.MAKE & TYPE 2.DIMENSIONS	MA MA MA	MEASUREMENT VISUAL MEASUREMENT	100% SAMPLE	MANFR'S DRG. BHDL DATA SHEET	-DO- MANFR'S DRG. BHDL DATA SHEET BEARING MANUF'S CATALOGUES	Log Book -DO- -DO-	3 3 3	- - -	
1.11	SLIP RING	3.SURFACE FINISH 1.SURFACE COND. 2.DIMENSIONS	MA MA MA	VISUAL VISUAL MEASUREMENT	100% 100% SAMPLE	- - MANUF'S DRG	-DO- -DO- MANUF'S DRG	-DO- -DO- -DO-	3 3 3	- - -	
1.12	OIL SEALS & GASKETS	3.TEMP.WITH- STAND CAPACITY 4.HV/IR 1.MATERIAL OF GASKET 2.SURFACE COND. 3.DIMENSIONS	MA MA MA MA MA	ELECT.TEST -DO- VISUAL VISUAL MEASUREMENT	-DO- 100% 100% 100% SAMPLE	MANUF'S SPEC. -DO- MANUF'S DRG/SPECS MANUF'S DRG	-DO- -DO- MANUF'S DRG/SPECS. FREE FROM VISUAL DEFECTS MANUF'S DRG	-DO- -DO- -DO- -DO- -DO-	3 3 3 3 3	- - - - -	
BHEL		PARTICULARS		BIDDER/VENDOR							
		NAME									
		SIGNATURE									
		DATE									
											BIDDER'S/VENDOR'S COMPANY SEAL

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SL NO.	COMPONENT/OPERATION	SHEET 5 OF 9	QUALITY PLAN			CUSTOMER :			PROJECT			SPECIFICATION :		
			CHARACTERISTIC CHECK	CAT	TYPE/METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	ITEM: AC ELECT. MOTORS 75KW & ABOVE (LV & MV)	QUALITY PLAN NUMBER PED-508-Q-Q-007/2	TITLE	NUMBER :	SECTION
1	2	3	4	5	6	7	8	9	10	11	P	W	V	
2.0	IN PROCESS		MA	VISUAL	100%	-DO-	GOOD FINISH	LOG BOOK	3	-				
2.1	STATOR FRAME WELDING (IN CASE OF FABRICATED STATOR)	1.WORKMANSHIP & CLEANNESS 2.DIMENSIONS	MA	MEASUREMENT	-DO-	MANUF'S DRG	MANUF'S DRG	-DO-	3	-				
2.2	MACHINING	1.FINISH 2.DIMENSIONS	MA	VISUAL	100%	-DO-	GOOD FINISH	LOG BOOK	3	-				
			MA	MEASUREMENT	-DO-	MANUF'S DRG	MANUF'S DRG	-DO-	3	-				
2.3	PAINTING	3.SHAFT SURFACE FLOWS 1.SURFACE PREPARATION 2.PAINT THICKNESS (BOTH PRIMER & FINISH COAT) 3.SHADE 4.ADHESION	MA	PT	-DO-	RELEVANT SPEC./ASTM-E165	MANUF'S SPEC./BHEL SPEC./	-DO-	3	-	1			
			MA	VISUAL	100%	MANFR'S SPEC./BHEL SPEC./ RELEVANT STAND	BHEL SPEC. SAME AS COL.7	LOG BOOK	3	-				
			MA	MEASUREMENT BY ELCOMETER	SAMPLE	-DO-	-DO-	-DO-	3	-	2			
			MA	VISUAL	-DO-	-DO-	-DO-	Log Book	3	-				
			MA	CROSS CUTTING & TAPE TEST	-DO-	-DO-	-DO-	Log Book	3	-				
BHEL														
PARTICULARS														
BIDDER/VENDOR														
NAME														
SIGNATURE														
DATE														
BIDDER/SVENDORS COMPANY SEAL														

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CUSTOMER :		PROJECT :		SCCL TPP ABHIJEET TPP		SPECIFICATION :					
BIDDER/ VENDOR SYSTEM		TITLE		NUMBER :		NUMBER :					
QUALITY PLAN		QUALITY PLAN		SPECIFICATION :		SPECIFICATION :					
SHEET 7 OF 9		ITEM: AC ELECT. MOTORS 75KW & ABOVE (LV & MV)		TITLE		TITLE					
COMPONENT/OPERATION		REFERENCE DOCUMENT		ACCEPTANCE NORM		FORMAT OF RECORD					
CHARACTERISTIC CHECK		EXTENT OF CHECK		TYPE/ METHOD OF CHECK		AGENCY					
3		6		5		P W V					
2		4		7		10					
1		8		9		11					
2.7	COMPLETE STATOR ASSEMBLY	4.DURATION	MA	-DO-	-DO-	Log Book	3	-	2		
2.8	BRAZING/COMPRESSION JOINT	1.COMPACTNESS & CLEANLINESS	MA	100%	-DO-	Log Book	3	-	-		
2.9	COMPLETE ROTOR ASSEMBLY	1.COMPLETENESS	CR	-DO-	-DO-	Log Book	3	-	-		
		2.SOUNDNESS	CR	-DO-	-DO-	Log Book	3	-	-		
		3.HV	MA	-DO-	-DO-	Log Book	3	-	-		
		1.RESIDUAL UNBALANCE	CR	-DO-	MFG SPEC./ ISO 1840	Log Book	3	2	1	VERIFICATION FOR MV MOTOR ONLY	
		2.SOUNDNESS OF DIE CASTING	CR	-DO-	MFG. SPEC.	Log Book	3	2	-		
2.10	ASSEMBLY	1.ALIGNMENT	MA	-DO-	-DO-	Log Book	3	-	-		
		2.WORKMANSHIP	MA	-DO-	-DO-	Log Book	3	-	-		
		3.AXIAL PLAY	MA	-DO-	-DO-	Log Book	3	-	2		
		4.DIMENSIONS	MA	-DO-	MFG.DRG./ MFG SPEC.	Log Book	3	-	-		
		5.CORRECTNESS, COMPLETENESS, TERMINATIONS/ MARKING/ COLOUR CODE	MA	100%	MFG SPEC. RELEVANT IS	Log Book	3	-	-		
BHEL		PARTICULARS		BIDDER/VENDOR							
		NAME									
		SIGNATURE									
		DATE									
										BIDDER/SVENDORS COMPANY SEAL	

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	<b>CUSTOMER :</b> SCCL TPP ABHIJEET TPP		<b>PROJECT TITLE :</b> QUALITY PLAN		<b>SPECIFICATION NUMBER :</b> NUMBER PED-506-00-0-007/2		<b>SPECIFICATION TITLE :</b> SECTION AGENCY		<b>VOLUME IB REMARKS :</b> P W V	
	<b>BIDDER/ VENDOR :</b> SYSTEM CAT.		<b>EXTENT OF CHECK :</b> TYPE/ METHOD OF CHECK		<b>ACCEPTANCE NORM :</b> OF RECORD		<b>SECTION AGENCY :</b> P W V		<b>REMARKS :</b> 10 11	
<b>SL. NO.</b> 1	<b>COMPONENT/OPERATION</b> SHEET 9 OF 9	<b>QUALITY PLAN CHARACTERISTIC CHECK</b> 3	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>	<b>9</b>	<b>10</b>	<b>11</b>
<b>NOTES:</b> 1 DEPENDING UPON THE SIZE AND CRITICALLY, WITNESSING BY BHEL SHALL BE DECIDED. 2 ROUTINE TESTS ON 100% MOTORS SHALL BE DONE BY THE VENDOR. HOWEVER, BHEL SHALL WITNESS ROUTINE TESTS ON RANDOM SAMPLES. THE SAMPLING PLAN SHALL BE MUTUALLY AGREED UPON. 3 IN CASE TEST CERTIFICATES FOR THESE TESTS ON SIMILAR TYPE, SIZE AND DESIGN OF MOTOR FROM INDEPENDENT LABORATORY ARE AVAILABLE, THESE TEST MAY NOT BE REPEATED. 4 WHEREVER CUSTOMER IS INVOLVED IN INSPECTION WITH THE CUSTOMERS, AGENCY (1) SHALL MEAN BHEL AND CUSTOMERS BOTH TOGETHER.										
<b>BHEL</b>										
<b>PARTICULARS</b>										
<b>NAME</b>										
<b>SIGNATURE</b>										
<b>DATE</b>										
<b>BIDDER/VENDOR</b>										
<b>BIDDER'S/VENDOR'S COMPANY SEAL</b>										

RB

CUSTOMER :		PROJECT				SCCL TPP ABHIJEET TPP				SPECIFICATION :			
BIDDER/ VENDOR		TITLE				QUALITY PLAN				NUMBER :			
SYSTEM		QUALITY PLAN				NUMBER PED-506-00-Q-006/0				TITLE			
SL. NO.	COMPONENT/OPERATION	SHEET 1 OF 2	CHARACTERISTICS CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ITEM AC. ELECT. MOTORS BELOW 75KW (LV) ACCEPTANCE NORM	FORMAT OF RECORD	SECTION AGENCY	VOLUME IIB		
											P	W	V
1		2		4	5	6	7	8	9	10			11
1.0	PAINTING		1. SHADE	MA	VISUAL	SAMPLE	MANUF'S SPEC/BHEL SPEC./RELEVANT STANDARD	BHEL SPEC. SAME AS COL.7	LOG BOOK	3			
2.0	ASSEMBLY		1. WORKMANSHIP 2. DIMENSIONS 3. CORRECTNESS COMPLETENESS TERMINATIONS/ MARKING/COLOUR CODE	MA	VISUAL	100%	MANUF'S SPEC	MANUF'S SPEC	-DO-	3			
3.0	TESTS		1. ROUTINE TEST INCLUDING SPECIAL TEST AS PER BHEL SPEC. 2. OVERALL DIMENSIONS & ORIENTATION	MA	-DO-	100%	MFG. DRG./ MFG. SPEC. MFG. DRG./ MFG. SPEC. MFG. DRG./ MFG. SPEC. IS-325/ BHEL SPEC./ DATA SHEET	MFG. DRG./ MFG. SPEC. MFG. DRG./ MFG. SPEC. MFG. DRG./ MFG. SPEC. SAME AS COL.7	TEST REPORT	3	2,1	2,1	NOTE -1
BHEL		PARTICULARS				BIDDER/VENDOR							
		NAME											
		SIGNATURE											
		DATE											
										BIDDER'S/VENDORS COMPANY SEAL			

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SL. NO.	COMPONENT/OPERATION	QUALITY PLAN	CUSTOMER :		PROJECT		SCCL TPP, ABHIJEET TPP		SPECIFICATION :		
			BIDDER/ VENDOR	SYSTEM	TITLE	QUALITY PLAN	NUMBER :	TITLE :	SECTION	AGENCY	VOLUME IIB
SHEET 2 OF 2		CHARACTERISTICS CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	P	W	V
1	2	3	4	5	6	7	8	9	10	11	
		3. NAMEPLATE DETAILS.	MA	VISUAL	100%	IS-325 & DATA SHEET	IS-325 & DATA SHEET	INSPN. REPORT	3	1	
		NOTES:									
		1									
		2									
		3									
		ROUTINE TESTS ON 100% MOTORS SHALL BE DONE BY THE VENDOR. HOWEVER, BHEL SHALL WITNESS ROUTINE TESTS ON RANDOM SAMPLES. THE SAMPLING PLAN SHALL BE MUTUALLY AGREED UPON WHERE EVER CUSTOMER IS INVOLVED IN INSPECTION, (1) SHALL MEAN BHEL AND CUSTOMERS BOTH TOGETHER. FOR EXHAUST/VENTILATION FAN MOTORS OF RATING UPTO 1.9KW , ONLY ROUTINE TEST CERTIFICATES SHALL BE FURNISHED FOR SCRUTINY.									
BHEL		PARTICULARS		BIDDER/VENDOR							
		NAME									
		SIGNATURE									
		DATE									
										BIDDERS/VENDORS COMPANY SEAL	

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**TITLE : TECHNICAL SPECIFICATION  
FOR  
CONDENSER ON LOAD TUBE CLEANING  
SYSTEMS (COLTCS) & DEBRIS FILTER (DF)**

**SPEC. NO. PE-TS-381/382-165-N001**

**VOLUME : II B**

**SECTION : D**

**REV. NO. 0**




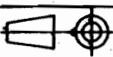
**DATE :12.04.2012**

**SHEET .1of 1**

**SECTION D4  
STANDARD TECHNICAL SPECIFICATION  
FOR  
C&I SYSTEMS**

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# MOTOR OPERATED VALVE ACTUATOR DATA SHEET

NTPC DRAWING NO.					
OWNER :					
 <b>THE SINGARENI COLLIERIES COMPANY LTD.</b> <small>(A Government company) POWER PROJECT DIVISION</small>					
CONSULTANT :					
 <b>एन टी पी सी लिमिटेड</b> <b>NTPC Limited</b> <small>(A Government of India Enterprise) CONSULTING WING</small>					
PROJECT :					
<b>SCCL COAL BASED THERMAL POWER PLANT</b> (2 X 600MW)					
PACKAGE					
<b>BOILER TURBINE GENERATOR PACKAGE</b>					
CONTROLLER		DEPT. CODE	NAME	SIGN	DATE
 <b>BHARAT HEAVY ELECTRICALS LTD.</b> POWER SECTOR PROJECTS ENGINEERING MANAGEMENT NEW DELHI		DRN	MS		13.04.12
		CHD	MK		13.04.12
		APPD	SHB		13.04.12
TITLE					
<b>MOTOR OPERATED VALVE ACTUATOR DATA SHEET</b>					
		DEPT.	SCALE	DRAWING NO.	
		SIGN		PE-ID-381-145-1902	
		DATE		SHEET 1 OF 5	REV. 00

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**SPECIFICATION SHEET FOR  
MOTORISED VALVE ACTUATOR**  
**2 x 600MW SINGARENI - SCCL TPP**

SPECIFICATION NO.: PE-ID-381-145-1902

VOLUME

SECTION

REV. NO. 00

DATE: 13.04.12

SHEET 2

OF 5

TAG No :-  
Qty :-.....Nos.....

**Data Sheet A & B**

DATA SHEET-A  
(TO BE FILLED BY PURCHASER)

DATA SHEET-B  
(TO BE FILLED-UP BY BIDDER)

<b>GENERAL*</b>	* PROJECT	<b>2 x 600MW SINGARENI - SCCL TPP</b>
	OFFER REFERENCE	
	* TAG NO. SERVICE	
	* DUTY	<input type="checkbox"/> ON / OFF <input type="checkbox"/> INCHING
	* LINE SIZE (inlet/outlet): MATERIAL	
	* VALVE TYPE	<input type="checkbox"/> GLOBE <input type="checkbox"/> GATE <input type="checkbox"/> REG. GLOBE <input type="checkbox"/> BUTTERFLY
	* OPENING / CLOSING TIME	..... SECONDS
	* WORKING PRESSURE	..... KG/SQ.CM.
	AMBIENT CONDITION	SHALL BE SUITABLE FOR CONTINUOUS OPERATION UNDER AN AMBIENT TEMP. OF 0-55 DEG C AND RELATIVE HUMIDITY OF 0-95%
	VALVE SEAT TEST PRESS	BIDDER TO SPECIFY
REQUIRED VALVE TORQUE	BIDDER TO SPECIFY	
ACTUATOR RATED TORQUE	BIDDER TO SPECIFY	
<b>CONSTRUCTION AND SIZING</b>	CONSTRUCTION	TOTALLY ENCLOSED, WEATHER PROOF, IP:55
	MECHANICAL POSITION INDICATOR	TO BE PROVIDED FOR 0-100% TRAVEL
	BEARINGS	DOUBLE SHIELDED, GREASE LUBRICATED ANTI-FRICTION.
	GEAR TRAIN FOR LIMIT SWITCH/TORQUE SWITCH OPERATION	METAL (NOT FIBRE GEARS). SELF-LOCKING TO PREVENT DRIFT UNDER TORQUE SWITCH SPRING PRESSURE WHEN MOTOR IS DE-ENERGIZED.
SIZING	OPEN/CLOSE AT RATED SPEED AGAINST DESIGNED DIFFERENTIAL PRESSURE AT 90 % OF RATED VOLTAGE. FOR ISOLATING SERVICE THREE SUCCESSIVE OPEN-CLOSE OPERATIONS OR 15 MINS. WHICHEVER IS HIGHER. For regulating service 150 starts/Hr min.	
<b>HANDWHEEL</b>	* REQUIRED	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO
	* ORIENTATION	<input type="checkbox"/> TOP MOUNTED <input type="checkbox"/> SIDE MOUNTED
	TQ DISENGAGE AUTOMATICALLY DURING MOTOR OPERATION.	
<b>ELECTRIC ACTUATOR</b>	ACTUATOR MAKE/MODEL	BIDDER TO SPECIFY
	MOTOR MAKE / MODEL / TYPE / RATING (KW)	BIDDER TO SPECIFY
	MOTOR TYPE	SQUIRREL CAGE INDUCTION MOTOR, STARTING CURRENT LIMITED TO SIX TIMES THE RATED CURRENT.
	ACTUATOR WIRING DIAGRAM & No.	<input checked="" type="checkbox"/> BIDDER TO ENCLOSE <input type="checkbox"/> ENCLOSED
	COLOUR SHADE	<input checked="" type="checkbox"/> BLUE (RAL 5012) ENAMEL/ GREY ENAMEL PAINT(SHADE 631 AS PER IS.5) OR EQUIVALENT <input type="checkbox"/> .....
	SHAFT RPM	BIDDER TO SPECIFY
	OLR-SET VALUE	BIDDER TO SPECIFY
	STARTING / FULL LOAD CURRENT	BIDDER TO SPECIFY
	NO. OF REV FOR FULL TRAVEL	BIDDER TO SPECIFY
	@ PWR SUPP TO MTR / STARTER	415V±10%, 3PH, AC, 50Hz±5%, 10%(ABSOLUTE) COMBINED VOLTAGE & FREQUENCY VARIATION
	@ CONTROL VOLTAGE REQUIREMENT	110V AC- TO BE DERIVED FROM THE POWER SUPPLY TO THE STARTER
	@ ENCLOSURE CLASS OF MOTOR	<input type="checkbox"/> IP 65 <input checked="" type="checkbox"/> IP 67 FOR OUTDOOR <input type="checkbox"/> FLAME PROOF <input checked="" type="checkbox"/> IP 55 FOR INDOOR, TOTALLY ENCL, SELF VENTILATED.

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**SPECIFICATION SHEET FOR  
MOTORISED VALVE ACTUATOR**

**2 x 600MW SINGARENI - SCCL TPP**

SPECIFICATION NO.: PE-ID-381-145-1902

VOLUME

SECTION

REV. NO. 00

DATE: 13.04.12

SHEET 2

OF 5

TAG No :-  
Qty :-.....Nos.....

**Data Sheet A & B**

DATA SHEET-A  
(TO BE FILLED BY PURCHASER)

DATA SHEET-B  
(TO BE FILLED-UP BY BIDDER)

	<input checked="" type="checkbox"/> INSULATION CLASS <input type="checkbox"/> CLASS-B <input checked="" type="checkbox"/> CLASS-F WITH TEMPERATURE RISE LIMITED TO CLASS-B	
	<input checked="" type="checkbox"/> CONTINUOUS OPERATION TIME S2-15 MINUTES	
	<input checked="" type="checkbox"/> POWER CABLE TYPE / SIZE LATER (TO BE PROVIDED IN THE CONTRACT STAGE)	
	<input checked="" type="checkbox"/> CONTROL CABLE TYPE / SIZE LATER (TO BE PROVIDED IN THE CONTRACT STAGE)	
	<input checked="" type="checkbox"/> WINDING TEMP PROTECTION <input checked="" type="checkbox"/> THERMOSTAT <input checked="" type="checkbox"/> THERMISTOR WITH SWITCHING UNIT <input checked="" type="checkbox"/> 3 Nos., 1 IN EACH PH. <input type="checkbox"/> ONE	
	SINGLE PHASE / WRONG PHASE SEQUENCE PROTECTION REQUIRED	
<b>INTEGRAL STARTER</b>	INTEGRAL STARTER <input checked="" type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED	
	TYPE OF SWITCHING DEVICE <input checked="" type="checkbox"/> CONTACTORS <input type="checkbox"/> THYRISTORS	
	TYPE <input checked="" type="checkbox"/> CONVENTIONAL <input type="checkbox"/> SMART (NON-INTRUSIVE)	
	IF SMART	
	a) SERIAL LINK INTERFACE <input type="checkbox"/> INTEGRAL <input type="checkbox"/> FIELD MOUNTED	
	b) SERIAL LINK PROTOCOL <input type="checkbox"/> FOUNDATION FIELD-BUS <input type="checkbox"/> PROFI-BUS <input type="checkbox"/> TCP/IP <input type="checkbox"/> .....	
	c) SERIAL LINK MEDIA: <input type="checkbox"/> TWISTED PAIR Cu-CBL <input type="checkbox"/> CO-AXIAL Cu-CBL <input type="checkbox"/> QFC	
	d) HAND HELD PROGRAMMER <input type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED	
	e) MASTER STATION (See note-10) <input type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED	
	f) MASTER STN INTRFACE WITH DCS <input type="checkbox"/> REQUIRED MODBUS <input type="checkbox"/> TCP/IP	
	g) DETAILS OF SPECIAL CABLE <input type="checkbox"/> ENCLOSED <input type="checkbox"/> NOT REQUIRED	
	WIRING DIAGRAM & No. <input checked="" type="checkbox"/> BIDDER TO ENCLOSE <input type="checkbox"/> ENCLOSED	
	STEP DOWN CONT. TRANSFORMER <input checked="" type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED	
	OPEN / CLOSE PB <input checked="" type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED	
	STOP PB <input checked="" type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED	
	INDICATING LAMPS <input checked="" type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED	
	LOCAL-REMOTE S/S <input checked="" type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED	
STATUS CONTACTS FOR MONITORING <input checked="" type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED		
INTEGRAL STARTER DISTURBED SIGNAL REQUIRED(O/L RELAY OPERATED, CONT./POWER SUPPLY FAILED,S/S IN LOCAL,TORQUE SWITCH OPTD MID WAY)		
<b>INTERPOSING RELAY (Applicable for Integral Starter)</b>	INTERPOSING RELAY <input checked="" type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED	
	INTERPOSING RELAY (QUANTITY) <input checked="" type="checkbox"/> 2 NOS. <input type="checkbox"/> 3 NOS.	
	DRIVING VOLTAGE <input checked="" type="checkbox"/> 20.5 - 24V DC <input type="checkbox"/> _____ V DC	
	DRIVING CURRENT <input checked="" type="checkbox"/> 125 mA MAX <input type="checkbox"/> _____ mA MAX	
	LOAD RESISTANCE <input checked="" type="checkbox"/> > 192 ohms - < 25 K ohms <input type="checkbox"/> > _____ ohms - < _____ ohms	
<b>TORQUE SWITCH (Not Applicable for Smart Actuator)</b>	MECHANICAL LATCHING DEVICE <input checked="" type="checkbox"/> REQUIRED(REFER NOTE-6)	
	MFR & MODEL NO. BIDDER TO SPECIFY	
	OPEN / CLOSE <input checked="" type="checkbox"/> 1 No. <input type="checkbox"/> 2Nos. / <input checked="" type="checkbox"/> 1 No. <input type="checkbox"/> 2Nos	
	CONTACT TYPE 2 NO + 2 NC	
	RATING 5A, 240 V AC / 0. 5A,220 V DC	
	ENCLOSURE IP 55	
	CALIBRATED KNOBS(OPEN&CLOSE TS) REQUIRED FOR SETTING DESIRED TORQUE	
	ACCURACY ±3% OF SET VALUE	
<b>LIMIT SWITCH (Not Applicable for Smart Actuator)</b>	MFR & MODEL NO. BIDDER TO SPECIFY	
	OPEN : INT : CLOSE <input type="checkbox"/> 1 No. <input checked="" type="checkbox"/> 2 Nos.    2 Nos. (ADJ.) <input type="checkbox"/> 1 No. <input checked="" type="checkbox"/> 2Nos.	

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**SPECIFICATION SHEET FOR  
MOTORISED VALVE ACTUATOR**

**2 x 600MW SINGARENI - SCCL TPP**

SPECIFICATION NO.: PE-ID-381-145-1902

VOLUME

SECTION

REV. NO. 00

DATE: 13.04.12

SHEET 2

OF 5

TAG No :-  
Qty :-.....Nos.....

**Data Sheet A & B**

DATA SHEET-A  
(TO BE FILLED BY PURCHASER)

DATA SHEET-B  
(TO BE FILLED-UP BY BIDDER)

	CONTACT TYPE	2 NO + 2 NC	
	RATING (AC / DC)	5A, 240 V AC / 0. 5A,220 V DC	
	ENCLOSURE CLASS	IP 55	
<b>POSITION TRANSMITTER</b> (For Inching Duty Drives)	POSITION TRANSMITTER	<input checked="" type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED	
	MFR & MODEL NO.	BIDDER TO SPECIFY	
	TYPE	<input checked="" type="checkbox"/> ELECTRONIC (2-WIRE) CONTACTLESS <input type="checkbox"/> ELECTRONIC (2 WIRE) RI CONVERTER	
	SUPPLY	<input checked="" type="checkbox"/> 24V DC <input type="checkbox"/> .....	
	OUTPUT	<input checked="" type="checkbox"/> 4-20mA	
	ACCURACY	± 1% FS	
	ENCLOSURE CLASS	IP 55	
<b>TERMINAL BOX</b>	MOTOR TERMINAL BOX	REQUIRED	
	ACTUATOR TERMINAL BOX	REQUIRED	
	ENCL CLASS MTR T.B. / ACTUATOR T.B.	<input type="checkbox"/> IP65 <input checked="" type="checkbox"/> IP67.....	<input type="checkbox"/> IP65 <input checked="" type="checkbox"/> IP67.....
	@ EARTHING TERMINAL	PROVIDED	
	PLUG & SOCKET (9 PIN) (FOR COMM, LS/TS FEED BACK, PoT)	<input checked="" type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED <input checked="" type="checkbox"/> 2 NOS. <input type="checkbox"/> .....	
<b>CABLE GLANDS</b>	@ POWER CABLE GLAND	SIZE : .....	
	@ SPACE HEATER CABLE GLAND	SIZE : .....	
	OTHER CONTROL CABLE GLANDS	QUANTITY & SIZE : TWO (SIZE TO BE FURNISHED LATER)	
<b>SPACE HEATER</b>	@ SPACE HEATER	REQUIRED	
	@ POWER SUPPLY		
	@ RATING		
<b>WEIGHT</b>	TOTAL WEIGHT (ACTUATOR + ACCESSORIES)	BIDDER TO SPECIFY _____ Kg.	

- NOTES:**
- SCOPE: DESIGN, MANUFACTURE, INSPECTION, TESTING AND DELIVERY TO SITE OF ELECTRIC ACTUATOR FOR INCHING OR OPEN / CLOSE DUTY.
  - CODES & STANDARDS: DESIGN AND MATERIALS USED SHALL COMPLY WITH THE RELEVANT LATEST NATIONAL AND INTERNATION STANDARD. AS A MINIMUM, THE FOLLOWING STANDARDS SHALL BE COMPLIED WITH: IS-9334, IS-2147, IS-2148, IS-325, IS-2959, IS-4691 AND IS-4722
  - TEMPERATURE RISE SHALL BE RESTRICTED TO 70 DEG. C FOR AMBIENT TEMPERATURE OF 50 DEG C.
  - CABLE GLANDS OF DOUBLE COMPRESSION TYPE BRASS MATRIAL, SHALL BE PROVIDED.
  - THE MAKE OF THE MOTOR WILL BE ANY OF THE FOLLOWING : CGL / SIEMENS / ABB / NGEF / BHARAT BIJLI / KIRLOSKAR
  - THE TORQUE SWITCHES SHALL BE PROVIDED WITH MECHANICAL LATCHING DEVICE TO PREVENT OPERATION WHEN UNSEATING FROM THE END POSITIONS. THE LATCHING DEVICE SHALL UNLATCH AS SOON AS THE VALVE LEAVES THE END POSITION. IF SUCH PROVISION IS NOT POSSIBLE, THE TORQUE SWITCHES SHALL BE BYPASSED BY END-POSITION LIMIT SWITCHES WHICH OPENS ON VALVE LEAVING END POSITION.THESE LIMIT SWITCHES ARE ADDITIONAL TO THE NUMBER OF LIMIT SWITCHES SPECIFIED ELSEWHERE.
  - THE MOTOR SHALL OPERATE SATISFACTORILY UNDER THE +/- 10% SUPPLY VOLTAGE VARIATION AT RATED FREQUENCY, -5% TO +3% VARIATION IN FREQUENCY AT RATED SUPPLY VOLTAGE, SIMULTANEOUS VARIATION IN VOLTAGE & FREQUENCY THE SUM OF ABSOLUTE PERCENTAGE NOT EXCEEDING 10%.
  - THE MOTOR SHALL BE SUITABLE FOR DIRECT ON LINE STARTING.

<b>NAME</b>	<b>PREPARED BY</b>	<b>CHECKED BY</b>	<b>APPROVED BY</b>	<b>COMPANY SEAL</b>
	MS	MK	SHB	
	<b>SIGNATURE</b>			
<b>DATE</b>	13.04.2012	13.04.2012	13.04.2012	<b>DATE</b>

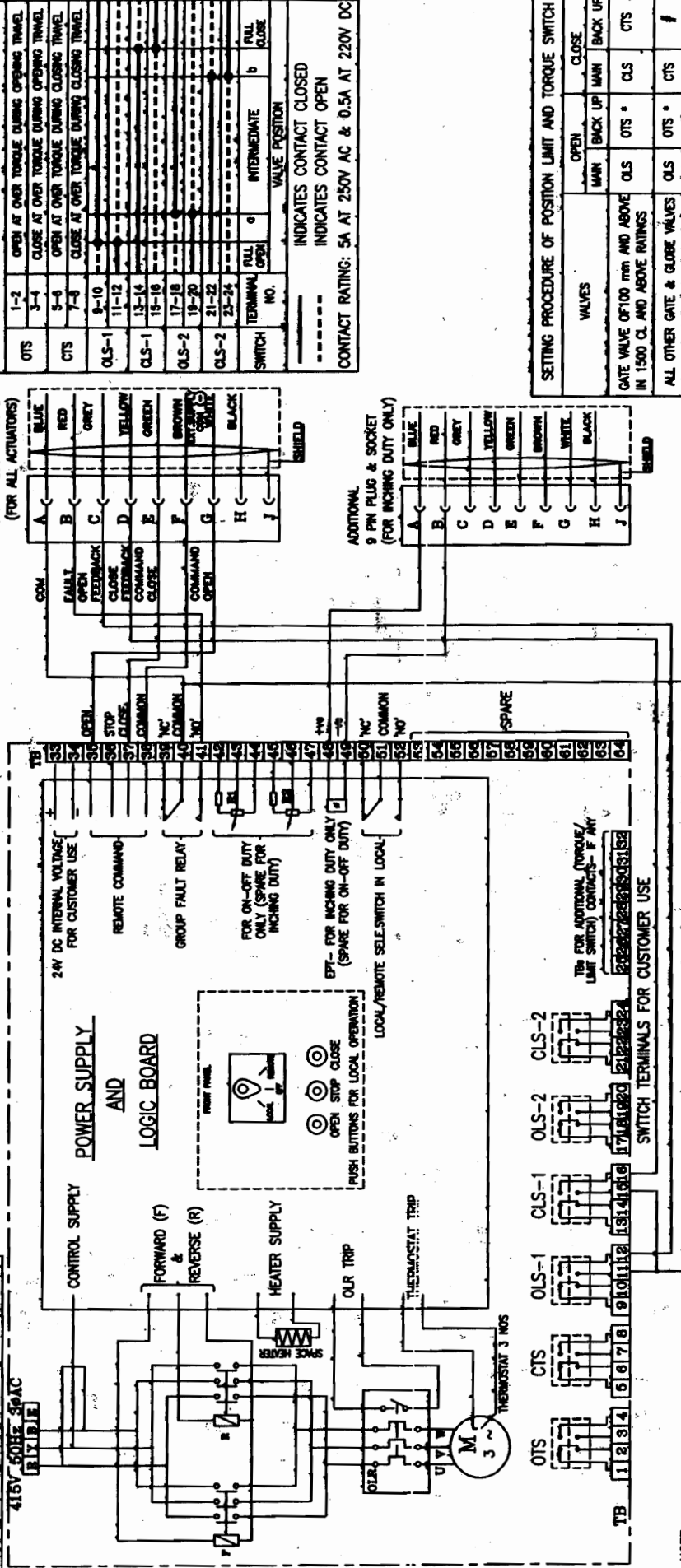
NOTES\* = TO BE FILLED BY MPL (LEAD AGENCY). @ = TO BE FILLED BY ES

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3-V-MISC-24283

OK DRAWING



**CONTACT DEVELOPMENT DIAGRAM**

OTS	1-2	OPEN AT OVER TORQUE DURING OPENING TRAVEL
	3-4	CLOSE AT OVER TORQUE DURING OPENING TRAVEL
CTS	5-6	OPEN AT OVER TORQUE DURING CLOSING TRAVEL
	7-8	CLOSE AT OVER TORQUE DURING CLOSING TRAVEL
OLS-1	9-10	
	11-12	
OLS-1	13-14	
	15-16	
OLS-2	17-18	
	19-20	
OLS-2	21-22	
	23-24	
SWITCH	TERMINAL NO.	FULL OPEN
		INTERMEDIATE
		b
		FULL CLOSE

INDICATES CONTACT CLOSED  
 ----- INDICATES CONTACT OPEN  
 CONTACT RATING: 5A AT 250V AC & 0.5A AT 220V DC

**SETTING PROCEDURE OF POSITION LIMIT AND TORQUE SWITCH**

VALVES	OPEN		CLOSE	
	MAIN	BACK UP	MAIN	BACK UP
GATE VALVE OF 100 mm AND ABOVE IN 1500 CL AND ABOVE RATINGS	OLS	OTS *	OLS	CTS
ALL OTHER GATE & GLOBE VALVES	OLS	OTS *	OLS	CTS

f - OLS NOT TO BE CONNECTED IN TRIP CIRCUIT  
 \* - BYPASS OTS FOR INITIAL 5% OF TRAVEL (FOR GATE VALVES ONLY)

**TYPE OF PRODUCT OR NAME OF CUSTOMER/PROJECT**  
 ELECTRICAL VALVE ACTUATORS (AC) WITH INTEGRAL STARTERS FOR NTPC PROJECTS (DRAWN FOR INTERMEDIATE POSITION OF VALVES)

**REFERENCE INFORMATION**

DIET	38-121	SCALE	NTS	WEIGHT (KG)	
CODE					

**BHARAT HEAVY ELECTRICALS LTD.**  
 UNIT: HIGH PRESSURE BOILER PLANT, THERMOVALVE-0000A.

NAME	SIGN	DATE	NO. OF VALVE
M.P.ESWAR	M.P.	17.03.05	
D.DHAKARAN	D.D	17.03.05	
K.KARUNACHALAM	K.A	17.03.05	


**WIRING DIAGRAM (TERMINAL PLAN)**  
 FOR ACTUATOR WITH INTEGRAL STARTER WITH PLUG & SOCKET FOR NTPC PROJECTS

U 01  
 DRAWING NO. 3-V-MISC-24283  
 REV 0

- NOTE:-**
- ALL TORQUE AND LIMIT SWITCHES (OTS, CTS, OLS1&2, CLS1&2) ARE WITH 2NO+2NC CONTACTS. '1NO+1NC' IS TERMINATED IN TBS 1-24. REMAINING CONTACTS ARE FOR INTERNAL USE. ANY SPARE CONTACTS WHICH ARE NOT USED INTERNALLY ARE TO BE TERMINATED IN TBS 25-32.
  - CTS - TORQUE SWITCHES FOR CW ROTATION (CLOSE)
  - OTS - TORQUE SWITCHES FOR CCW ROTATION (OPEN)
  - OLS-1, OLS-2 - LIMITSWITCHES FOR POSITION OPEN
  - CLS-1, CLS-2 - LIMITSWITCHES FOR POSITION CLOSE
  - EPT - ELECTRONIC POSITION TRANSMITTER (CONTACTLESS TYPE, FOR INCHING DUTY)
  - R1-R2 - POTENTIOMETER 2 x 100 OHMS (FOR ON-OFF DUTY)
  - FOR COMMANDS & EPT EITHER INTERNALLY GENERATED 24 VDC OR EXTERNAL SUPPLY OF 24VDC CAN BE USED
  - M - MOTOR 3/4 415V 50 Hz AC SUPPLY
  - TORQUE SWITCH BYPASS WITH LIMITSWITCH BOTH ON OPEN & CLOSE DIRECTION TO BE DONE INTERNALLY.

Applicable for 1x300 MW- VISHAKAHAPATNAM ABHIJEET TPP.

FORM NO. PEM-6686-0

	<b>SPECIFICATION SHEET FOR MOTORISED VALVE ACTUATOR</b>	SPECIFICATION NO.: PE-ID-375-145-1902			
		VOLUME	II B		
		SECTION	D		
		REV. NO.	00	DATE:	03.10.11
		SHEET	2	OF	7

TAG No :-  
Qty :-.....Nos.....

**Data Sheet A & B**

DATA SHEET-A (TO BE FILLED BY PURCHASER)	DATA SHEET-B (TO BE FILLED-UP BY BIDDER)
---	---

<b>GENERAL*</b>	* PROJECT	
	OFFER REFERENCE	
	* TAG NO. SERVICE	
	* DUTY	<input type="checkbox"/> ON / OFF <input type="checkbox"/> INCHING
	* LINE SIZE (inlet/outlet): MATERIAL	
	* VALVE TYPE	<input type="checkbox"/> GLOBE <input type="checkbox"/> GATE <input type="checkbox"/> REG. GLOBE <input type="checkbox"/> BUTTERFLY
	* OPENING / CLOSING TIME	..... SECONDS
	* WORKING PRESSURE	..... KG/SQ.CM.
	AMBIENT CONDITION	SHALL BE SUITABLE FOR CONTINUOUS OPERATION UNDER AN AMBIENT TEMP. OF 0-55 DEG C AND RELATIVE HUMIDITY OF 0-95%
	VALVE SEAT TEST PRESS	BIDDER TO SPECIFY
	REQUIRED VALVE TORQUE	BIDDER TO SPECIFY
	ACTUATOR RATED TORQUE	BIDDER TO SPECIFY
<b>CONSTRUCTION AND SIZING</b>	CONSTRUCTION	TOTALLY ENCLOSED, WEATHER PROOF
	MECHANICAL POSITION INDICATOR	TO BE PROVIDED FOR 0-100% TRAVEL
	BEARINGS	DOUBLE SHIELDED, GREASE LUBRICATED ANTI-FRICTION.
	GEAR TRAIN FOR LIMIT SWITCH/TORQUE SWITCH OPERATION	METAL (NOT FIBRE GEARS). SELF-LOCKING TO PREVENT DRIFT UNDER TORQUE SWITCH SPRING PRESSURE WHEN MOTOR IS DE-ENERGIZED.
SIZING	OPEN/CLOSE AT RATED SPEED AGAINST DESIGNED DIFFERENTIAL PRESSURE AT 90 % OF RATED VOLTAGE. FOR ISOLATING SERVICE THREE SUCCESSIVE OPEN-CLOSE OPERATIONS OR 15 MINS. WHICHEVER IS HIGHER. For regulating service 150 starts/Hr min.	
<b>HANDWHEEL</b>	* REQUIRED	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO
	* ORIENTATION	<input type="checkbox"/> TOP MOUNTED <input type="checkbox"/> SIDE MOUNTED
	TO DISENGAGE AUTOMATICALLY DURING MOTOR OPERATION.	
<b>ELECTRIC ACTUATOR</b>	ACTUATOR MAKE/MODEL	BIDDER TO SPECIFY
	MOTOR MAKE / MODEL / TYPE / RATING (KW)	BIDDER TO SPECIFY
	MOTOR TYPE	SQUIRREL CAGE INDUCTION MOTOR, STARTING CURRENT LIMITED TO SIX TIMES THE RATED CURRENT.
	ACTUATOR WIRING DIAGRAM & No.	<input checked="" type="checkbox"/> ENCLOSED (3-V-MISC-24227)
	COLOUR SHADE	<input checked="" type="checkbox"/> GREY ENAMEL PAINT (SHADE 631 AS PER IS.5) OR EQUIVALENT (shall be finalised during detail engg.)
	SHAFT RPM	BIDDER TO SPECIFY
	OLR SET VALUE	BIDDER TO SPECIFY
	STARTING / FULL LOAD CURRENT	BIDDER TO SPECIFY
	NO. OF REV FOR FULL TRAVEL	BIDDER TO SPECIFY
	@ PWR SUPP TO MTR / STARTER	415V±10%, 3PH, AC, 50Hz±5%, 10%(ABSOLUTE) COMBINED VOLTAGE & FREQUENCY VARIATION
	@ CONTROL VOLTAGE REQUIREMENT	110V AC- TO BE DERIVED FROM THE POWER SUPPLY TO THE STARTER
	@ ENCLOSURE CLASS OF MOTOR	<input type="checkbox"/> IP 65 <input checked="" type="checkbox"/> IP 67 <input type="checkbox"/> FLAME PROOF TOTALLY ENCL, SELF VENTILATED.

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**SPECIFICATION SHEET FOR  
MOTORISED VALVE ACTUATOR**

SPECIFICATION NO.: PE-ID-375-145-I902

VOLUME II B

SECTION D

REV. NO. 00

DATE: 03.10.11

SHEET 3

OF 7

TAG No :-

Qty :-.....Nos.....


**Data Sheet A & B**

DATA SHEET-A  
(TO BE FILLED BY PURCHASER)

DATA SHEET-B  
(TO BE FILLED-UP BY BIDDER)

	@ INSULATION CLASS <input type="checkbox"/> CLASS-B <input checked="" type="checkbox"/> CLASS-F WITH TEMPERATURE RISE LIMITED TO CLASS-B	
	@ CONTINUOUS OPERATION TIME S2-15 MINUTES	
	@ POWER CABLE TYPE / SIZE LATER (TO BE PROVIDED IN THE CONTRACT STAGE)	
	@ CONTROL CABLE TYPE / SIZE LATER (TO BE PROVIDED IN THE CONTRACT STAGE)	
	@ WINDING TEMP PROTECTION <input checked="" type="checkbox"/> THERMOSTAT <input type="checkbox"/> THERMISTOR WITH SWITCHING UNIT <input checked="" type="checkbox"/> 3 Nos., 1 IN EACH PH <input type="checkbox"/> ONE	
	SINGLE PHASE / WRONG PHASE SEQUENCE PROTECTION REQUIRED	
<b>INTEGRAL STARTER</b>	INTEGRAL STARTER <input checked="" type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED	
	TYPE OF SWITCHING DEVICE <input checked="" type="checkbox"/> CONTACTORS <input type="checkbox"/> THYRISTORS	
	TYPE <input checked="" type="checkbox"/> CONVENTIONAL <input type="checkbox"/> SMART (NON-INTRUSIVE)	
	IF SMART	
	a) SERIAL LINK INTERFACE <input type="checkbox"/> INTEGRAL <input type="checkbox"/> FIELD MOUNTED	
	b) SERIAL LINK PROTOCOL <input type="checkbox"/> FOUNDATION FIELD-BUS <input type="checkbox"/> PROFI-BUS <input type="checkbox"/> TCP/IP <input type="checkbox"/> .....	
	c) SERIAL LINK MEDIA <input type="checkbox"/> TWISTED PAIR Cu-CBL <input type="checkbox"/> CO-AXIAL Cu-CBL <input type="checkbox"/> OFC	
	d) HAND HELD PROGRAMMER <input type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED	
	e) MASTER STATION (See note-10) <input type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED	
	f) MASTER STN INTRFACE WITH DCS <input type="checkbox"/> REQUIRED MODBUS <input type="checkbox"/> TCP/IP	
	g) DETAILS OF SPECIAL CABLE <input type="checkbox"/> ENCLOSED <input type="checkbox"/> NOT REQUIRED	
	WIRING DIAGRAM & No. <input checked="" type="checkbox"/> BIDDER TO ENCLOSE <input type="checkbox"/> ENCLOSED	
	STEP DOWN CONT. TRANSFORMER <input checked="" type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED	
	OPEN / CLOSE PB <input checked="" type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED	
	STOP PB <input checked="" type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED	
	INDICATING LAMPS <input checked="" type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED	
	LOCAL REMOTE S/S <input checked="" type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED	
	STATUS CONTACTS FOR MONITORING <input checked="" type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED	
INTEGRAL STARTER DISTURBED SIGNAL REQUIRED(O/L RELAY OPERATED, CONT./POWER SUPPLY FAILED,S/S IN LOCAL, THERMOSTAT TRIP, TORQUE SWITCH (OPTD MID WAY)		
<b>INTERPOSING RELAY</b> (Applicable for Integral Starter)	INTERPOSING RELAY <input checked="" type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED	
	INTERPOSING RELAY (QUANTITY) <input checked="" type="checkbox"/> 2 NOS. <input type="checkbox"/> 3 NOS.	
	DRIVING VOLTAGE <input checked="" type="checkbox"/> 20.5 – 24V DC <input type="checkbox"/> _____ V DC	
	DRIVING CURRENT <input checked="" type="checkbox"/> 125 mA MAX <input type="checkbox"/> _____ mA MAX	
	LOAD RESISTANCE <input checked="" type="checkbox"/> > 192 ohms - < 25 K ohms <input type="checkbox"/> > _____ ohms - < _____ ohms	
<b>TORQUE SWITCH</b> (Not Applicable for Smart Actuator)	MECHANICAL LATCHING DEVICE <input checked="" type="checkbox"/> REQUIRED(REFER NOTE-6)	
	MFR & MODEL NO. BIDDER TO SPECIFY	
	OPEN / CLOSE <input checked="" type="checkbox"/> 1 No. <input type="checkbox"/> 2Nos. / <input checked="" type="checkbox"/> 1 No. <input type="checkbox"/> 2Nos	
	CONTACT TYPE 2 NO + 2 NC	
	RATING 5A, 240 V AC / 0. 5A,220 V DC	
	ENCLOSURE IP 66	
	CALIBRATED KNOBS(OPEN&CLOSE TS) REQUIRED FOR SETTING DESIRED TORQUE	
	ACCURACY ±3% OF SET VALUE	
<b>LIMIT SWITCH</b> (Not Applicable for Smart Actuator)	MFR & MODEL NO. BIDDER TO SPECIFY	
	OPEN : INT : CLOSE <input type="checkbox"/> 1 No. <input checked="" type="checkbox"/> 2 NOS.    2 Nos. (ADJ.) <input type="checkbox"/> 1 No. <input checked="" type="checkbox"/> 2Nos.	

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	<b>SPECIFICATION SHEET FOR MOTORISED VALVE ACTUATOR</b>	SPECIFICATION NO.: PE-ID-375-145-I902	
		VOLUME	II B
		SECTION	D
		REV. NO.	00
		SHEET	4 OF 7

TAG No :-  
Qty :-.....Nos.....

**Data Sheet A & B**

<b>DATA SHEET-A</b> (TO BE FILLED BY PURCHASER)	<b>DATA SHEET-B</b> (TO BE FILLED-UP BY BIDDER)
--	--

	CONTACT TYPE	2 NO + 2 NC	
	RATING (AC / DC)	5A, 240 V AC / 0. 5A, 220 V DC	
	ENCLOSURE CLASS	IP 66	
<b>POSITION TRANSMITTER</b>	POSITION TRANSMITTER	<input checked="" type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED	
	MFR & MODEL NO.	BIDDER TO SPECIFY	
	TYPE	<input checked="" type="checkbox"/> ELECTRONIC (2-WIRE) CONTACTLESS (LVDT TYPE) <input type="checkbox"/> ELECTRONIC (2 WIRE) R/I CONVERTER	
	SUPPLY	<input checked="" type="checkbox"/> 24V DC <input type="checkbox"/> .....	
	OUTPUT	<input checked="" type="checkbox"/> 4-20mA	
	ACCURACY	± 1% FS	
	ENCLOSURE CLASS	IP 65	
<b>TERMINAL BOX</b>	MOTOR TERMINAL BOX	REQUIRED	
	ACTUATOR TERMINAL BOX	REQUIRED	
	ENCL CLASS MTR T.B. / ACTUATOR T.B.	<input type="checkbox"/> IP65 <input checked="" type="checkbox"/> IP67.....	<input type="checkbox"/> IP65 <input checked="" type="checkbox"/> IP67.....
	@ EARTHING TERMINAL	PROVIDED	
	PLUG & SOCKET(9 PIN) (FOR COMM, LS/TS FEED BACK, PoT)	<input type="checkbox"/> REQUIRED <input checked="" type="checkbox"/> NOT REQUIRED <input type="checkbox"/> 2 NOS. <input type="checkbox"/> .....	
<b>CABLE GLANDS</b>	@ POWER CABLE GLAND	SIZE : TO BE FURNISHED LATER	
	@ SPACE HEATER CABLE GLAND	SIZE : TO BE FURNISHED LATER	
	OTHER CONTROL CABLE GLANDS	QUANTITY & SIZE : TWO (SIZE TO BE FURNISHED LATER)	
<b>SPACE HEATER</b>	@ SPACE HEATER	REQUIRED	
	@ POWER SUPPLY	240V AC SINGLE PHASE	
	@ RATING	BIDDER TO SPECIFY	
<b>WEIGHT</b>	TOTAL WEIGHT (ACTUATOR + ACCESSORIES)	BIDDER TO SPECIFY _____ Kg.	

- NOTES:**
- SCOPE: DESIGN, MANUFACTURE, INSPECTION, TESTING AND DELIVERY TO SITE OF ELECTRIC ACTUATOR FOR INCHING OR OPEN / CLOSE DUTY.
  - CODES & STANDARDS: DESIGN AND MATERIALS USED SHALL COMPLY WITH THE RELEVANT LATEST NATIONAL AND INTERNATIONAL STANDARD. AS A MINIMUM, THE FOLLOWING STANDARDS SHALL BE COMPLIED WITH: IS-9334, IS-2147, IS-2148, IS-325, IS-2959, IS-4691, IS-4722 AND IEC 34-1.
  - TEMPERATURE RISE SHALL BE RESTRICTED TO 70 DEG. C FOR AMBIENT TEMPERATURE OF 50 DEG C.
  - CABLE GLANDS OF DOUBLE COMPRESSION TYPE HEAVY DUTY BRASS MACHINE FINISHED & NICKEL CHROME PLATED CONFORMING TO BS:6121 SHALL BE PROVIDED.
  - THE MAKE OF THE MOTOR WILL BE AS PER APPROVED VENDOR LIST.
  - THE TORQUE SWITCHES SHALL BE PROVIDED WITH MECHANICAL LATCHING DEVICE TO PREVENT OPERATION WHEN UNSEATING FROM THE END POSITIONS. THE LATCHING DEVICE SHALL UNLATCH AS SOON AS THE VALVE LEAVES THE END POSITION. IF SUCH PROVISION IS NOT POSSIBLE, THE TORQUE SWITCHES SHALL BE BYPASSED BY END-POSITION LIMIT SWITCHES WHICH OPENS ON VALVE LEAVING END POSITION. THESE LIMIT SWITCHES ARE ADDITIONAL TO THE NUMBER OF LIMIT SWITCHES SPECIFIED ELSEWHERE.
  - THE MOTOR SHALL OPERATE SATISFACTORILY UNDER THE +/- 10% SUPPLY VOLTAGE VARIATION AT RATED FREQUENCY, -5% TO +5% VARIATION IN FREQUENCY AT RATED SUPPLY VOLTAGE, SIMULTANEOUS VARIATION IN VOLTAGE & FREQUENCY THE SUM OF ABSOLUTE PERCENTAGE NOT EXCEEDING 10%.
  - THE MOTOR SHALL BE SUITABLE FOR DIRECT ON LINE STARTING.

	<b>PREPARED BY</b>	<b>CHECKED BY</b>	<b>APPROVED BY</b>	<b>COMPANY SEAL</b>  NAME SIGNATURE DATE
<b>NAME</b>	KANISHKA TIWARI	SURESH SHARMA	DIPESH PALIT	
<b>SIGNATURE</b>				
<b>DATE</b>	03.10.2011	03.10.2011	03.10.2011	<b>DATE</b>

NOTES\* - TO BE FILLED BY MPL (LEAD AGENCY). @- TO BE FILLED BY ES

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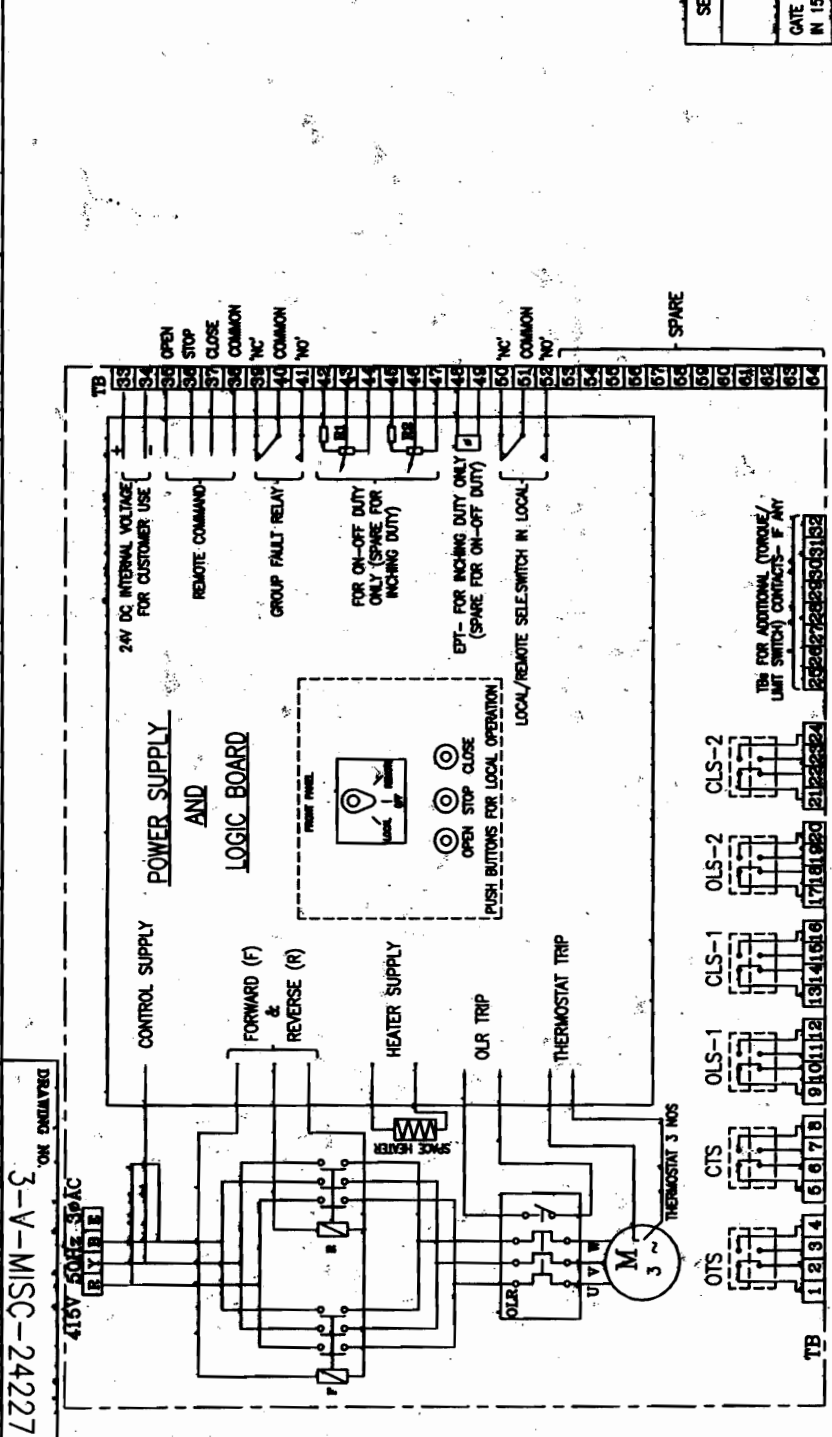
ALL DIMENSIONS ARE IN MILLIMETRES. FOR TOLERANCES OF UNTOLERANCED DIMENSIONS DURING MANUFACTURE REFER RELEVANT QCP / QP.

### CONTACT DEVELOPMENT DIAGRAM

OTS	1-2	OPEN AT OVER TORQUE DURING OPENING TRAVEL
	3-4	CLOSE AT OVER TORQUE DURING OPENING TRAVEL
CTS	5-6	OPEN AT OVER TORQUE DURING CLOSING TRAVEL
	7-8	CLOSE AT OVER TORQUE DURING CLOSING TRAVEL
OLS-1	9-10	STOP
	11-12	COMMON
CLS-1	13-14	COMMON
	15-16	'NC'
OLS-2	17-18	COMMON
	19-20	'NO'
CLS-2	21-22	COMMON
	23-24	'NC'
SWITCH	TERMINAL NO.	FULL OPEN
		INTERMEDIATE
		b
		FULL CLOSE

INDICATES CONTACT CLOSED  
INDICATES CONTACT OPEN

CONTACT RATING: 5A AT 250V AC & 0.5A AT 220V DC



### SETTING PROCEDURE OF POSITION LIMIT AND TORQUE SWITCH

VALVES	OPEN		CLOSE	
	MAIN	BACK UP	MAIN	BACK UP
GATE VALVE OF 100 mm AND ABOVE IN 1500 CL AND ABOVE RATINGS	OLS	OTS *	CLS	CTS
ALL OTHER GATE & GLOBE VALVES	OLS	OTS *	CLS	CTS
# - CLS NOT TO BE CONNECTED IN TRIP CIRCUIT				#
* - BYPASS OTS FOR INITIAL 5% OF TRAVEL (FOR GATE VALVES ONLY)				

TYPE OF PRODUCT ELECTRICAL VALVE ACTUATORS (AC) WITH INTEGRAL STARTERS  
(DRAWN FOR INTERMEDIATE POSITION OF VALVES)

OR NAME OF CUSTOMER/PROJECT

**BHARAT HEAVY ELECTRICALS LTD.**  
UNIT: HEAVY PRESSURE BOLTER PLANT,  
THERMOMAT ALL-INDIA

DEPT. VL. SCALE WEIGHT (KG.)

REV. DATE ALTERED CTD & APPD

CAUTION: The information on this document is the property of BHARAT HEAVY ELECTRICALS LTD. It must not be used directly or indirectly in any way detrimental to the interest of the company.

NAME	N.P.ESWAR	SEEN	N.P.	DATE	07.10.04
DESIGN	D.DINAKARAN	D.D.	D.D.	DATE	07.10.04
APPROVED	K.ARAMACHALAM	K.A.	K.A.	DATE	07.10.04

REFERENCE INFORMATION

CARD CODE	U 01
DRAWING NO.	3-V-MISC-24227
REV	0

- NOTE:-
1. ALL TORQUE AND LIMIT SWITCHES (OTS,CTS,OLS1&2, CLS1&2) ARE WITH 2NO+2NC CONTACTS '1NO+1NC' IS TERMINATED IN TBS 1-24, REMAINING CONTACTS ARE FOR INTERNAL USE. ANY SPARE CONTACTS WHICH ARE NOT USED INTERNALLY ARE TO BE TERMINATED IN TBS 25-32
  2. CTS - TORQUE SWITCHES FOR CW ROTATION (CLOSE)
  3. OTS - TORQUE SWITCHES FOR CCW ROTATION (OPEN)
  4. OLS-1, OLS-2 - LIMITSWITCHES FOR POSITION OPEN
  5. CLS-1, CLS-2 - LIMITSWITCHES FOR POSITION CLOSE
  6. EPT - ELECTRONIC POSITION TRANSMITTER (CONTACTLESS, LVDT TYPE, FOR INCHING DUTY)
  7. R1-R2-POTENTIOMETER 2 x 100 OHMS (FOR ON-OFF DUTY)
  8. FOR COMMANDS & EPT EITHER INTERNALLY GENERATED 24 VDC OR EXTERNAL SUPPLY OF 24VDC CAN BE USED
  9. M - MOTOR 3φ 415V 50 Hz AC SUPPLY

THIS WIRING DIAGRAM IS TYPICAL ONLY, REFER DATASHEET FOR DETAILS



**DATA SHEET FOR PRESSURE / DIFFERENTIAL PRESSURE TRANSMITTER**

SPECIFICATION NO.:	
VOLUME	
SECTION	
REV. NO.	DATE:
SHEET 1	OF 2

TAG No. .... Qty.....

Data Sheet No.: PES-145-01-DS1-0

**Data Sheet A & B**

DATA SHEET-A FOR PRESSURE / DIFFERENTIAL PRESSURE TRANSMITTER (TO BE FILLED BY PURCHASER)	DATA SHEET-B (TO BE FILLED-UP BY BIDDER)
--	---

<b>GENERAL</b>	MANUFACTURER	
	MODEL NUMBER	
<b>TECHNICAL</b>	TYPE (SMART TRANSMITTER-HART COMPATIBLE)	<input type="checkbox"/> INDUCTANCE <input type="checkbox"/> CAPACITANCE <input type="checkbox"/> STRAIN GAUGE
	POWER SUPPLY	24V DC
	TRANSMITTER MEASUREMENT	<input type="checkbox"/> PRESSURE <input checked="" type="checkbox"/> DIFF. PRESSURE
	OUTPUT SIGNAL	4-20 mA
	NO. OF WIRE	TWO
	ACCURACY	± 0.2% OF SPAN
	LINEARITY, HYSTERISIS AND DEAD BAND	± 0.1% OF SPAN
	REPEATABILITY	± 0.05% OF SPAN
	STABILITY	± 0.25 % OF SPAN OR BETTER FOR 6 MONTHS
	SENSITIVITY	± 0.05% OF SPAN
	<b>MATERIAL</b>	
	A) BODY	FORGED CARBON STEEL
	B) ELEMENT	316 SS L *(SS316 for Singrauli)
	C) SEAL	TEFLON
	CONTINUOUSLY ADJUSTABLE SPAN AND ZERO ADJUSTMENT PROVIDED	<input type="checkbox"/> YES <input type="checkbox"/> NO
	MOUNTING	<input type="checkbox"/> WALL/PIPE STAND <input checked="" type="checkbox"/> TRANSMITTER RACK
	ENCLOSURE	NEMA-4 X / IP-67
TURN DOWN RATIO	50:1	
INSULATION RESISTANCE	TO BE SPECIFIED BY BIDDER	
ZERO SUPPRESSION RANGE	TO BE SPECIFIED BY BIDDER	
ZERO ELEVATION RANGE	TO BE SPECIFIED BY BIDDER	

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**DATA SHEET FOR PRESSURE / DIFFERENTIAL PRESSURE TRANSMITTER**

SPECIFICATION NO.:	
VOLUME	
SECTION	
REV. NO.	DATE:
SHEET 2	OF 2

TAG No. .... Qty .....


Data Sheet No.: PES-145-01-DS1-0

**Data Sheet A & B**

DATA SHEET-A FOR PRESSURE / DIFFERENTIAL PRESSURE TRANSMITTER  
(TO BE FILLED BY PURCHASER)

DATA SHEET-B  
(TO BE FILLED-UP BY BIDDER)

INTEGRAL INDICATOR(LCD TYPE)	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO			
TRANSMITTER SHALL BE ABLE TO DRIVE OUTPUT IMPEDANCE OF 600 OHMS.	YES			
ZERO DRIFT	< 0.1%			
SPAN DRIFT	< 0.1%			
MANIFOLD				
DIFFERENTIAL PRESSURE MEASUREMENT	5 WAY			
CABLE ENTRY DETAIL	SUITABLE FOR DIA OF 17.5 mm			
NAME SIGNATURE DATE	PREPARED BY	CHECKED BY	APPROVED BY	COMPANY SEAL NAME SIGNATURE DATE

	<b>CHECK LIST FOR PRESSURE / DIFFERENTIAL PRESSURE TRANSMITTER (Mechanical Auxiliary Packages)</b>	SPECIFICATION NO.:	
		VOLUME	
		SECTION	
		REV. NO.	DATE:
		SHEET <u>3</u> OF <u>3</u>	
Data Sheet No.: PE-CL-999-145-1026-0			

SL NO	TESTS/CHECKS	QUANTM OF CHECK	REFERENCE DOC. ACCEPTANCE NORMS	AGENCY			REMARKS
				M	C	B	
1.0	CHECKS FOR VISUAL, MODEL TAG NO.	SEE NOTE-1 BELOW	APPROVED TECHINCAL REQUIREMENT/ DATA SHEET	P	W	V	MFR TO CARRY OUT ROUTINE TEST ON 100%. WHEN MATERIAL CORELATION ARE NOT AVAILABLE MFR'S COMPLIANCE TO BE PROVIDED
2.0	PROCESS CONNECTION	-do-		P	W	V	
3.0	ACCURACY	-do-		P	W	V	
4.0	REPEATEABILITY	-do-		P	W	V	
5.0	HYSTERISIS	-do-		P	W	V	
6.0	EFFECT OF TEMP VARIATION ON ACCURACY	-do-		P	W	V	
7.0	SPAN /ZERO ADJUSTMENT	ONE/TYPE		P	W	V	
8.0	EFFECT OF SUPPLY VOLTAGE VARIATION	ONE/TYPE		P	W	V	
9.0	HIGH PRESSURE TEST	SEE NOTE-1 BELOW		P	W	V	
10.0	BURN IN TEST	ONE/TYPE		P	W	V	
11.0	DEGREE OF PROTECTION	ONE/TYPE		P	W	V	

**LEGEND:**

M: MANUFACTURER/ SUB CONTRACTOR, C: CONTRACTOR/ NOMINATED INSP AGENCY, B: BHEL. P: PERFORM, W: WITNESS, V: VERIFICATION.

**NOTE:**

1. QUANTUM OF CHECK SHALL BE AS BELOW  
100 % - BY MANUFACTURER  
RANDOM FOR EACH TYPE - BY BHEL & CUSTOMER
2. MANUFACTURER TO MAINTAIN CALIBRATED INSTRUMENT HAVING BETTER ACCURACY THAN THE ITEM UNDER TEST. INSPECTING ENGINEER SHALL CHECK THE SAME.
3. IN CASE OF IMPORTED ITEMS CONTRACTORS SHALL REVIEW TC's AND NOT INSPECT.

CONTRACTOR TO PROVIDE COMPLIANCE CERTIFICATE FOR TESTS/CHECKS VERIFIED BY CONTRACTOR AND SUBMIT THE SAME ALONGWITH TEST CERTIFICATES TO BE VERIFIED BY BHEL.

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**DATA SHEET FOR  
PRESSURE / DIFFERENTIAL PRESSURE GAUGE**

SPECIFICATION NO.:	
VOLUME	
SECTION	
REV. NO.	DATE:
SHEET 1	OF 2

Data Sheet No.: PE-DC-999-145-1026-A

TECHNICAL REQUIREMENTS FOR PRESSURE / DIFFERENTIAL  
PRESSURE GAUGE

TO BE FILLED-UP /CONFIRMED  
BY BIDDER

(TO BE FILLED BY PURCHASER)

<b>=GENERAL</b>	MANUFACTURER	
	MODEL NUMBER	
<b>TECHNICAL</b>	SENSING ELEMENT	<input type="checkbox"/> BOURDON <input type="checkbox"/> DIAPHRAGM (BOURDON FOR HIGH PRESS AND DIAPHRAGM FOR LOW PRESS APPLICATION)
	MATERIAL	SENSING ELEMENT - AISI 316 L SS *(SS316 for Singrauli) MOVEMENT - AISI 304 L SS *(SS304 for Singrauli) CASING - <input type="checkbox"/> DIE CAST AL <input checked="" type="checkbox"/> SS
	ENCLOSURE	CLASS: <input type="checkbox"/> IP-55 <input checked="" type="checkbox"/> IP-65 <input type="checkbox"/> EXPL PROOF PAINT: <input type="checkbox"/> ENAMEL <input checked="" type="checkbox"/> EPOXY
	DIAL	SIZE: 150 MM COLOR: WHITE NUMERALS: BLACK SCALE: LINEAR, 270° ARC GRADUATED IN METRIC UNITS
	CASE	COLOUR: BLACK
	SPAN/ZERO ADJUSTMENT	INT. MICRO SCREW
	RANGE SELECTION	SHOULD COVER 125% OF OPERATING PARAMETER
	OVER RANGE PROTECTION	1.5 TIMES OF FSD
	BLOW OUT DISC	REQUIRED
	SWITCHING FACILITY (IF APPLICABLE) TYPE	NOT REQUIRED <input type="checkbox"/> MICRO SWITCH <input type="checkbox"/> OTHER
NO. / TYPE OF CONTACTS	2 NOS. SPDT	
CONTACT RATING	5A 230V AC, 0.25A 220V DC	
SETTING RANGE	FIELD ADJUSTABLE OVER FULL RANGE	
REPEATABILITY	± 1% OF FSR	
POWER SUPPLY	<input type="checkbox"/> 230V AC <input type="checkbox"/> 110V AC	
<b>PERFORMANCE</b>	ACCURACY	± 1% OF SPAN
<b>CONNECTION</b>	PROCESS	<input type="checkbox"/> M20 x 1.5 (M) <input type="checkbox"/> 1/2" NPT (M) <input checked="" type="checkbox"/> 1/2" NPT (F) <input type="checkbox"/> OTHER
	LOCATION	BOTTOM
<b>ACCESSORIES</b>	NAME PLATE / METAL TAG	SS
	OTHER	SIPHON FOR STEAM, 3-WAY MANIFOLD FOR PRESSURE GAUGE, 5-WAY MANIFOLD F OR DIFF PR GAUGE, SNUBBER FOR PUMP DISCHARGE, CHEMICAL SEAL DIAPHRAGM FOR CORROSSIVE, OIL SERVICES and SLURRY APPLICATION TO BE PROVIDED
<b>OTHER REQUIREMENT</b>	INSTRUMENT LIST	INSTRUMENT LIST COMPRISING OF TAG NO., SERVICE, DESIGN/OPERATING PRESSURE & TEMPERATURE TO BE ATTACHED
<b>QUALITY REQUIREMENT</b>	CHECK LIST FOR PG/DPG	REFER CHECK LIST NO PE-CL-999-145-1026-0

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**CHECK LIST FOR  
PRESSURE / DIFFERENTIAL PRESSURE GAUGE  
(Mechanical Auxiliary Packages)**

SPECIFICATION NO.:	
VOLUME	
SECTION	
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SHEET 2	OF 2


Data Sheet No.: PE-CL-999-145-1026-0

SL NO	TESTS/CHECKS	QUANTM OF CHECK	REFERENCE DOC. ACCEPTANCE NORMS	AGENCY			REMARKS
				P	W	V	
1.0	CHECK FOR		APPROVED TECHNICAL REQUIREMENT/ DATA SHEET				MFR TO CARRY OUT ROUTINE TEST ON 100%. WHEN MATL CORELATION ARE NOT AVAILABLE MFR'S COMPLIANCE TO BE PROVIDED
	1.1 DIAL SIZE	100%		M	C	C	
	1.2 MODEL NO/TAG NO	100%		M	C	C	
	1.3 RANGE/SCALE	100%		M	C	C	
	1.4 END CONNECTION	100%		M	C	C	
	1.5 SWITCH CONTACT RATING & NOS	100%		M	C	C	
2.0	CALIBRATION						
	2.1 ACCURACY	100%		M	C	B	
	2.2 REPEATABILITY (FOR SWITCH)	100%		M	C	B	
	2.3 SET POINT ADJUSTMENT FOR SWITCH	100%		M	C	C	
3.0	OVER PRESSURE & LEAK TEST	100%		M	C	C	
4.0	OPERATION OF PR. RELEIF DEVICE	ONE PER TYPE		M	C	C	
5.0	REVIEW OF T.C. FOR MATERIAL OF--						
	5.1 SENSOR	FOR LOT		-	-	B	
	5.2 MOVEMENT			-	-	B	
	5.3 PROCESS CONNECTION			-	-	B	
	5.4 HOUSING		-	-	B		
6.0	REVIEW OF T.C. FOR DEGREE OF PROTECTION	TYPE TEST	-	-	B		
7.0	REVIEW OF T.C. FOR CONTACT RATING OF SWITCH	ONE PER TYPE	-	-	B		
8.0	ACCESSORIES AS APPLICABLE	100%	M	C	C		

**LEGEND:**  
M: MANUFACTURER/ SUB CONTRACTOR, C: CONTRACTOR/ NOMINATED INSP AGENCY, B: BHEL. P: PERFORM, W: WITNESS, V: VERIFICATION.

**NOTE:**  
CONTRACTOR TO PROVIDE COMPLIANCE CERTIFICATE FOR TESTS/CHECKS VERIFIED BY CONTRACTOR AND SUBMIT THE SAME ALONGWITH TEST CERTIFICATES TO BE VERIFIED BY BHEL.

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	TITLE:	SPECIFICATION NO. PES-145-36
	<b>SPECIFICATION FOR PROGRAMMABLE LOGIC CONTROLLER SYSTEM</b>	VOLUME II-B
		SECTION D
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### 1. SCOPE

This specification covers the Design, Manufacture, Assembly, Inspection and Testing at manufacturer's works, proper packing and delivery to site, erection and commissioning of the PLC Control & Monitoring System comprising PLC Control panel/Remote I/O panel (housing Processors, I/O cards, power supply packs etc.), Operator workstations(OWS), Printers, Annunciation system, UPS, cables and all other equipments and accessories required for completeness of the system as mentioned in different sections of this specification.

### 2. GENERAL

- 2.1. The PLC shall perform protection logic, interlock and sequential control functions such as binary logic operation, set/reset operation, timers, counters, logic blocks, math functions, input quality checking engineering unit conversion, Boolean functions & PID control (Analog logic function).
- 2.2. The system shall be redundant in processor, power supply and communication interfaces unless otherwise specified. The system shall have self-diagnostic features. The control of all drives and equipment shall be effected through the keyboard/mouse / panel mounted push button / control switches as per Data sheets-A&B.
- 2.3. The system shall have facility for connecting to Main Plant's Distributed control system (DCS) using hardware / software interface for two-way transfer of signals.
- 2.4. The mimic shall be displayed on the OWS screen and may also be provided on the control desk/panel (as per Data sheets).
- 2.5. In case OWS is provided, HMI functions like Trends, Curves, Bar charts, Historical storage of Data, Logs and reports etc. shall be provided in addition to Plant-schematics. The necessary catalogue / literature elaborating the features of HMI shall be supplied along with the bid.
- 2.6. It shall be possible to use the same OWS as programming station.
- 2.7. The PLC system shall be sized to meet process/system requirements as per the approved P&IDs and Control write-up.
- 2.8. The PLC system shall be designed to ensure that no single device failure should result in failure of any other device.
- 2.9. Signal multiplication where required shall be done in PLC. Use of relays for multiplication of contacts (for control, monitoring and alarm) is not acceptable. The control/ monitoring components on the control panel/ desk shall be driven through I/O modules.


### 3. TECHNICAL REQUIREMENTS

Details of various PLC system components shall be inclusive of but not limited to the following:

#### 3.1. CODES AND STANDARDS

- 3.1.1. The equipment covered under this specification shall meet the requirements of latest edition of all applicable codes and standards like ANSI, NEMA, IEEE, IEC, NEC & IS.

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3.1.2. PLC shall conform to IEC: 1131

3.1.3. The offered PLC shall comply with safety standards as per Data sheet-A&B.

### 3.2. CONTROL PANEL

3.2.1. PLC control panel shall be freestanding type with provision for mimic display, push-button stations, control switches, indicating lamps, metering instruments like Indicators, ammeters etc. and facia windows for critical alarms.

3.2.2. The salient features of construction shall be:

Sheet material: Cold rolled sheet steel

Frame thickness: Not less than 3.0mm

Enclosure thickness: Not less than 2.0 mm for load bearing sections (mounted with instruments) and Not less than 1.6 mm for others

Gland plate thickness: 3.0mm

Base channel: ISMC 100 with anti-vibration mounting & foundation bolts.


3.2.3. Each panel shall be identified by a name plate, which shall be of non-rusting metal or three ply lamicold, with engraved lettering.

3.2.4. 25 x 6 mm Copper ground bus to be provided for each panel.

3.2.5. 240V AC single phase, thermostatically controlled space heaters shall be provided. Each free standing panel shall have a door switch operated fluorescent lamp and a 240V AC plug point.

3.2.6. Painting treatment shall be as per IS: 6005. Two coats of lead oxide primer shall be followed by powder coating. Paint shade shall be as specified in the "Data sheet for PLC system"-Data Sheet-A&B.

3.2.7. The annunciation system shall be facia window type, driven by the PLC. Audible alarm, Acknowledge, Reset and lamp test facility shall be provided as per ISA sequence - S18.1, M.

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3.3. PROCESSORS

3.3.1. The microprocessors shall be 32 bit, and Hot redundant.

3.3.2. Hot redundancy: PLC shall be provided with two processors (Main processing unit and memories) one for normal operation and one as hot standby. In case of failure of working processor, there shall be an appropriate alarm and simultaneously the hot standby processor shall take over the complete operation automatically. This transfer from main processor to standby processor shall be bump less and shall not cause any disturbance whatsoever. In the event of both processors failing, the system shall revert to fail safe mode. It shall be possible to keep any of the processor as master and other as standby.

3.3.3. An authorized forcing facility shall be provided for changing the status of inputs and outputs, timers and flags to facilitate fault finding and other testing requirements.

3.3.4. The standby processor shall be updated automatically in line with the changes made in the working processor.

3.3.5. In the event of any replacement of the processor, synchronization of the replaced processor shall be automatic upon live insertion.

3.3.6. The cycle time for input scanning, execution of logics, overheads and output scan shall not exceed 120 m sec.

3.3.7. The processor & memory shall be loaded up to 50% at normal conditions and maximum up to 60% under worst loading conditions.

3.3.8. The memories shall be field expandable.


3.4. INPUT / OUTPUT Modules

3.4.1. Input/output card assignments shall be modular i.e. no single card shall be assigned with more than one drive of a particular sub-system. The maximum number of channels per I/O module shall be as follows.

- Analog Input Module: 16
- Analog Output Module: 16
- Binary Input Module: 32
- Binary Output Module: 32
- Analog Input/output combined: 16
- Binary Input/output combined: 32

3.4.2. On line I/O replacement: All I/O cards shall have quick disconnect terminations allowing for card replacement without disconnection of external wiring and without switching off the power supply.

3.4.3. 10% spare capacity shall be ensured in each card channel assignment. Overall minimum 20% spare channels shall be provided.

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3.4.4. Output command to MCC/Switchgear shall be through coupling relays, whose mounting location shall be as per "Data sheet A & B for PLC System". In case coupling relays are located in PLC Panel, the same shall be in PLC vendor's scope of supply.

3.4.5. Status feedback from MCC shall be in the form of potential free contact.

### 3.5. DATA BUS/ I/O BUS

3.5.1. The Data bus connecting PLC and HMI work stations shall be TCP/IP on Ethernet.

3.5.2. The Data bus and I/O bus communication medium shall be twisted pair shield copper conductor for indoor locations and those areas not subjected to induced signals. Repeaters/signal amplifiers shall not be used. Copper conductor cable used shall be Category-5 or better. The communication medium shall be Fibre optic cable in the event any portion of communication cable run is in outdoor or where distances are beyond 500 meters.

### 3.6. OPERATOR WORK STATION (OWS)


3.6.1. The OWS and Keyboard shall be desktop mounted and shall be used for controlling, monitoring and programming function.

3.6.2. Colour CRT(s) with keyboard and mouse shall be as per Data Sheet-A&B. CRT shall have graphic display facility.

3.6.3. The OWS shall be with Windows based operating system having necessary Engineering/Configuring software.

### 3.7. PRINTER

Printers shall be provided as per Data Sheet-A&B.

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### 3.8. COMMUNICATION WITH PLANT DCS

- 3.8.1. The PLC system shall be provided with hardwired/serial interface for communication with plant DCS.
- 3.8.2. Serial communication to / from DCS where provided shall be engineered to ensure that signal communication time from / to DCS shall not exceed 1 seconds for control / feedback.
- 3.8.3. Serial communication to DCS shall be OPC (Data access 2.0), Ethernet based TCP/IP Protocol. Alternatively the serial communication shall be MODBUS protocol on RS 485 network.
- 3.8.4. Data transmitted from PLC to DCS shall include all information necessary for the DCS graphic displays to monitor and control the process equipment and PLC. Such data may include pertinent analog and digital status information, interlock, alarms and maintenance conditions. Data transmitted from DCS to the PLC shall include necessary signals to provide operator control interface from DCS for the process/equipment being controlled by PLC.
- 3.8.5. Bidder to include 'Light interface units, converters, Ethernet switch, accessories at PLC end for connectivity to other system. The bidder's terminal point shall be Ethernet port in case of copper medium connection to DCS or LIU in case of Fiber optic medium for connectivity with plant DCS. In case distance between PLC & DCS is greater than 1.8 Km, single mode of optical fiber cable with compatible accessories shall be used. For distance less than 1.8 Km multimode optical fiber ports shall be used.

### 3.9. POWER SUPPLY Scheme


- 3.9.1. PLC Panel and I/O Cabinets: PLC system shall be provided with 2x100% UPS fed from Two Nos. redundant 415V, 3-ph feeders, as per the scheme PE-SD-999-145-001, sh-08 of 08. Each UPS shall have 30 minutes back up. Input feeder failure shall be monitored in the PLC system. Necessary redundant power pack and transformers shall be provided (in the PLC panel) to derive the power supply for control desk, PLC panel and input / output cabinets etc
- 3.9.2. Remote I/O panels: Similar power supply arrangement as for PLC panels shall be provided if it is not possible to extend the power cable form UPS of PLC panels.
- 3.9.3. Each OWS and associated HMI peripherals shall be provided with a feeder from either one of the UPS

### 4. DRAWING/DOCUMENT AND DATA TO BE FURNISHED AFTER AWARD OF THE CONTRACT:

#### 4.1. For Approval:

- PLC system configuration drawing along with functional write-up.
- Input/Output signal list.
- BOM of PLC
- List of PLC controlled devices
- Control panel/control desk GA drawings.
- Control desk/panel component layout drawing.
- Control panel/control desk Foundation detail and cutout drawings
- Power distribution scheme

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- Block logic diagrams.
- Annunciation list.
- PLC control room layout drawing.
- List of soft signal exchange with Plant DCS.
- List of mandatory spares
- Quality plan
- Data Sheet-C
- CRT display
- Power supply scheme for PLC system, HMI & peripherals, Remote I/O etc.

#### 4.2. For Information:

- Cable schedule and cable interconnection drawing( in BHEL approved format)
  - Between Field and PLC
  - Between Field and MCC
  - Between MCC and PLC
- Electronic earthing requirements.
- Panel Heat dissipation data
- Product/component catalogues.
- Operation & Maintenance Manual on CDs.
- Softcopy of Final/As-built drawings on CDs.
- Calculation for Processor, Memory & Data bus loading


The above list is the minimum requirements. Additional documents/calculations required shall be finalized during contract stage.

#### 5. DRAWINGS AND DOCUMENTS TO BE SUBMITTED ALONG WITH THE BID

- Proposed PLC system configuration drawing with write-up
- Product catalogues and specifications for PLC as well as HMI application.
- Proposed power supply schemes for PLC system, peripherals, and Remote I/O panels.

#### 6. TESTING AND INSPECTION

- 6.1. The bidder shall adopt suitable quality assurance program to ensure that the equipments offered will meet the specification requirements in full.
- 6.2. BHEL's standard Quality Plan for PLC is enclosed with the specification. The bidder shall furnish his acceptance to BHEL's QP and submit the signed and stamped copy of QP along with the offer.
- 6.3. The complete PLC system, including all instrument and devices shall be subjected to standard factory tests (i.e. Type Tests and Routine Tests) as per relevant IS, NEMA, IEEE, IEC.
- 6.4. Factory Acceptance Test-FAT (Functional Tests) shall be performed prior to shipment and Owner/Purchaser shall be notified 15 days before the schedules dates of the test.
- 6.5. The certificates for following type tests, as per IEC Standard, shall be submitted: -
  - Surge protection test as per IEC-225-4
  - Dry heat test as per IEC-68-2-2
  - Damp Heat test as per IEC-68-2-3

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- Vibration Heat test as per IEC-68-2-6
- Electrostatic discharge test as per IEC-801-2 or equivalent
- Radio frequency Immunity test as per IEC-801-6 or equivalent
- Electromagnetic Immunity test as per IEC-801-3 or equivalent

**7. SPARES AND CONSUMABLES**

7.1. Commissioning Spares and consumables

The bidder shall supply all commissioning spares and consumables 'as required' during Start-up, as part of the main equipment supply.

7.2. Mandatory Spares

The bidder shall offer alongwith main offer, the Mandatory Spares as specified elsewhere in the specification. The Mandatory Spares offered shall be of the same make and type as the main equipment.

7.3. Recommended Spares

The bidder shall furnish a list of Recommended Spares indicating the normal service expectancy period and frequency of replacement; quantities recommended for 3 years operation alongwith unit rate against each item to enable BHEL/BHEL's Customer to place a separate order later, if required.

7.4. Special Tools & Tackles

The bidder shall supply all Special Tools & Tackles 'as required' during Start-up and further maintenance of the system, as part of the main equipment supply.

7.5. Spares, Service support

Bidder shall provide availability of spares and service support for minimum 10 years after guarantee period.

**8. MARKING AND PACKING**

8.1. Marking:


A stainless steel name-plate shall be permanently fixed on each equipment giving its Tag/serial Number and salient technical specification.

8.2. Packing:

All equipment/materials shall be suitably packed and protected for the entire period of dispatch, storage and erection against impact, abrasion, corrosion, incidental damage due to vermin, sunlight, high temperature, rain, moisture, humidity, dust, sea-water spray (where applicable) as well as rough handling and delays in transit and storage in open.

**9. PERFORMANCE AND GUARANTEE**

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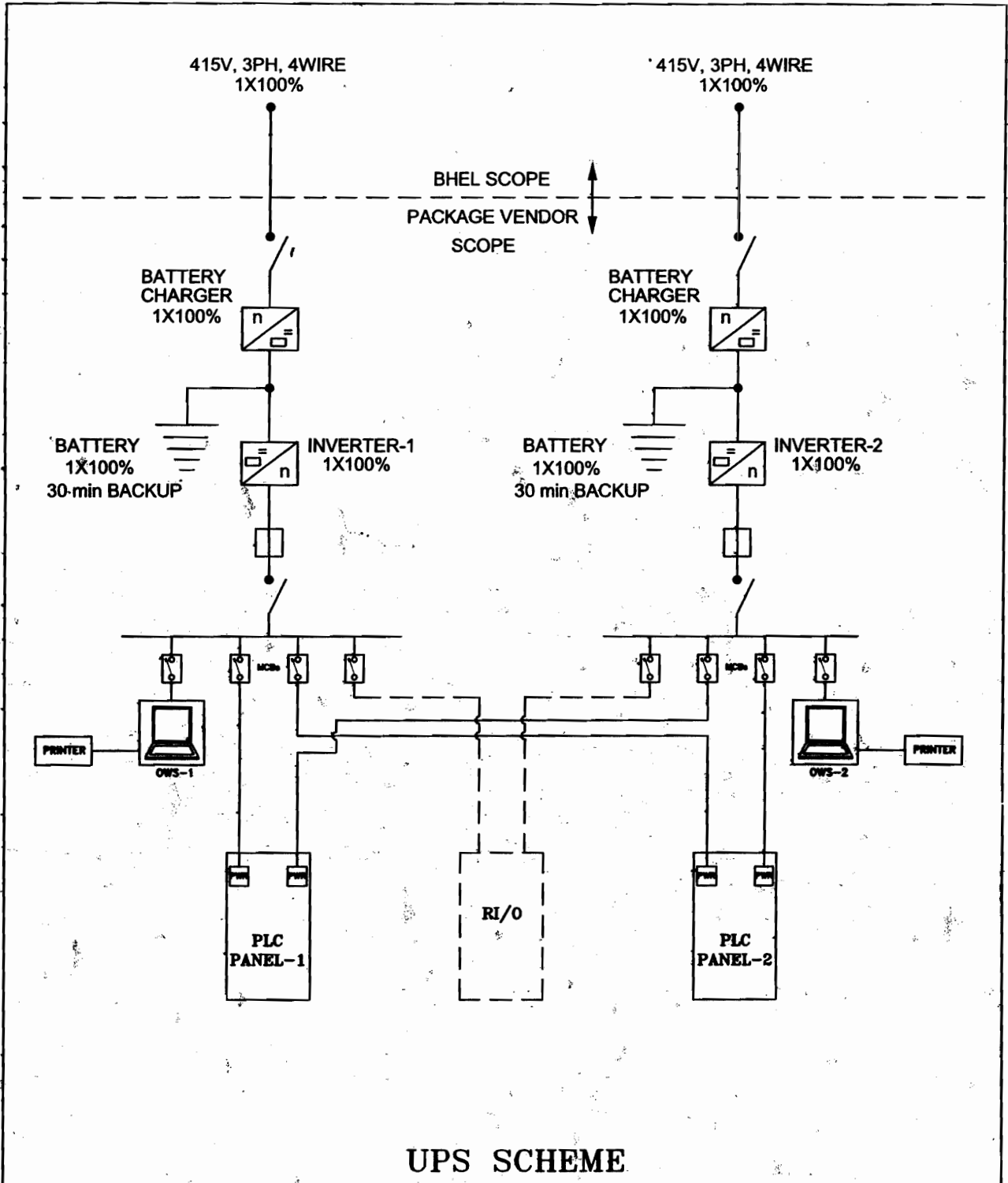
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The PLC system shall be guaranteed to meet the performance requirement as specified and also for trouble-free continuous operation for 12 months from the date of commissioning or 18 months from the date of delivery at site whichever is later unless specified otherwise in Vol-IIB Section - B or Section - C.

#### 10. APPLICABLE DATA SHEET FORMS


This document shall be read with the following data sheet forms :

- Data Sheet A & B for PLC system - PE-DC-999-145-I036-1
- Data Sheet C for PLC system PE-DC-999-145-I036-2




**UPS SCHEME**

**TYPICAL POWER SUPPLY ARRANGEMENT  
FOR PLC BASED CONTROL SYSTEM**

	<b>BHARAT HEAVY ELECTRICALS LTD</b> POWER SECTOR PROJECTS ENGINEERING MANAGEMENT NEW DELHI	DEPT CODE	NAME	SIGN	DATE
		I	DRN GA		26.08.07
			DSGN SSB		26.08.07
			CHD AK		26.08.07
			APPD AK		26.08.07
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 PEM :: C&I	<b>STANDARD QUALITY PLAN FOR PROGRAMMABLE LOGIC CONTROLLER</b>									
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Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency \$			Remarks
									P	W	V	
1.0	<b>Materials /Components</b>											
1.1	Panels & Control Desks Physical Inspection for Dimensions, Painting, Cutouts, Lifting / Locking Arrangements, Components, Drawing Pocket, Mounting accessories, Plinth & AV Pads, Cable Gland Plates, Hardwares, Hinges, Louvers & Filters, Fans & Panel Lamps	MA	Visual	100%	Contract specifications, Approved GA Drawings, BOQ	As per ref documents. No physical damage.	BHEL Quality Inspection Report.	3/2	2	1		
1.2	Power Supply/Packs, Battery & Battery charger, Transformer, UPS. Physical Inspection Physical Damages Dimensions Mounting Accessories	MA	Visual	100%	Contract specifications, BOQ.	As per reference documents, Test Report	BHEL Quality Inspection Report.	3/2	2	1		
1.3	Indicating Lamp, Annunciator, Meters, Transducers, Signal Converters, Instruments, Single Loop Controllers Physical Verification Physical Damages Dimensions Accessories	MA	Visual	100%	Contract specifications, BOQ.	As per ref documents No physical damage. Test/ Calibration report.	BHEL Quality Inspection Report	3/2	2	1		
1.4	PLC processors, I/O modules, Power Supply modules, Communication modules, Mounting Racks, Ethernet Physical Inspection • Identification Labels • Physical Damages • Quantity • Spare Capacity	MA	Visual	100%	Product Catalogue, Data sheets, Approved Configuration diagram, BOQ	As per ref documents. Test Certificates	BHEL Quality Inspection Report.	3/2	2	1		

LEGEND: \* CR - Critical characteristics  
 MA - Major characteristics  
 MI - Minor characteristics  
 P - Agency Performing the Test.  
 W - Agency Witnessing the Test.  
 V - Agency Verifying the Test.  
 1 - BHEL  
 2 - Vendor  
 3 - Sub-vendor

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Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency \$			Remarks
									P	W	V	
1.5	CPU, Monitor, Keyboard, Mouse, CD Drives, Printers, OS, System Software, Engineering software in the form of Licensed CD.	Physical Inspection Identification Labels, Tech. Specification Physical Damages Accessories Installation arrangements for Computers & Printers	MA	Visual	100%	Contract specifications, Product Catalogue, Approved GA / Configuration drawing, BOQ.	As per reference documents.	BHEL Quality Inspection Report.	3/2	2	1	

LEGEND: \* CR - Critical characteristics  
 MA - Major characteristics  
 MI - Minor characteristics

\$ P - Agency Performing the Test.  
 W - Agency Witnessing the Test.  
 V - Agency Verifying the Test.

1 - BHEL  
 2 - Vendor  
 3 - Sub-vendor

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Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records			Remarks	
								P	W	V		
<b>2.0</b>	<b>Assembly</b>											
2.1	Functional Test for HMI/OWS devices such as Monitors, Keyboards, Mouse, Printers etc.	Operation	MA	Functional	100%	Approved Configuration Diagram & BOQ and FAT	Correct Operation of interconnected Devices of HMI system.	BHEL Quality Inspection Report.	2	1	1	
2.2	Hardware Functional Verification.	Physical arrangement, Wiring check & labeling, Continuity Checking, IR & HV test	MA	Visual/Electrical	100%	Approved GA Drawing, Panel Wiring Diagram, IR & HV as per relevant International standard	Test Certification	BHEL Quality Inspection Report.	2	2	1	
2.3	Powering Up	Healthiness of all the modules/equipment, associated with Powering of PLC system	MA	Visual /Electrical	100%	Approved power supply scheme	All equipment to be healthy on power ON	BHEL Quality Inspection Report.	2	1	1	
2.4	Burn in test for PLC modules	Healthiness of PLC modules on, Continuous Energisation, Temperature maintenance	MA	Visual/Electrical	100%	FAT Procedure	Test certification as per FAT.	BHEL Quality Inspection Report.	2	2	1	

**LEGEND:** \* CR - Critical characteristics  
 MA - Major characteristics  
 MI - Minor characteristics

P - Agency Performing the Test.  
 W - Agency Witnessing the Test.  
 V - Agency Verifying the Test.

1 - BHEL  
 2 - Vendor  
 3 - Sub-vendor

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Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records			Remarks	
								P	W	V		
3.0	Factory Acceptance Test (FAT)											
3.1	Input Output Functional Verification	I/O configuration, I/O operation	MA	Visual/ Electrical	100%	FAT Procedure	AS per FAT	BHEL Quality Inspection Report.	2	1	1	
3.2	Processor Verification	Processor configuration, Powering up, standby operation (as applicable) and Loading	MA	Visual	100%	FAT Procedure	AS per FAT	BHEL Quality Inspection Report.	2	1	1	
3.3	Power Supply Module Verification	Redundancy Operation	MA	Electrical	100%	FAT Procedure	AS per FAT	BHEL Quality Inspection Report.	2	1	1	
3.4	Communication System Verification	Redundancy operation of Communication System, Measurement of Response Time, Communication with third party system	MA	Electrical	100%	FAT Procedure	AS per FAT	BHEL Quality Inspection Report.	2	1	1	
3.5	Diagnostic Verification	Self Diagnostic features of PLC system	MA	Visual	100%	FAT Procedure	AS per FAT	BHEL Quality Inspection Report.	2	1	1	
3.6	Control Panel/Desk Verification	Operation of PLC driven annunciation system, Mosaic, Push buttons & selector switches, Indicating lamps	MA	Visual	100%	FAT Procedure	AS per FAT	BHEL Quality Inspection Report.	2	1	1	
3.7	Software Verification	(i) Control Logics (ii) Engineering Features (iii) HMI Features	MA	Visual	100%	FAT Procedure	AS per FAT	BHEL Quality Inspection Report.	2	1	1	

LEGEND: \* CR - Critical characteristics  
 MA - Major characteristics  
 MI - Minor characteristics  
 P - Agency Performing the Test.  
 W - Agency Witnessing the Test.  
 V - Agency Verifying the Test.  
 1 - BHEL  
 2 - Vendor  
 3 - Sub-vendor

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**FACTORY ACCEPTANCE TEST (FAT) PROCEDURE**

This document covers procedure to conduct/witness PLC system functional tests in order to demonstrate conformity to purchase specifications and related engineering documents. The test shall be conducted at the system suppliers works. The system supplier shall conduct all functional tests before commencing FAT and test results shall be made available during FAT. Vendor must furnish following relevant drawings, duly approved by BHEL Engineering, for reference during FAT.

- a) Technical Specification of PLC.
- b) PLC System Configuration
- c) General Assembly Drawings.
- d) Panel Wiring Diagrams.
- e) Bill of Quantity for PLC System.
- f) Logic Diagram.
- g) HMI Schematics.
- h) Input / Output List.

Further the vendor shall furnish applicable product specification, datasheets, catalogues, test-certificates, and internal inspection records to enable FAT. Vendor shall also submit, to the inspecting agency, his standard test procedure, for clauses given below; where vendor's standard practice has been referred.

**APPLICABLE TEST PROCEDURE:**

**1. Input/Output Functional Verification.**

Check for correctness of addressing of racks, slots and I/O modules as per applicable PLC configuration diagram. Appropriate signal generators shall be used to simulate inputs and outputs to check operation and SCAN time. Check online replacement of cards, processors, power supply etc.

**2. Processor Verification**

PLC Configuration drawing to be referred for ascertaining

- i) Redundancy

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ii) Type (Hot or Cold)

Both the processors are to be checked for healthiness in case of redundant configuration as per vendor's standard practice. In case of hot redundancy, switchover of control from primary processor to standby processor shall be demonstrated for uninterrupted control and data processing as per vendor's standard practice. Switchover shall be witnessed, by manual power off or resetting the Primary CPU or simulating failure of primary processor. Checking should be by witnessing the lighting up of Processor's LEDs as per manufacturer's product standard.

Vendor shall demonstrate, as per Vendor's standard practice, adequate Loading (Spare Capacity) of Processors, as mentioned in contract specs. This shall be done, by simulating worst load operation of fully integrated PLC system.

**3. Power Supply Module Verification**

Check if PSM is in redundant mode as per specification. Check the healthiness of power supply from both the modules' lamp indication/measurement. Simulate failure of one PSM and verify that standby PSM has taken over without any interruption.

**4. Communication System Verification**

Communication system has to be in line with approved PLC Configuration Diagram. Verify that both the communication buses are intact and connected. Communication between PLC processors, I/O rack, OWS etc. is to be checked through simulation of input data. Simulate the bus failure by disconnection of working bus. Check that the communication continues without interruption or loss of data.

Following response times are to be demonstrated as per vendor's standard practice for conformance to contract specifications:

1. Screen update time
2. I/O scan time
3. SOE resolution time
4. Data transfer time with third party system using Communication Protocol as per Contract specification and as per quantum of data as per approved signal exchange list.

**5. Diagnostic Verification**

Product Catalogue/Literature shall be referred for checking of all diagnostic features. Hardware failure to be simulated by removing an I/O



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**6. Control Panel /Desk Verification**

- i) PLC driven annunciation system should be checked by alarm signal simulation.
- ii) Push Button and selector switch operation should be checked by verification of corresponding change of status of Data Base point.
- iii) Indicating lamp / MIMIC should be checked by corresponding Data Base point simulation.

**7. Software Verification**

- i). Control Logics:- Software switches, lamps and Analog sources shall be used for simulation of field conditions .Control logics shall be checked for its correct functionality as per approved logic schemes
- ii). Engineering features:-
  - a) Online changing of parameters, set points.
  - b) Online modification in Control Logic Diagrams.
  - c) Online configuration of Graphics, Trends, Logs, HSR.
- iii). HMI features:-  
Check for configuration & operation of Graphics, Trends, Logs, HSR and Alarms, in the form of Displays and Printouts, by simulation of Inputs as per approved documents.

**8. Burn in Elevated Temperature test**

Electronic equipments shall be subjected to Burn in elevated temperature test as per the procedure detailed below:

- a) (i) PLC modules are kept at 50 Deg c under continuous energized condition for 48 hours.

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ii) 48 hours test period shall be divided into 4 equal time segment of 12 hours duration each. For every 12 hours duration segment, after lapse of first 11 hours 110% of nominal voltage shall be applied to the panel under test for a period of 30 minutes followed by application of 90% of nominal voltage for the next 30 minutes.

b) Assembled Panels with complete wiring shall be kept under continuous energized condition for 120 hours at ambient temperature. Temperature rise in panels should be below 10 Deg C above ambient.