

**NATIONAL THERMAL POWER CORPORATION**  
**2X660 MW MAUDA STPP STAGE II**

**TECHNICAL SPECIFICATION  
OF  
MILL REJECT HANDLING SYSTEM**

**SPECIFICATION NO.: PE-TS-385-160-A001**



**BHARAT HEAVY ELECTRICALS LIMITED**  
**POWER SECTOR**  
**PROJECT ENGINEERING MANAGEMENT**  
**PPEI, NOIDA, INDIA**



TITLE:  
**TECHNICAL SPECIFICATION FOR  
MILL REJECT HANDLING SYSTEM**  
  
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DEPT: MAX

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**INDEX**  
**VOLUME-IIB**

<b>SECTION / ANNEXURE</b>	<b>DESCRIPTION</b>	<b>NO. OF SHEETS</b>
SECTION – A	INTENT OF SPECIFICATION	2
SECTION – B	PROJECT INFORMATION	16
SECTION – C1	SPECIFIC TECHNICAL REQUIREMENTS	13
ANNEXURE I	DATASHEET-A	1
ANNEXURE II	EQUIPMENT DESIGN/SELECTION CRITERIA	4
ANNEXURE III	MANUFACTURING QUALITY PLANS AND CUSTOMER INSPECTION REQUIREMENT <ul style="list-style-type: none"><li>• MILL REJECT SYSTEM</li><li>• LOCAL PANELS</li><li>• TRANSPORT VESSEL</li><li>• PYRITE HOPPER</li><li>• TERMINAL BOX</li><li>• BUNKER DISCHARGE GATE</li><li>• PRESSURE RELIEF VALVE</li><li>• AIR RECEIVER</li><li>• RUPTURE DISC</li><li>• CHAIN PULLEY BLOCK</li><li>• BAG FILTER</li><li>• MS ERW PIPES</li><li>• ACI BENDS</li><li>• KNIFE GATE VALVE</li><li>• COMPRESSOR</li><li>• SUMP PUMP</li><li>• EXPANSION BELLOW</li><li>• MS PLATES AND STRUCTURES</li></ul>	23
ANNEXURE IV	SUB-VENDOR LIST	3
ANNEXURE V	PAINTING SCHEDULE	2
ANNEXURE VI	LOW PRESSURE PIPING SPECIFICATION	26
ANNEXURE VII	SPARES	9
SECTION – C2	SPECIFIC TECHNICAL REQUIREMENTS FOR ELECTRICAL	75
SECTION – C3	SPECIFIC TECHNICAL REQUIREMENTS FOR CONTROL AND INSTRUMENTATION	70



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BHEL DOCUMENTS NO.:  
PE-TS-385-160-A001

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DEPT: MAX

REV. NO. 00

DATE:

<b>SECTION – D</b>	<b>STANDARD TECHNICAL REQUIREMENTS AIR RECEIVER</b>	<b>19</b>
	• CHAIN PULLEY BLOCK AND MONORAIL	
	• CONVEYING AIR COMPRESSOR	
	• CONVEYING VESSEL	
	• MILL REJECT BUNKER AND ACCESSORIES	
	• MILL REJECT DISCHARGE SPOUT AND PYRITE HOPPER	

### **VOLUME-III**

	<b>COMPLIANCE CUM CONFIRMATION CERTIFICATE</b>	<b>2</b>
	<b>SCHEDULES</b>	<b>2</b>
	<b>SUGGESTIVE PRICE FORMAT, DEVIATION SHEET AND GUARANTEED AUXILIARY POWER</b>	<b>6</b>
	<b>DRAWINGS/DOCUMENTS TO BE SUBMITTED WITH THE BID</b>	<b>1</b>
	<b>DRAWINGS/DOCUMENTS TO BE SUBMITTED AFTER AWARD OF CONTRACT ALONGWITH SCHEDULE OF SUBMISSION</b>	<b>3</b>
	<b>LIST OF BASIC DRAWINGS</b>	<b>1</b>

### **DRAWINGS**

	<b>FLOW DIAGRAM – MILL REJECT HANDLING SYSTEM</b>	<b>1</b>
	<b>MAIN EQUIPMENT PLAN</b>	<b>1</b>
	<b>GENERAL ARRANGEMENT OF BOWL MILL</b>	<b>1</b>
	<b>FOUNDATION PLAN OF MILL</b>	<b>1</b>
	<b>PIT AND TRENCH DETAILS FOR MILL REJECT SYSTEM</b>	<b>3</b>
	<b>T.G. EQUIPMENT LAYOUT PLAN (FOR CABLE ESTIMATION)</b>	<b>1</b>



TITLE:

**TECHNICAL SPECIFICATION FOR  
MILL REJECT HANDLING SYSTEM**

**2X660 MW MAUDA STPP STAGE II**

BHEL DOCUMENTS NO.: PE-TS-385-160-A001

VOLUME **II-B**

SECTION -A

REV. NO. 00


DATE:

Page

**VOLUME – II B**

**SECTION - A**

**INTENT OF SPECIFICATION**

	TITLE:	<b>TECHNICAL SPECIFICATION FOR MILL REJECT HANDLING SYSTEM</b>		BHEL DOCUMENTS NO.: PE-TS-385-160-A001
		<b>2X660 MW MAUDA STPP STAGE II</b>		VOLUME <b>II-B</b>
				SECTION -A
		REV. NO. 00		DATE:
		Page		

## INTENT OF SPECIFICATION

- 1.1** The specification is intended to cover design, engineering, manufacture, inspection and testing at vendor's/ sub-vendor's works, painting, forwarding, proper packing and shipment and delivery at site, unloading, handling & transportation at site, mandatory spares, E&C spares and special maintenance tools and tackles, Erection & Commissioning, minor civil works as required Performance and guarantee testing and handing over of **Mill Reject Handling System** as per details in different sections of this specification for **2x660MW MAUDA STPP STAGE-II**.
- 1.2** 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 standards of design, engineering and workmanship and shall be capable of performing the required duties in a manner acceptable to purchaser who will interpret the meaning of drawings and specifications and shall be entitled to reject any work or material which in his judgment is not in full accordance herewith.
- 1.3** The extent of work under the contract includes all items shown in the flow diagram, notwithstanding the fact that such items may have been omitted from the specification or schedules. Similarly extent of work also includes all items mentioned in the specification and/or schedules, notwithstanding the fact that such items may have been omitted in the drawing.
- 1.4** The general term and conditions, instructions to tendered and other attachment referred to elsewhere are made part of the tender specification. The equipment materials and works covered by this specification is subject to compliance to all attachments referred to in the specification. The bidder shall be responsible for and governed by all requirements stipulated herein.
- 1.5** While all efforts have been made to make the specification requirement complete & unambiguous, it shall be bidders' responsibility to ask for missing information, ensure completeness of specification, to bring out any contradictory requirement in different sections of the specification and within a section itself to the notice of BHEL and to seek any clarification on specification requirement in the format enclosed under Vol-III of the specification **within 10 days of receipt of tender documents**. In absence of any such clarifications, in case of any contradictory requirement, the more stringent requirement as per interpretation of Purchaser/Customer shall prevail and shall be complied by the bidder without any commercial implication on account of the same. Normally, in case of any contradiction in requirements between section-C and section-D, the requirements in Sec-C shall govern. Further in case of any missing information in the specification not brought out by the prospective bidders as part of pre-bid clarification, the same shall be furnished by Purchaser/ Customer as and when brought to their notice

	<b>TITLE:</b> <b>TECHNICAL SPECIFICATION FOR  MILL REJECT HANDLING SYSTEM</b>  <b>2X660 MW MAUDA STPP STAGE II</b>	BHEL DOCUMENTS NO.: PE-TS-385-160-A001	
		VOLUME <b>II-B</b>	
		SECTION -A	
		REV. NO. 00	DATE:
		Page	

either by the bidder or by purchaser/ customer themselves. However, such requirements shall be binding on the successful bidder without any commercial & delivery implication.

- 1.6** Deviations, if any, should be very clearly brought out clause by clause in the enclosed schedule; otherwise, it will be presumed that the vendor's offer is strictly in line with NIT specification.
- 1.7** In the event of any conflict between the requirements of two clauses of this specification documents or requirements of different codes and standards specified, the more stringent requirement as per the interpretation of the owner shall apply.



TITLE:  
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**2X660MW MAUDA STPP STAGE-II**

BHEL DOCUMENTS NO.: PE-TS-385-160-A001

VOLUME **II-B**

SECTION -B

REV. NO. 00


DATE:


Page


**VOLUME – II B**


**SECTION - B**

**PROJECT INFORMATION**

CLAUSE NO.	PROJECT INFORMATION			
1.00.00	<p><b>BACKGROUND</b></p> <p>Mouda STPP Stage-I comprising of two units of 500 MW each is presently under implementation. Now in view the huge power generation capacity requirement and future capacity addition plans, it is proposed to enhanced capacity of Mouda STPP. The present proposal is to install additional two units of 660 MW in Stage-II this making the ultimate capacity of the project to 2320 MW.</p>			
1.01.00	<p><b>LOCATION AND APPROACH</b></p> <p>The plant site is located in Mouda Tehsil, district Nagpur of Maharashtra Stage, having latitude and longitude of 20° 10'50" N and 79° 23'52" E respectively. The site is bounded by villages Kumbhari on North, Lapka &amp; Mouda on South, Koradi on East &amp; Rahli on West and is at a distance of about 4 Kms. From Mouda town and approachable from NH-6. Nearest railway station is Chacker 8 Kms away from site on Nagpur – Kolkata Broad Gauge (BG) section of South Eastern Railway (main line). The nearest commercial airport is at Nagpur located at a distance of approximately 42 Kms form the project site.</p> <p>Vicinity Plan is enclosed as <b>Annexure – I</b></p> <p>For further information apart from given in this sub-section and Bidders are also advised to visit the project site and collect data regarding local site conditions.</p>			
1.02.00	<p><b>LAND</b></p> <p>For Stage-I of Mouda project, about 1580 acres of land required for the project is acquired/under acquisition.</p> <p>About 125 acres of additional land for plant and 50 acres for Township required. The same has been identified contiguous to existing plant and township areas. The township is to be located in North West of the plant area and on Mouda – Ramtek road, 6 kms away from Mouda town. No major problem anticipated in acquisition as per site visit and discussions with State Govt. officials.</p> <p>About 550 acres of land is required for ash disposal. Alternatives suggested by Mouda site visited on 09.07.09 and the land near Kirmapur &amp; Kpra villages have been finalized. In principle land availability for Mouda Stage-II has been obtained from Office of the Collector, Nagpur vide letter ref. No. Desk-17/Resettlement/T-1/w.s. 323/09 dated 27.08.09.</p>			
1.03.00	<p><b>WATER</b></p> <p>Make up water requirement for Stage-II of this project would be about <b>4800 m<sup>3</sup>/hr.</b> Water requirement for the project will be met from pondage created on river Wain Ganga/ Kanhan by construction of dam near Gosikhurd by Govt. of Maharashtra. Make-up water shall be drawn from above mentioned source and shall be pumped to the raw water reservoir located about 24 Kms from intake well.</p> <p>Maharashtra Government has approved the reservation of 100 MCM water including the evaporation losses for NTPC in Goshikhurd Project for the ultimate stage of the project (Stage-I 2x500 MW) + Stage-II (2x660 MW). Ministry of Industries, Energy and Labour Department, Government of Maharashtra vide letter dated 10.12.2002 has given in principle consent for making available the required water for the Mouda project.</p>			
<p><b>MOUDA SUPER THERMAL POWER PROJECT STAGE-II (2X660 MW) STEAM GENERATOR PACKAGE</b></p>		<p><b>TECHNICAL SPECIFICATION SECTION-VI BID DOC. NO. : CS-9575/9571/0360/0370/9586-102-2</b></p>	<p><b>PART-A SUB SECTION-II PROJECT INFORMATION</b></p>	<p><b>PAGE 1 OF 17</b></p>

CLAUSE NO.	PROJECT INFORMATION			
1.04.00	<p><b>Railway Siding</b></p> <p>Employer intends to construct the railway siding to project site from the nearest existing railway line. However the same may not be available to the bidder for his use to transport equipment and material.</p> <p>Bidder may visit the site and acquaint themselves with the facilities available.</p>			
1.05.00	<p><b>COAL AVAILABILITY AND TRANSPORTATION</b></p> <p><b>Coal Availability</b></p> <p>Raw coal is proposed as fuel. The annual coal requirement would be about of 7.5 MTPA for 2X660 MW of Mouda STPP Stage-II.</p> <p>Likely coal source for the expansion project is similar to Mouda TPP Stage-I. The matter has been taken up with Ministry of Coal, Govt. of India for Long Term Coal Linkage.</p> <p><b>Coal Transportation</b></p> <p>Coal is proposed to be transported through Indian Railways network.</p>			
1.06.00	<p><b>Coal Quality Parameters / Fuel Oil Characteristics</b></p> <p>The coal quality parameters and Fuel oil Characteristics are attached at SUB-SECTION-V, PART-A.</p>			
1.07.00	<p><b>Capacity</b></p> <p>Stage-I : 2x500 MW Under Construction / Implementation</p> <p>Stage-II : 2x660 MW Present proposal</p>			
1.08.00	<p><b>Construction Power</b></p> <p>The requirements of the construction power supply for the project would be met from the existing 11 kV Miscellaneous Switchgear located near 132 KV switchyard. Necessary 11 kV ring main/LT sub-stations shall be provided for the required power plant area.</p>			
1.09.00	<p><b>Metrological Data</b></p> <p>The metrological data from nearest observatory is placed at <b>Annexure-II</b>.</p>			
1.10.00	<p><b>Plant Water Scheme</b></p> <p>The Plant water scheme is described below.</p>			
1.10.01	<p><b>Condenser Cooling (CW) Water System</b></p> <p>It is proposed to provide recirculating type CW system with induced draft type cooling towers. For the recirculating type CW system it is proposed to supply clarified water as make up. Raw water from the make-up water pump house shall be pumped to a Water Pretreatment Plant (PT - CW system). The treated clarified water shall be led to the cold water channel of CW system. CW system shall be operated at a C.O.C of about 4 . Chemical treatment programme (using acid dosing and scale cum corrosion inhibitors dosing) may be employed in addition to blow down of CW water to control the CW system chemistry in case CW system is required to be operated beyond 4COC. The expected circulating water analysis is</p>			
<p>MOUDA SUPER THERMAL POWER PROJECT STAGE-II (2X660 MW) STEAM GENERATOR PACKAGE</p>		<p>TECHNICAL SPECIFICATION SECTION-VI BID DOC. NO. : CS-9575/9571/0360/0370/9586-102-2</p>	<p>PART-A SUB SECTION-II PROJECT INFORMATION</p>	<p>PAGE 2 OF 17</p>

CLAUSE NO.	PROJECT INFORMATION				
<p>1.10.02</p> <p>1.10.03</p> <p>1.10.04</p> <p>1.10.05</p> <p>1.11.00</p>	<p>given in this sub-section <b>Annexure-III</b>. CW blow down shall be drawn from the discharge of CW pumps and the same shall be led to a Service water Tank. For carrying circulating water from CW pump house to TG-area and from TG area to cooling tower, steel lined concrete encased duct would be provided. For interconnecting CW duct with CW pump, condenser and cooling towers, steel pipes would be used. Cooled water from cooling tower will be led to CW pump house through the cold water channel by gravity.</p> <p><b>Equipment Cooling Water (ECW) System (Unit Auxiliaries)</b></p> <p>The plant auxiliaries of Steam Generator and Turbine Generator shall be cooled by Demineralized (DM) water in a closed circuit. The primary circuit DM water shall be cooled through plate type 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 cooling towers and shall be returned back to the system. It is proposed to provide independent primary cooling water circuit for Steam Generator &amp; auxiliaries and TG &amp; its auxiliaries.</p> <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 system, compressor of mill reject system etc. shall be cooled by separate cooling water System using separate set of pumps and cooling towers.</p> <p><b>Ash Water System</b></p> <p>Gland sealing are provided in necessary LP &amp; HP water pumps, flushing water pumps &amp; seal water pumps for slurry disposal pump .</p> <p><b>Other Miscellaneous Water Systems</b></p> <p>a) CW system blow down water shall be used for the plant service water requirement, dust suppression system of coal handling plant, ash slurry pumps sealing, sealing of Vacuum pumps (if applicable) of Ash Handling plant, make-up to fire water storage tanks and cooling water requirement of hydrogen generation plant. The service (wash water) water collected from various areas shall be treated using oil water separators, tube settlers, coal settling pits etc. as per requirement and treated water from liquid effluent treatment plant shall be recycled back to the service water system for re-use. The excess service water shall be led to central monitoring basin for disposal.</p> <p>b) Separate water Pre-treatment plants are proposed for Circulating Water (PT-CW) system, Demineralization Plant (PT-DM) plant.</p> <p>c) The drinking water requirement of the plant and colony shall be provided from the above mentioned Water (PT- CW) pretreatment plant.</p> <p>d) 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 Dematerializing plant.</p> <p>e) The quality of cooling water &amp; DM water is given in this sub-section as <b>Annexure-III &amp; IV</b> respectively.</p> <p><b>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 this sub-section as <b>Annexure-V</b>.</p>	<p>MOUDA SUPER THERMAL POWER PROJECT STAGE-II (2X660 MW) STEAM GENERATOR PACKAGE</p>	<p>TECHNICAL SPECIFICATION SECTION-VI BID DOC. NO. : CS-9575/9571/0360/0370/9586-102-2</p>	<p>PART-A SUB SECTION-II PROJECT INFORMATION</p>	<p>PAGE 3 OF 17</p>

CLAUSE NO.	PROJECT INFORMATION			
1.12.00	<p><b>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 as given in this sub-section as <b>Annexure-VI.</b></p>			
MOUDA SUPER THERMAL POWER PROJECT STAGE-II (2X660 MW) STEAM GENERATOR PACKAGE	TECHNICAL SPECIFICATION SECTION-VI BID DOC. NO. : CS-9575/9571/0360/0370/9586-102-2	PART-A SUB SECTION-II PROJECT INFORMATION	PAGE 4 OF 17	

CLAUSE NO.

PROJECT INFORMATION



Annexure-II

**जलवायवी सारणी**  
**CLIMATOLOGICAL TABLE**

1951 से 1980 तक के जलवायु पर आधारित  
BASED ON OBSERVATIONS FROM 1951 TO 1980

स्थान : नागपुर (सोनगाँव)      देशांतर      देशांतर      अक्षांश      देशांतर      देशांतर  
STATION : Nagpur(Sonegaon)      LAT 21°06' N      LONG 79°03' E      310 METRES      310 METRES

माह	वायु तापमान				वायु तापमान				वायु तापमान				वायु तापमान				वायु तापमान				वायु तापमान									
	दृष्क बल्ब	नम बल्ब	दैनिक अधिकतम	दैनिक न्यूनतम	दैनिक अधिकतम	दैनिक न्यूनतम	दैनिक अधिकतम	दैनिक न्यूनतम	दैनिक अधिकतम	दैनिक न्यूनतम	दैनिक अधिकतम	दैनिक न्यूनतम	दैनिक अधिकतम	दैनिक न्यूनतम	दैनिक अधिकतम	दैनिक न्यूनतम	दैनिक अधिकतम	दैनिक न्यूनतम	दैनिक अधिकतम	दैनिक न्यूनतम	दैनिक अधिकतम	दैनिक न्यूनतम	दैनिक अधिकतम	दैनिक न्यूनतम	दैनिक अधिकतम	दैनिक न्यूनतम	दैनिक अधिकतम	दैनिक न्यूनतम		
JAN	16.7	13.0	28.6	12.4	31.8	7.9	35.0	29	1900	3.9	07	63	12.1	2.0	0.5	10.2	1.0	105.2	0.0	60.3	107	8.6								
FEB	20.3	14.3	32.1	15.0	35.8	10.1	38.0	28	1950	5.0	12	49	11.7	1.7	0.5	12.3	1.1	157.0	0.0	51.6	195	7.9								
MAR	25.5	16.7	36.3	19.0	40.1	14.1	45.0	25	1852	6.3	04	30	12.0	1.7	0.5	17.6	1.5	194.2	0.0	45.0	26	8.5								
APR	31.0	19.9	40.2	23.9	43.4	19.2	46.1	30	139	13.9	01	34	14.4	2.3	0.6	13.2	1.4	129.0	0.0	59.4	19	9.6								
MAY	34.0	21.9	42.0	27.9	45.5	22.9	47.8	26	194	19.4	04	32	16.5	2.5	0.6	16.3	1.2	164.8	0.0	59.7	05	13.4								
JUN	39.0	23.8	37.0	26.3	43.5	22.3	47.2	10	200	20.0	18	61	24.5	5.3	2.0	172.2	9.0	500.6	0.3	315.0	12	14.1								
JUL	26.3	24.1	31.5	24.1	35.9	21.9	40.6	13	194	13	13	83	28.2	6.9	3.6	304.3	15.0	586.7	89.9	219.2	23	12.0								
AUG	25.7	23.0	30.4	23.6	33.9	21.9	37.8	25	183	18.3	20	92	27.9	9.9	3.9	231.8	14.4	595.1	47.0	215.4	04	11.1								
SEP	26.2	23.6	31.8	22.9	34.5	20.8	39.9	29	165	23	23	80	27.1	6.2	3.5	194.4	9.4	627.1	46.8	184.4	19	9.5								
OCT	25.1	20.9	32.6	19.8	34.9	15.0	38.3	08	11.8	25	25	67	21.4	3.0	1.8	51.4	2.8	266.5	0.0	164.6	30	7.6								
NOV	21.0	16.4	30.4	14.9	32.7	11.1	35.6	07	6.7	30	30	60	15.1	2.2	0.4	11.8	0.7	162.3	0.0	81.5	20	7.2								
DEC	17.1	13.5	28.2	12.1	31.0	8.1	33.9	25	5.5	29	29	64	12.6	1.9	0.7	17.2	0.8	165.7	0.0	61.0	05	6.4								
वर्षावकाल	24.9	19.3	33.5	20.2	45.5	7.1	47.8		3.9			60	18.6	3.5	1.3	1112.7	58.3	1931.4	364.7	315.0		9.5								
वर्षावकाल	30.8	21.2	30.8	21.2	30.8	21.2	30.8	21.2	30.8	21.2	30.8	21.2	30.8	21.2	30.8	21.2	30.8	21.2	30.8	21.2	30.8	21.2	30.8	21.2	30.8	21.2	30.8	21.2	30.8	21.2



## Annexure – III

## COOLING WATER ANALYSIS

Constituent	as	mg per litre
Calcium	CaCO <sub>3</sub>	407
Magnesium	CaCO <sub>3</sub>	250
Sodium & Potassium	CaCO <sub>3</sub>	175
Cations	CaCO <sub>3</sub>	832
Bicarbonates	CaCO <sub>3</sub>	516
Chloride	CaCO <sub>3</sub>	162
Sulphate	CaCO <sub>3</sub>	154
Anions	CaCO <sub>3</sub>	832
Silica	SiO <sub>2</sub>	50
Iron	Fe	< 0.8
pH Value	-	8.4
TSS	mg/l	< 25

**Note :** The C.W system is expected to operate at about 3.0 Cycles of Concentration.

CLAUSE NO.


PROJECT INFORMATION





Annexure – IV

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

S.No.	Characteristics		Value
i)	Silica (Max.)	-	0.02 ppm as SiO <sub>2</sub>
ii)	Iron as Fe	-	Nil
iii)	Total hardness	-	Nil
iv)	pH value	-	6.8 to 7.2
v)	Conductivity	-	Not more than 0.1 excluding the effects of free CO <sub>2</sub>

CLAUSE NO.	PROJECT INFORMATION																							
	<p style="text-align: right;"><b>Annexure - V</b></p> <p><b>CRITERIA FOR EARTHQUAKE RESISTANT DESIGN OF STRUCTURES AND EQUIPMENT</b></p> <p>All structures and equipment shall be designed for seismic forces adopting the site specific seismic information provided in this document and using the other provisions in accordance with IS:1893 (Part 1):2002 and IS:1893 (Part 4):2005. Pending finalisation of Parts 2, 3 and 5 of IS:1893, provisions of part 1 shall be read along with the relevant clauses of IS:1893:1984, for structures other than the buildings and industrial structures including stack-like structures.</p> <p>A site specific seismic study has been conducted for the project site. The peak ground horizontal acceleration for the project site, the site specific acceleration spectral coefficients (in units of gravity acceleration 'g') in the horizontal direction for the various damping values and the multiplying factor (to be used over the spectral coefficients) for evaluating the design acceleration spectra are as given at <b>APPENDIX-I</b>.</p> <p>Vertical acceleration spectral values shall be taken as 2/3rd of the corresponding horizontal values.</p> <p>The site specific design acceleration spectra shall be used in place of the response acceleration spectra, given at figure-2 in IS:1893 (Part 1) and Annex B of IS:1893 (Part 4). The site specific acceleration spectra along with multiplying factors specified in Annexure-I includes the effect of the seismic environment of the site, the importance factor related to the structures and the response reduction factor. Hence, the design spectra do not require any further consideration of the zone factor (Z), the importance factor (I) and response reduction factor (R) as used in the IS:1893 (Part 1 and Part 4).</p> <p><b>Damping in Structures</b></p> <p>The damping factor (as a percentage of critical damping) to be adopted shall not be more than as indicated below for:</p> <table border="0"> <tr> <td>a)</td> <td>Steel structures</td> <td>:</td> <td>2%</td> </tr> <tr> <td>b)</td> <td>Reinforced Concrete structures</td> <td>:</td> <td>5%</td> </tr> <tr> <td>c)</td> <td>Reinforced Concrete Stacks</td> <td>:</td> <td>3%</td> </tr> <tr> <td>d)</td> <td>ND Cooling Towers</td> <td>:</td> <td>2%</td> </tr> <tr> <td>e)</td> <td>Steel stacks</td> <td>:</td> <td>2%</td> </tr> </table>			a)	Steel structures	:	2%	b)	Reinforced Concrete structures	:	5%	c)	Reinforced Concrete Stacks	:	3%	d)	ND Cooling Towers	:	2%	e)	Steel stacks	:	2%	
a)	Steel structures	:	2%																					
b)	Reinforced Concrete structures	:	5%																					
c)	Reinforced Concrete Stacks	:	3%																					
d)	ND Cooling Towers	:	2%																					
e)	Steel stacks	:	2%																					
MOUDA SUPER THERMAL POWER PROJECT STAGE-II (2X660 MW) STEAM GENERATOR PACKAGE	TECHNICAL SPECIFICATION SECTION-VI BID DOC. NO. : CS-9575/9571/0360/0370/9586-102-2	PART-A SUB SECTION-II ANNEXURE-V	PAGE 10 OF 17																					

CLAUSE NO.	PROJECT INFORMATION			
	<p><b>Method of Analysis</b></p> <p>Since most structures in a power plant are irregular in shape and have irregular distribution of mass and stiffness, dynamic analysis for obtaining the design seismic forces shall be carried out using the response spectrum method. The number of vibration modes used in the analysis should be such that the sum total of modal masses of all modes considered is at least 90 percent of the total seismic mass and shall also meet requirements of IS:1893 (Part 1). Modal combination of the peak response quantities shall be performed as per Complete Quadratic Combination (CQC) method or by an acceptable alternative as per IS:1893 (Part 1).</p> <p>In general, seismic analysis shall be performed for the three orthogonal (two principal horizontal and one vertical) components of earthquake motion. The seismic response from the three components shall be combined as specified in IS:1893 (Part 1).</p> <p>For buildings, if the design base shear (<math>V_B</math>) obtained from modal combination is less than the base shear (<math>\bar{V}_B</math>) computed using the approximate fundamental period (<math>T_a</math>) given in IS:1893:Part 1 and using site specific acceleration spectra with appropriate multiplying factor, the response quantities (e.g. member forces, displacements, storey forces, storey shears and base reactions) shall be enhanced in the ratio of <math>\bar{V}_B / V_B</math>. However, no reduction is permitted if <math>\bar{V}_B</math> is less than <math>V_B</math>.</p> <p>For regular buildings less than 12m in height, design seismic base shear and its distribution to different floor levels along the height of the building may be carried out as specified under clause 7.5, 7.6 &amp; 7.7 of IS:1893 (Part 1) and using site specific design acceleration spectra. The design horizontal acceleration spectrum value (<math>A_h</math>) shall be computed for the fundamental natural period as per clause 7.6 of IS:1893 (Part 1) using site specific spectral acceleration coefficients with appropriate multiplying factor given in Annexure-I. Further, the spectral acceleration coefficient shall get restricted to the peak spectral value if the fundamental natural period of the building falls to the left of the peak in the spectral acceleration curve.</p> <p><b>Design/Detailing for Ductility for Structures</b></p> <p>The site specific design acceleration spectra is a reduced spectra and has an in-built allowance for ductility. Structures shall be engineered and detailed in accordance with relevant Indian/International standards to achieve ductility.</p>			
MOUDA SUPER THERMAL POWER PROJECT STAGE-II (2X660 MW) STEAM GENERATOR PACKAGE	TECHNICAL SPECIFICATION SECTION-VI BID DOC. NO. : CS-9575/9571/0360/0370/9586-102-2	PART-A SUB SECTION-II ANNEXURE-V	PAGE 11 OF 17	

CLAUSE NO.	PROJECT INFORMATION			
	<p style="text-align: center;"><b>APPENDIX – I</b></p> <p><b><u>SITE SPECIFIC SEISMIC PARAMETERS FOR DESIGN OF STRUCTURES AND EQUIPMENT</u></b></p> <p><b>The various site specific seismic parameters for the project site shall be as follows:</b></p> <ol style="list-style-type: none"> <li>1) Peak ground horizontal acceleration : 0.17g</li> <li>2) Multiplying factor to be applied to the site specific horizontal acceleration spectral coefficients (in units of gravity acceleration ‘g’) to obtain the design acceleration spectra               <ol style="list-style-type: none"> <li>a) for moment resisting steel frames designed and detailed as per IS:800 and moment resisting RC frames designed and detailed as per IS:456 : 0.057</li> <li>b) for braced steel frames designed and detailed as per IS:800 : 0.043</li> <li>c) for moment resisting RC frames designed and detailed as per IS:456 and IS:13920 : 0.034</li> <li>d) for design of structures not covered under 2 (a) to 2 (c) above and under 3 below : 0.057</li> </ol> </li> <li>3) Multiplying factor to be applied to the site specific horizontal acceleration spectral coefficients (in units of gravity acceleration ‘g’) for design of equipment and structures where inelastic action is not relevant or not permitted : 0.113</li> </ol> <p>Note: g = Acceleration due to gravity</p> <p>The horizontal seismic acceleration spectral coefficients are furnished in subsequent pages.</p>			
<b>MOUDA SUPER THERMAL POWER PROJECT STAGE-II (2X660 MW) STEAM GENERATOR PACKAGE</b>	<b>TECHNICAL SPECIFICATION SECTION-VI BID DOC. NO. : CS-9575/9571/0360/0370/9586-102-2</b>	<b>PART-A SUB SECTION-II ANNEXURE-V</b>	<b>PAGE 12 OF 17</b>	

CLAUSE NO.

PROJECT INFORMATION





APPENDIX – I(Contd.)


**HORIZONTAL SEISMIC ACCELERATION SPECTRAL COEFFICIENTS**


(In units of 'g')

Time Period (Sec)	Damping Factor (As a percentage of Critical Damping)							
	0.800	1.000	1.600	2.000	3.000	5.000	7.000	10.000
0.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
0.030	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
0.050	1.840	1.881	1.793	1.696	1.579	1.430	1.341	1.257
0.100	4.210	4.434	3.960	3.473	2.934	2.323	1.998	1.715
0.108	4.616	4.877	4.343	3.760	3.143	2.451	2.089	1.775
0.110	4.718	4.981	4.343	3.832	3.195	2.483	2.111	1.790
0.115	4.975	4.981	4.343	4.024	3.324	2.562	2.165	1.826
0.119	5.182	4.981	4.343	4.024	3.436	2.624	2.208	1.854
0.121	5.269	4.981	4.343	4.024	3.436	2.654	2.230	1.868
0.122	5.269	4.981	4.343	4.024	3.436	2.670	2.240	1.875
0.125	5.269	4.981	4.343	4.024	3.436	2.716	2.272	1.895
0.127	5.269	4.981	4.343	4.024	3.436	2.751	2.293	1.909
0.129	5.269	4.981	4.343	4.024	3.436	2.751	2.313	1.922
0.132	5.269	4.981	4.343	4.024	3.436	2.751	2.338	1.942
0.133	5.269	4.981	4.343	4.024	3.436	2.751	2.338	1.949
0.134	5.269	4.981	4.343	4.024	3.436	2.751	2.338	1.951
0.150	5.269	4.981	4.343	4.024	3.436	2.751	2.338	1.951
0.200	5.269	4.981	4.343	4.024	3.436	2.751	2.338	1.951
0.250	5.269	4.981	4.343	4.024	3.436	2.751	2.338	1.951
0.300	5.269	4.981	4.343	4.024	3.436	2.751	2.338	1.951
0.350	5.269	4.981	4.343	4.024	3.436	2.751	2.338	1.951
0.400	5.269	4.981	4.343	4.024	3.436	2.751	2.338	1.951
0.450	5.269	4.981	4.343	4.024	3.436	2.751	2.338	1.951
0.500	5.269	4.981	4.343	4.024	3.436	2.751	2.338	1.951
0.525	5.269	4.981	4.343	4.024	3.436	2.751	2.338	1.951
0.542	5.269	4.981	4.343	4.024	3.436	2.751	2.338	1.951
0.550	5.269	4.981	4.284	4.024	3.436	2.751	2.338	1.951
0.576	5.269	4.752	4.090	4.024	3.436	2.751	2.338	1.951
0.597	5.269	4.585	3.946	3.886	3.436	2.751	2.338	1.951
0.603	5.269	4.539	3.907	3.847	3.400	2.751	2.338	1.951
0.637	4.987	4.297	3.699	3.642	3.218	2.751	2.338	1.951
0.645	4.926	4.243	3.653	3.597	3.178	2.716	2.338	1.951
0.650	4.888	4.211	3.625	3.569	3.154	2.695	2.338	1.951
0.658	4.828	4.160	3.581	3.526	3.116	2.663	2.338	1.951
0.667	4.763	4.103	3.532	3.478	3.073	2.627	2.306	1.951
0.700	4.539	3.910	3.366	3.314	2.929	2.503	2.197	1.859
0.750	4.236	3.649	3.141	3.093	2.733	2.336	2.051	1.735
0.800	3.971	3.421	2.945	2.900	2.563	2.190	1.923	1.626
0.850	3.738	3.220	2.772	2.729	2.412	2.061	1.809	1.531
0.900	3.530	3.041	2.618	2.578	2.278	1.947	1.709	1.446
0.950	3.344	2.881	2.480	2.442	2.158	1.844	1.619	1.369

CLAUSE NO.	PROJECT INFORMATION								
<b>APPENDIX – I(Contd.)</b>									
<b><u>HORIZONTAL SEISMIC ACCELERATION SPECTRAL COEFFICIENTS</u></b>									
<b>(In units of 'g')</b>									
Time Period (Sec)	Damping Factor (As a percentage of Critical Damping)								
	0.800	1.000	1.600	2.000	3.000	5.000	7.000	10.000	
1.000	3.177	2.737	2.356	2.320	2.050	1.752	1.538	1.301	
1.050	3.026	2.607	2.244	2.210	1.952	1.669	1.465	1.239	
1.100	2.888	2.488	2.142	2.109	1.864	1.593	1.398	1.183	
1.150	2.763	2.380	2.049	2.017	1.783	1.523	1.337	1.131	
1.200	2.648	2.281	1.963	1.933	1.708	1.460	1.282	1.084	
1.250	2.542	2.190	1.885	1.856	1.640	1.402	1.230	1.041	
1.300	2.444	2.105	1.812	1.785	1.577	1.348	1.183	1.001	
1.350	2.353	2.027	1.745	1.719	1.519	1.298	1.139	0.964	
1.400	2.269	1.955	1.683	1.657	1.464	1.251	1.099	0.929	
1.450	2.191	1.888	1.625	1.600	1.414	1.208	1.061	0.897	
1.500	2.118	1.825	1.571	1.547	1.367	1.168	1.025	0.867	
1.550	2.050	1.766	1.520	1.497	1.323	1.130	0.992	0.839	
1.600	1.986	1.711	1.473	1.450	1.281	1.095	0.961	0.813	
1.650	1.925	1.659	1.428	1.406	1.242	1.062	0.932	0.788	
1.700	1.869	1.610	1.386	1.365	1.206	1.031	0.905	0.765	
1.750	1.815	1.564	1.346	1.326	1.171	1.001	0.879	0.743	
1.800	1.765	1.521	1.309	1.289	1.139	0.973	0.854	0.723	
1.850	1.717	1.479	1.274	1.254	1.108	0.947	0.831	0.703	
1.900	1.672	1.441	1.240	1.221	1.079	0.922	0.809	0.685	
1.950	1.629	1.404	1.208	1.190	1.051	0.898	0.789	0.667	
2.000	1.589	1.369	1.178	1.160	1.025	0.876	0.769	0.651	
2.050	1.550	1.335	1.149	1.132	1.000	0.855	0.750	0.635	
2.100	1.513	1.303	1.122	1.105	0.976	0.834	0.732	0.620	
2.150	1.478	1.273	1.096	1.079	0.953	0.815	0.715	0.605	
2.200	1.444	1.244	1.071	1.055	0.932	0.796	0.699	0.591	
2.250	1.412	1.216	1.047	1.031	0.911	0.779	0.684	0.578	
2.300	1.381	1.190	1.024	1.009	0.891	0.762	0.669	0.566	
2.350	1.352	1.165	1.003	0.987	0.872	0.746	0.654	0.554	
2.400	1.324	1.140	0.982	0.967	0.854	0.730	0.641	0.542	
2.450	1.297	1.117	0.962	0.947	0.837	0.715	0.628	0.531	
2.500	1.271	1.095	0.942	0.928	0.820	0.701	0.615	0.520	
2.550	1.246	1.073	0.924	0.910	0.804	0.687	0.603	0.510	
2.600	1.222	1.053	0.906	0.892	0.788	0.674	0.592	0.500	
2.650	1.199	1.033	0.889	0.875	0.774	0.661	0.580	0.491	
2.700	1.177	1.014	0.873	0.859	0.759	0.649	0.570	0.482	
2.750	1.155	0.995	0.857	0.844	0.745	0.637	0.559	0.473	
2.800	1.135	0.978	0.841	0.829	0.732	0.626	0.549	0.465	
2.850	1.115	0.960	0.827	0.814	0.719	0.615	0.540	0.456	
2.900	1.096	0.944	0.812	0.800	0.707	0.604	0.530	0.449	
2.950	1.077	0.928	0.799	0.786	0.695	0.594	0.521	0.441	
3.000	1.059	0.912	0.785	0.773	0.683	0.584	0.513	0.434	
3.050	1.042	0.897	0.772	0.761	0.672	0.574	0.504	0.427	

CLAUSE NO.	PROJECT INFORMATION								
<b>APPENDIX – I(Contd.)</b>									
<b><u>HORIZONTAL SEISMIC ACCELERATION SPECTRAL COEFFICIENTS</u></b> <b>(In units of 'g')</b>									
Time Period (Sec)	Damping Factor (As a percentage of Critical Damping)								
	0.800	1.000	1.600	2.000	3.000	5.000	7.000	10.000	
3.100	1.025	0.883	0.760	0.748	0.661	0.565	0.496	0.420	
3.150	1.009	0.869	0.748	0.737	0.651	0.556	0.488	0.413	
3.200	0.993	0.855	0.736	0.725	0.641	0.548	0.481	0.407	
3.250	0.978	0.842	0.725	0.714	0.631	0.539	0.473	0.400	
3.300	0.963	0.829	0.714	0.703	0.621	0.531	0.466	0.394	
3.350	0.948	0.817	0.703	0.693	0.612	0.523	0.459	0.388	
3.400	0.934	0.805	0.693	0.682	0.603	0.515	0.452	0.383	
3.450	0.921	0.793	0.683	0.672	0.594	0.508	0.446	0.377	
3.500	0.908	0.782	0.673	0.663	0.586	0.501	0.439	0.372	
3.550	0.895	0.771	0.664	0.654	0.577	0.494	0.433	0.366	
3.600	0.883	0.760	0.654	0.644	0.569	0.487	0.427	0.361	
3.650	0.870	0.750	0.645	0.636	0.562	0.480	0.421	0.356	
3.700	0.859	0.740	0.637	0.627	0.554	0.474	0.416	0.352	
3.750	0.847	0.730	0.628	0.619	0.547	0.467	0.410	0.347	
3.800	0.836	0.720	0.620	0.611	0.539	0.461	0.405	0.342	
3.850	0.825	0.711	0.612	0.603	0.532	0.455	0.399	0.338	
3.900	0.815	0.702	0.604	0.595	0.526	0.449	0.394	0.334	
3.950	0.804	0.693	0.596	0.587	0.519	0.444	0.389	0.329	
4.000	0.794	0.684	0.589	0.580	0.513	0.438	0.385	0.325	
MOUDA SUPER THERMAL POWER PROJECT STAGE-II (2X660 MW) STEAM GENERATOR PACKAGE	TECHNICAL SPECIFICATION SECTION-VI BID DOC. NO. : CS-9575/9571/0360/0370/9586-102-2				PART-A SUB SECTION-II ANNEXURE-V		PAGE 15 OF 17		

CLAUSE NO.	PROJECT INFORMATION											
	<p style="text-align: center;"><b>Annexure – VI</b></p> <p style="text-align: center;"><b>CRITERIA FOR WIND RESISTANT DESIGN OF STRUCTURES AND EQUIPMENT</b></p> <p>All structures shall be designed for wind forces in accordance with IS: 875 (Part-3) and as specified in this document. See APPENDIX – II for site specific information.</p> <p>Along wind forces shall generally be computed by the Peak (i.e. 3 second gust) Wind Speed method as defined in the standard.</p> <p>Along wind forces on slender and wind sensitive structures and structural elements shall also be computed, for dynamic effects, using the Gust Factor or Gust Effectiveness Factor Method as defined in the standard. The structures shall be designed for the higher of the forces obtained from Gust Factor method and the Peak Wind Speed method.</p> <p>Analysis for dynamic effects of wind must be undertaken for any structure which has a height to minimum lateral dimension ratio greater than “5” and/or if the fundamental frequency of the structure is less than 1 Hz.</p> <p>Susceptibility of structures to across-wind forces, galloping, flutter, ovalling etc. should be examined and designed/detailed accordingly following the recommendations of IS:875(Part-3) and other relevant Indian standards.</p> <p>It should be estimated if size and relative position of other structures are likely to enhance the wind loading on the structure under consideration. Enhancement factor, if necessary, shall suitably be estimated and applied to the wind loading to account for the interference effects.</p> <p><b>Damping in Structures</b></p> <p>The damping factor (as a percentage of critical damping) to be adopted shall not be more than as indicated below for:</p> <table border="0" style="width: 100%;"> <tr> <td style="width: 80%;">a) Welded steel structures</td> <td style="text-align: right;">: 1.0%</td> </tr> <tr> <td>b) Bolted steel structures</td> <td style="text-align: right;">: 2.0%</td> </tr> <tr> <td>c) Reinforced concrete structures</td> <td style="text-align: right;">:1.6%</td> </tr> <tr> <td>d) Steel stacks</td> <td style="text-align: right;">: As per IS:6533 &amp; CICIND Model Code whichever is more critical.</td> </tr> </table>				a) Welded steel structures	: 1.0%	b) Bolted steel structures	: 2.0%	c) Reinforced concrete structures	:1.6%	d) Steel stacks	: As per IS:6533 & CICIND Model Code whichever is more critical.
a) Welded steel structures	: 1.0%											
b) Bolted steel structures	: 2.0%											
c) Reinforced concrete structures	:1.6%											
d) Steel stacks	: As per IS:6533 & CICIND Model Code whichever is more critical.											
MOUDA SUPER THERMAL POWER PROJECT STAGE-II (2X660 MW) STEAM GENERATOR PACKAGE	TECHNICAL SPECIFICATION SECTION-VI BID DOC. NO. : CS-9575/9571/0360/0370/9586-102-2	PART-A SUB SECTION-II ANNEXURE-VI	PAGE 16 OF 17									

CLAUSE NO.	PROJECT INFORMATION			
	<p style="text-align: center;"><b>APPENDIX-II</b></p> <p><b>SITE SPECIFIC DESIGN PARAMETERS</b></p> <p>The various design parameters, as defined in IS: 875 (Part-3), to be adopted for the project site shall be as follows:</p> <p>a) The basic wind speed "<math>V_b</math>" at ten metres above the mean ground level : 44 meters/second</p> <p>b) The risk coefficient "<math>K_1</math>" : 1.07</p> <p>c) Category of terrain : Category-2</p> <p>Note: Notwithstanding the values of the above mentioned parameters, the design wind pressure so computed at any point shall not be taken less than 1500 N/Sq. metre for all classes of structures, i.e. A, B &amp; C, as defined in IS: 875 (Part-3).</p>			
MOUDA SUPER THERMAL POWER PROJECT STAGE-II (2X660 MW) STEAM GENERATOR PACKAGE	TECHNICAL SPECIFICATION SECTION-VI BID DOC. NO. : CS-9575/9571/0360/0370/9586-102-2	PART-A SUB SECTION-II ANNEXURE-VI	PAGE 17 OF 17	



TITLE:  
**TECHNICAL SPECIFICATION FOR  
MILL REJECT HANDLING SYSTEM**  
  
**2X660MW MAUDA STPP STAGE-II**

BHEL DOCUMENTS NO.: PE-TS-385-160-A001

VOLUME **II-B**

SECTION -C

REV. NO. 00

DATE:

Page

**VOLUME – II B**

**SECTION – C**

**SPECIFIC TECHNICAL REQUIREMENTS**



TITLE:  
**TECHNICAL SPECIFICATION FOR  
MILL REJECT HANDLING SYSTEM**  
  
**2X660MW MAUDA STPP STAGE-II**

BHEL DOCUMENTS NO.: PE-TS-385-160-A001

VOLUME **II-B**

SECTION -C

REV. NO. 00

DATE:

Page

## 1.0 SCOPE OF WORK FOR 2X600MW MAUDA STPP STAGE-II

Design, engineering, manufacture, inspection and testing at vendor's/ sub-vendor's works, painting, forwarding, proper packing, shipment and delivery at site, unloading, handling & transportation at site, Erection & Commissioning, minor civil works as required, performance and guarantee testing and handing over of Mill Reject Handling System as per details in different sections of this specification.

Detailed system write-up & control philosophy shall be furnished by the successful bidder during detail engineering & the same shall be subject to customer approval during detail engineering.

## 1.1 SCOPE OF SUPPLY

Scope of supply shall comprise of but not necessarily limited to the following:

- a) 18 nos. of pneumatic Cylinder operated plate/ knife gate valve (200 Nb) with open and close limit switches at mill outlet/pyrite hopper inlet.
- b) 18 nos. of pyrite hoppers complete with sizing grid, flexible/expansion joint at its inlet, rupture disc, by pass chute, oversize material chute, water spray nozzles & supporting structures.
- c) 36 nos. (2 Nos. per pyrite hopper) of Level probes for pyrite hoppers.
- d) 18 nos. of Temperature Switches for pyrite hoppers.
- e) 18 nos. of pneumatically operated plate/knife gate valve (200 Nb) at pyrite hopper outlet for pyrite hopper isolation with open and close limit switches for interlock.
- f) 18 nos. of pneumatically operated plate/knife gate valve (200 Nb) at oversize discharge chute of pyrite hopper provided with open & close limit switches for interlock with pyrite hopper inlet knife gate valve.
- g) 18 nos. of pneumatically operated plate/knife gate valve (200 Nb) at by pass chute of pyrite hopper provided with open & close limit switches for interlock with pyrite hopper inlet knife gate valve.
- h) 18 nos. of transporter vessel /denseveyor complete with pneumatically operated dome/ material handling valve, Alloy CI outlet bend, local control panel etc.
- i) 18 sets of MS ERW Heavy grade pipe for mill reject conveying from denseveyor/ transporter vessel to Mill Reject Storage bunker.
- j) One lot of Alloy CI bends (400BHN).
- k) 4 sets of terminal boxes (Two set per unit) with up stand on bunker top for terminating the reject conveying pipes.
- l) Two (2) nos. mill reject bunker along with structure, with 3mm thick SS-304 lining on straight portion & conical portion and lever operated bunker discharge gate with canvas chute at bunker outlet , operating & maintenance platform, hand railing , bag filter, level probe(RF type level Probe), pressure relieve valve, chain pulley block with traveling trolley and monorail arrangement etc.



TITLE:  
**TECHNICAL SPECIFICATION FOR  
MILL REJECT HANDLING SYSTEM**  
  
**2X660MW MAUDA STPP STAGE-II**

BHEL DOCUMENTS NO.: PE-TS-385-160-A001

VOLUME **II-B**

SECTION -C

REV. NO. 00

DATE:

Page

- m) 2 nos. (1W+1S) non lubricated reciprocating type skid-mounted air compressor with drive motor, local control panel, instruments and all other accessories.
- n) Four nos. air receivers (i.e. two no. per unit) complete with drain traps, safety relief valve, instruments and all accessories.
- o) 4 Nos. fixed type sump pump complete with suction (min 5 m long) & discharge hose (min 10 m long) for pumping out water drains from local pit to nearest plant drain, control panel, instruments and all other accessories.
- p) 1 lot of piping , fittings, valves & instruments for conveying air, instrument air, cooling water for dome valve top plate (if applicable), cooling water quenching in the pyrite hopper, cooling water for air compressor etc
- q) 1 lot of Local Control Panel/pneumatic panels/JBs (1 no. for each pyrite hopper) properly mounted on rack. (supplier's scope)
- r) 1 lot of insulation & cladding, if required, to maintain surface temperature of pyrite hopper within 60° C
- s) All structures including pipe cum cable rack required for supporting of various pipes in bidder's scope. Bidder may take support from existing mill bunker bay structures wherever possible.
- t) All insert plates, embedment plates, foundation bolts/ anchor bolts etc. required for bidder's equipment.
- u) Initial charge of all lubricants and fluids.
- v) Electrical and C&I scope as per enclosure elsewhere in the specification.
- w) One set of Erection & commissioning spares as required for the complete system.
- x) One set of special maintenance tools & tackles, if any. These tools shall not be used for erection/ commissioning purposes and shall be in an unused and new condition when they are handed over to the customer at site. Each tool shall be stamped so as to be identified easily for its use. The tools shall be supplied in a steel toolbox.
- y) All counter- flanges with nuts, bolts and gaskets at all the terminal points.
- z) Relevant scope of supply as per GTR, GCC & SCC.
- aa) Any other instrument, item required for making the installation complete in all respect within battery limits and for satisfactory operation of the system, unless specifically EXCLUDED from scope under Clause No. 2.0 below.
- bb) DCS based control system as specified in C&I specification.

## 1.2 SCOPE OF SERVICES

Scope of services shall include but not necessarily limited to the following:

- a) Unloading, Storage, handling and transportation at site
- b) Minor civil work like pinning, chipping of foundation, grouting supply of EPs/ insert plates etc.
- c) Pre-Commissioning work such as flushing, hydraulic testing etc. Necessary instrumentation for pre-commissioning activities shall be arranged by the successful bidder at their own cost.



TITLE:  
**TECHNICAL SPECIFICATION FOR  
MILL REJECT HANDLING SYSTEM**  
  
**2X660MW MAUDA STPP STAGE-II**

BHEL DOCUMENTS NO.: PE-TS-385-160-A001

VOLUME **II-B**

SECTION -C

REV. NO. 00

DATE:

Page

- d) Erection & Commissioning of Mill Reject Handling System.
- e) Inspection & testing, PG test/Functional Guarantee (FG) test
- f) Painting of all equipment within the battery limit
- g) Electrical scope of services as per enclosure elsewhere in the specification
- h) Preparation of Civil input drawings & documents for foundation details (including load data, GA, foundation pocket details etc.) of storage bunkers/silos, compressors, air receivers, pipe rack and pit / trench details for denseveyor / transporter vessel and reject conveying pipes.
- i) Review of Civil drawings prepared by BHEL based on civil input drawing furnished by the successful bidder.
- j) Preparation of all necessary drawings/data/ documents for obtaining necessary approval of statutory authorities on behalf of the customer. Necessary fee for obtaining such approval shall also be borne by the bidder.
- k) Relevant scope of services as per GTR, GCC, ECC & SCC.
- l) Any other service required for making the installation complete in all respect within battery limits and for satisfactory erection & commissioning of the system, unless specifically EXCLUDED from scope under Clause .No. 2.0 below.

## 2.0 EXCLUSION

- a) Civil work for Mill Reject Handling system including
  - i) Road approach for various facilities related to Mill Reject Handling System.
  - ii) Denseveyor/ Transporter vessel foundation
  - iii) Pit & Trench as required in mill bay
  - iv) Mill Reject compressor & Air receiver foundation
  - v) Mill Reject bunker foundation
  - vi) Various cable trenches, pipe pedestals & pipe rack foundation.

However, location, sizing and loads and any other input related to above as applicable for above shall be given by the successful bidder within 8 weeks of placement of LOI.

- b) Fire Protection system for compressor house
- c) Lighting of Mill bay, Compressor house & bunker area
- d) Electrical exclusion as per Electrical scope sheet enclosed elsewhere in the specification
- e) Relevant exclusion as per GTR, GCC, SCC & ECC.

## 3.0 SERVICES TO BE PROVIDED BY THE CUSTOMER

- (A) Instrument air: Tapping terminated with an isolation valve for Instrument air shall be provided at first column of each bunker bay at pressure of 5-7 Kg/Sq cm.



TITLE:  
**TECHNICAL SPECIFICATION FOR  
MILL REJECT HANDLING SYSTEM**  
  
**2X660MW MAUDA STPP STAGE-II**

BHEL DOCUMENTS NO.: PE-TS-385-160-A001

VOLUME **II-B**

SECTION -C

REV. NO. 00

DATE:

Page

- (B) Service water: Tapping terminated with an isolation valve for service water shall be provided at first column of each boiler unit at pressure of 2.5-3 Kg/Sq cm.
- (C) Auxiliary Cooling Water: Supply and return water Tapping terminated with an isolation valve for ECW circuit. Equipment water shall be provided at 36°C at 5m from compressor at a pressure of 5 Kg/sq cm (Approx). Pressure drop will be of 20 MWC and temperature of hot water shall be limited to 43°C.

#### 4.0 TERMINAL POINT

- Mill Reject inlet towards pyrite hopper side : Mill reject spout (tramp iron) as per details indicated in enclosed GA of Mills. Work downstream up to mill reject bunker outlet with canvas chute and discharge gate is by bidder.
- Mill Reject outlet towards road tanker : Mill reject bunker outlet with canvas chute. Bidder shall terminate his work with the canvas chute and lever operated discharge gate.
- Cooling water (ECW) : At Inlet & Outlet header at distance of 5m from MRS compressor house (Location)
- Service Water : At First Col of each boiler unit
- Instrument Air : At First Col of each mill bay.

#### 5.0 PERFORMANCE /FUNCTIONAL GUARANTEES & LIQUIDATED DAMAGES

**PG /FG test shall comprise of**

**Category – I Guarantees (Liquidated damages are applicable for these guarantees).**

- i) Guaranteed auxiliary power consumption for conveying air compressor(refer schedule-Vol III)

If the contractor is not able to demonstrate the guarantees, CLIENT/ BHEL will have the right to Reject the equipment / system / plant and recover the payments already made or accept the equipment / system after levying liquidated damages.

- ii) Continuous effective discharge and conveying at the rated capacity of the mill rejects without spillage or blockage in the system.
- iii) Following shall be demonstrated at site for compressor
- Capacity and discharge pressure of each air compressor
  - Power consumption of each air compressor at its rated duty point with its own motor.

**Category – III Guarantees**



TITLE:  
**TECHNICAL SPECIFICATION FOR  
MILL REJECT HANDLING SYSTEM**  
  
**2X660MW MAUDA STPP STAGE-II**

BHEL DOCUMENTS NO.: PE-TS-385-160-A001

VOLUME **II-B**

SECTION -C

REV. NO. 00

DATE:

Page

- I. Guarantees of all equipment as per approved data sheet & quality plan.
- II. Particulate emission rate from bag filters less than 50 mg/nm<sup>3</sup> of air shall be demonstrated at site
- III. Vibration and noise level of each compressor and any other rotating equipment shall be demonstrated at site.
- IV. Parallel operation of air compressors, if applicable, shall be demonstrated at site.

All the plant, equipment and systems covered under this specification shall perform continuously without exceeding the noise level over the entire range of output and operating frequency.

Noise level measurement shall be carried out using applicable and internationally acceptable standards. The measurement shall be carried out with a calibrated integrating sound level meter meeting the requirement of IEC 651 or BS 5969 or IS 9779.

Sound pressure shall be measured all around the equipment at a distance of 1.0m horizontally from the nearest surface of any equipment/machine and at a height of 1.5m above the floor level in elevation.

A minimum of 6 points around each equipment shall be covered for measurement. Additional measurement points shall be considered based on the applicable standards and the size of the equipment. The measurement shall be done with slow response on the A - weighting scale. The average of A-weighted sound pressure level measurements expressed in decibels to a reference of 0.0002 micro bar, shall not exceed the guaranteed value. Corrections for background noise shall be considered in line with the applicable standards. All the necessary data for determining these corrections, in line with the applicable standards, shall be collected during the tests.

In case during test it is found that the equipment/system has failed to meet the guarantees, the contractor shall carry out all necessary modifications and/or replacements to make the equipment/system comply with the guaranteed requirements at no extra cost to the Employer. However, if the contractor is not able to demonstrate the guarantees, even after the above modifications/replacements within a reasonable period allowed by CLIENT/BHEL, after the tests have been completed, CLIENT/BHEL will have the right to Reject the equipment / system / plant and recover the payments already made or accept the equipment / system after assessing the deficiency in respect of the various ratings, performance parameters and capabilities and recover from the contract price an amount equivalent to the damages as determined by Client/BHEL.

## **6.0 ERECTION, PRE-OPERATIONAL TESTING/STARTUP & COMMISSIONING PROCEDURE**

This shall be as furnished by the successful bidder during detail engineering for customer's review and acceptance.



TITLE:  
**TECHNICAL SPECIFICATION FOR  
MILL REJECT HANDLING SYSTEM**  
  
**2X660MW MAUDA STPP STAGE-II**

BHEL DOCUMENTS NO.: PE-TS-385-160-A001

VOLUME **II-B**

SECTION -C

REV. NO. 00

DATE:

Page

## 7.0 PAINTING/CORROSION PROTECTION REQUIREMENT

Successful bidder shall furnish detailed Painting Schedule for Mill Reject System (based on painting schedule attached with specification elsewhere) for customer / client approval during detail engineering.

## 8.0 LAYOUT REQUIREMENTS

Piping and equipment installation shall be according to the regulations and recommendations of recognized Indian / International Standards, Codes and Statutes, as and where applicable, practice in vogue (to be supported with back up document to the satisfaction of customer).

The mill reject compressors will be located in Main Plant Compressor room. Area required for locating the same shall be indicated by the bidder in their bid.

## 9.0 EQUIPMENT DESIGN CRITERIA

**9.0.1** The minimum design criteria to be followed for various equipment shall be as per requirements indicated under Annexure-II, standard technical specifications & Data Sheet-A for Mill Reject Handling System. In case of *any contradictory requirement* in specification of particular equipment, the requirement given in section C shall prevail over those indicated in Section-D. Further in case of any contradictory requirement within the same section and clarifications not having been sought by the bidders wrt the same within the stipulated period, the most stringent requirement as per interpretation of the customer will prevail. Successful bidder will furnish detailed data sheets/ specifications/design calculations for various equipment for customer/consultant's approval during detail engineering. All comments made by customer/consultant shall be incorporated by the successful bidder without any commercial and delivery implication.

**9.0.2** Technical details (constructional features, MOC etc) of non-lubricated reciprocating conveying air compressor, if being offered by any of the bidders, shall be finalized during detail engineering and the same shall be subject to customer's /client's acceptance without any commercial implication.

**9.0.3** Properties of Mill Rejects to be considered for sizing /selection /design of various equipments shall be as follows:

Normal size	:	(-) 25 mm (about 90% of total reject)
Maximum size	:	(-) 40 mm (about 10% of total reject)
Temperature °C (Normal/Design)	:	180/200 (**)
Bulk density	:	1.6 T/m <sup>3</sup> for volumetric calculation
	:	2.4 T/m <sup>3</sup> for structural calculation

(\*\*) Note: Mill Reject System design shall also consider the presence of occasional burning coal particles along with the rejects, which would increase the reject temperature.

Note: All pipe sizing and equipment sizing, capacity of pyrite hopper and pyrite vessel shall be subject to customer's approval during detail engineering without any cost implication to the customer.



TITLE:  
**TECHNICAL SPECIFICATION FOR  
MILL REJECT HANDLING SYSTEM**  
  
**2X660MW MAUDA STPP STAGE-II**

BHEL DOCUMENTS NO.: PE-TS-385-160-A001

VOLUME **II-B**

SECTION -C

REV. NO. 00

DATE:

Page

### 10.0 QUALITY PLANS, INSPECTION & TESTING PROCEDURE

All QPs / CLs shall be submitted by the bidder for Customer/Consultant's review and approval. All comments made by customer/ consultant shall be incorporated by the successful bidder without any commercial and delivery implication.

### 11.0 DRAWINGS/ DOCUMENTS REQUIRED WITH THE BID

The drawings and documents to be submitted with the bid shall strictly be as per clause 15.0.1 below. Any documents other than those indicated therein will not be reviewed and will not form part of contract.

### 12.0 DRAWINGS/ DOCUMENTS REQUIRED DURING DETAIL ENGINEERING

The tentative list of drawings and documents required during detail engineering shall be minimum as per clause 15.0.2 below. The list, however, will be finalized with the successful bidder prior to start of detail engineering.

### 13.0 DRAWING/DOCUMENT DISTRIBUTION SCHEDULE

Bidder to note that the successful bidder, during detail engineering, will submit the drg/doc through web based Document Management System. Bidder would be provided access to the DMS for drg/doc approval and adequate training for the same. Detailed methodology would be finalized during the kick-off meeting. Bidder to ensure following at their end:

- Internet explorer version – Minimum Internet Explorer 7
- Internet speed – 2 mbps (Minimum preferred)
- Pop ups from our external DMS IP (124.124.36.198) should not be blocked
- Vendor's Internal proxy setting should not block DMS application's link (<http://124.124.36.198/wrenchwebaccess/login.aspx>)”
- DMS user manuals to be used by BHEL PEM vendors for uploading, viewing, revising, commenting and tracking documents on PEM's DMS have been uploaded on PEM internet website (www.bhelpem.com ) under the Vendor session.
- For quick access bidder may refer the link <http://bhelpem.com/DMSManuals/DMSManuals.html>

For final distribution of O&M manual, 12 print sets and 3 CDs are required.

Also refer Volume III – Annexure VI.

### 14.0 DRAWINGS ENCLOSED WITH THE SPECIFICATION

The following drawings/ sketches enclosed will form part of the specification.

- a) Flow Diagram - Mill Reject Handling System
- b) Main Equipment Plan



TITLE:  
**TECHNICAL SPECIFICATION FOR  
MILL REJECT HANDLING SYSTEM**  
  
**2X660MW MAUDA STPP STAGE-II**

BHEL DOCUMENTS NO.: PE-TS-385-160-A001

VOLUME **II-B**

SECTION -C

REV. NO. 00

DATE:

Page

- c) General Arrangement and Foundation of HP 1103 MILL (with planetary gear box)
- d) Pit and Trench details for Mill Reject System

The flow diagram shows the minimum requirement to be followed including minimum requirement of instruments. Any additional equipment/instruments required for safe, efficient & reliable operation of the system within the battery limit shall also be considered as included in bidder's scope without any commercial/ cost implication to BHEL.

#### **15.0.1 LIST OF DRAWINGS / DOCUMENTS TO BE FURNISHED ALONG WITH OFFER**

Refer Volume III – Annexure V

#### **15.0.2 LIST OF DRAWING/DOCUMENTS TO BE FURNISHED AFTER PLACEMENT OF LOI**

Refer Volume III – Annexure VI

#### **16.0 SPECIFIC C&I REQUIREMENT**

- 16.0.1 The bidder will terminate all signals from instruments/sensors on each pyrite hopper/ transporter vessel on local control panel/ pneumatic panel dedicated to each pyrite hopper/ transporter vessel. Analogues & binary signals shall be terminated on separate Terminal boxes for wiring to SG C&I. Alternatively bidder may provide JBs for each pyrite hopper/denseveyor. In such case, separate JBs shall be provided for terminating analogue & binary signals.
- 16.0.2 The bidder will terminate all signals from local & field instruments /sensors related to compressor on compressor control panel. Analogues & binary signals shall be terminated on separate terminal boxes for wiring to SG C&I. Alternatively bidder may provide JBs properly mounted on rack and local to the compressor for terminating field & local signals from compressor control panel. In such case, separate JBs shall be provided for terminating analogue & binary signals.
- 16.0.3 Signals from mill reject bunker, air receivers, service water & instrument air line shall be directly connected to SG C&I.



**SUB-SECTION - III-A4**

**MILL REJECT HANDLING SYSTEM**

**MOUDA SUPER THERMAL POWER PROJECT  
STAGE-II (2x660 MW)  
STEAM GENERATOR PACKAGE**

**TECHNICAL SPECIFICATION  
SECTION-VI  
BID DOCUMENT NO. : CS-9575 9571 0370 0360 9586-102-2**

CLAUSE NO.	SCOPE OF SUPPLY SERVICES <span style="float: right; background-color: black; color: black;">[REDACTED]</span>		
<p>1.00.00</p> <p>1.01.00</p>	<p><b>MILL REJECT HANDLING SYSTEM</b></p> <p>To handle the Mill Rejects on a continuous basis, the Bidder shall provide a Mill Reject Handling System. The Mill Reject Handling System shall comprise of a pneumatic conveying system. The Rejects shall be stored in storage silo. From the storage silo the Mill Rejects shall be disposed off in trucks.</p> <p>The scope of supply for mill reject handling system shall include but not limited to the following:</p> <ul style="list-style-type: none"> <li>(a.) One (1) no. pyrite hopper with discharge chute, emergency chute work etc. for each mill as required.</li> <li>(b.) Two (2) nos. pneumatically operated isolation gates for inlet and outlet of pyrite hoppers complete with compressed air pipe work, solenoid valves &amp; supporting arrangement for each pyrite hopper.</li> <li>(c.) Conveying pipe work from individual mill reject handling equipment to the reject storage silos with all accessories such as bends, fixtures, flange joints, structural steel supports, anchors/inserts trestles, walkways etc. as required.</li> <li>(d.) Mill reject storage silos (2 nos.), one (1) no. for each unit in steel construction each having an effective storage capacity of sixteen (16) hrs. considering all the working mills of the unit in operation and rejecting <input type="checkbox"/> of 1% of mill capacity for the worst coal conditions. Necessary supporting steel structure, platforms, staircase, manual operated unloading gate, 3 mm thick SS plate liners covering straight length portion and conical portion of mill reject storage hoppers (bunkers), level switches, air relief devices, etc. shall also be provided.</li> </ul> <p>The storage silos shall be designed to provide a clear access of 4.5 m for a Road Tanker/Trucks to come under the silo &amp; receive the rejects using suitable chute work.</p> <ul style="list-style-type: none"> <li>(e.) Suitable spray quenching system, to cool the mill reject in pyrite hoppers.</li> <li>(f.) 4 nos. air receivers (two (2) nos. air receivers per unit) of adequate capacity with all accessories, Interconnecting piping, support etc.</li> <li>(g.) Two nos. (1 no. operation + 1 no. stand by) air compressors (with drives and accessories) to cater the compressed air requirements of mill reject handling system for two (2) units working simultaneously. Compressors shall be located in the main compressor house.</li> <li>(h.) Necessary lifting devices of adequate capacity to handle the mill reject handling equipment.</li> <li>(i.) Complete control &amp; instrumentation as specified in C&amp;I section.</li> <li>(j.) Necessary electrical equipment as specified.</li> <li>(k.) Civil structural works associated with mill reject handling system including foundation bolts, pockets, grouting and underpinning etc.</li> </ul>		
<p>MOUDA SUPER THERMAL POWER PROJECT STAGE-II (2X660 MW) STEAM GENERATOR PACKAGE</p>	<p>TECHNICAL SPECIFICATION SECTION-VI BID DOC. NO. : CS-9575 9571 0360 0370 9586-102-2</p>	<p>PART-A SUB SECTION-III: A4 MILL REJECT HANDLING SYSTEM</p>	<p>PAGE 1 OF 1</p>



# **SUB-SECTION-II:M4**

## **MILL REJECT HANDLING SYSTEM**

**MOUDA STPP-II (2x660MW) SOLAPUR STPP (2 x 660MW)  
NABINAGAR STPP (3x 660MW) MEJA TPP-I (2 x 660MW)  
RAGHUNATHPUR TPP PHASE-II (2 x660MW)  
STEAM GENERATOR PACKAGE**

**TECHNICAL SPECIFICATION  
SECTION-VI  
BID DOC NO.: CS-9575 9571 0370 0360 9586-102-2**

CLAUSE NO.	TECHNICAL REQUIREMENTS																																				
<p>1.00.00</p> <p>2.00.00</p>	<p style="text-align: center;"><b>MILL REJECT HANDLING SYSTEM</b></p> <p><b>MILL REJECT HANDLING SYSTEM</b></p> <p>Dense phase pneumatic conveying system shall to be employed for handling of the mill rejects. Each mill reject discharge hopper shall be fitted with a positive pressure pneumatic conveying vessel which shall discharge the mill rejects through pipe lines in storage 'SILO'. Each unit shall be provided with an independent 'SILO' having a collection capacity of 16 hours. The transmitting vessel shall operate on level probe mode with timer back-up.</p> <p>100% standby capacity compressor shall be provided by the bidder. The capacity of the compressors shall be selected considering all the working mills of all units operating simultaneously for the worst coal condition.</p> <p><b>MILL REJECT HANDLING SYSTEM OF PNEUMATIC TYPE MEETING THE FOLLOWING REQUIRMENT SHALL BE PROVIDED.</b></p> <table border="1"> <thead> <tr> <th>Sl.No.</th> <th>System Parameter</th> <th>Pneumatic Handling System</th> </tr> </thead> <tbody> <tr> <td>1.</td> <td>Duty</td> <td>Continuous</td> </tr> <tr> <td>2.</td> <td>Number of mill reject storage bins and capacity</td> <td>(a) One (1) no. for each unit (b) 16 hours storage capacity considering all the working mills of the unit for worst coal condition</td> </tr> <tr> <td>3.</td> <td>Number of mills working per boiler</td> <td>As specified by Boiler/ Mill manufacturer</td> </tr> <tr> <td>4.</td> <td>Design value of 1% of the mill capacity for the worst coal rejects</td> <td>condition.</td> </tr> <tr> <td>5.</td> <td>Maximum temp. of rejects</td> <td>As specified by boiler/ mill manufacturer.</td> </tr> <tr> <td>6.</td> <td>Maximum size of mill reject to be handled</td> <td>(-) 40 mm *</td> </tr> <tr> <td>7.</td> <td>Bulk density of mill rejects for volumetric computation</td> <td>1600 kg/m<sup>3</sup></td> </tr> <tr> <td>8.</td> <td>Bulk density of mill rejects for LOADS/ STRENGTH Computation</td> <td>2400 kg/m<sup>3</sup></td> </tr> <tr> <td>9.</td> <td>Inlet/outlet** valves of mill reject discharge hopper</td> <td>Pneumatically operated knife edge gate valve.</td> </tr> <tr> <td>10.</td> <td>Inlet valve of the vessel</td> <td>Plate valve/dome valve/butterfly valve/cone valve.</td> </tr> <tr> <td>11.</td> <td>Sizing grid</td> <td>40 mm x 40 mm</td> </tr> </tbody> </table>	Sl.No.	System Parameter	Pneumatic Handling System	1.	Duty	Continuous	2.	Number of mill reject storage bins and capacity	(a) One (1) no. for each unit (b) 16 hours storage capacity considering all the working mills of the unit for worst coal condition	3.	Number of mills working per boiler	As specified by Boiler/ Mill manufacturer	4.	Design value of 1% of the mill capacity for the worst coal rejects	condition.	5.	Maximum temp. of rejects	As specified by boiler/ mill manufacturer.	6.	Maximum size of mill reject to be handled	(-) 40 mm *	7.	Bulk density of mill rejects for volumetric computation	1600 kg/m <sup>3</sup>	8.	Bulk density of mill rejects for LOADS/ STRENGTH Computation	2400 kg/m <sup>3</sup>	9.	Inlet/outlet** valves of mill reject discharge hopper	Pneumatically operated knife edge gate valve.	10.	Inlet valve of the vessel	Plate valve/dome valve/butterfly valve/cone valve.	11.	Sizing grid	40 mm x 40 mm
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<p>MOUDA STPP-II (2x660MW) SOLAPUR STPP (2 x 660MW) NABINAGAR STPP (3x 660MW) MEJA TPP-I (2 x 660MW) RAGHUNATHPUR TPP PHASE-II (2 x660MW) STEAM GENERATOR PACKAGE</p>	<p>TECHNICAL SPECIFICATION SECTION-VI          BID DOC NO.: CS-9575 9571 0370 0360 9586-102-2</p>	<p>PART-B          SUB-SECTION-II:M4          MILL REJECT HANDLING SYSTEM</p>	<p>PAGE 1 OF 2</p>																																		

CLAUSE NO.	TECHNICAL REQUIREMENTS		
	12. Emergency ** discharge chute with manually operated knife edge gate valves	Yes	
	13. Piping	MS IS:3589	
	14. Bends/Fittings Laterals	Alloy CI to hardness 400 BHN	
	* In case the bidder expects higher size from pyrite hopper outlet then suitable capacity crusher shall be provided to bring down the size of reject to (-) 40 mm for pneumatic type system offered, which shall be base offer.		
	** The wearing parts of all the valves shall be provided with abrasion resistant material of hardness of 350-400 BHN.		
MOUDA STPP-II (2x660MW) SOLAPUR STPP (2 x 660MW) NABINAGAR STPP (3x 660MW) MEJA TPP-I (2 x 660MW) RAGHUNATHPUR TPP PHASE-II (2 x660MW) STEAM GENERATOR PACKAGE	TECHNICAL SPECIFICATION SECTION-VI BID DOC NO.: CS-9575 9571 0370 0360 9586-102-2	PART-B SUB-SECTION-II:M4 MILL REJECT HANDLING SYSTEM	PAGE 2 OF 2

	<b>TITLE:</b> <b>TECHNICAL SPECIFICATION FOR  MILL REJECT HANDLING SYSTEM</b>  <b>2X660MW MAUDA STPP STAGE-II</b>	BHEL DOCUMENTS NO.: PE-TS-385-160-A001	
		VOLUME <b>II-B</b>	
		SECTION -C	
		REV. NO. 00	DATE:
		Page	

**ANNEXURE – I**

**DATASHEET – A**



TITLE:  
**TECHNICAL SPECIFICATION FOR  
MILL REJECT HANDLING SYSTEM**  
  
**2X660MW MAUDA STPP STAGE-II**

BHEL DOCUMENTS NO.: PE-TS-385-160-A001

VOLUME **II-B**

SECTION -C

REV. NO. 00

DATE:

Page

### DATASHEET-A (MILL REJECT SYSTEM)

S. No.	Items/Description	2x660 MW MAUDA STPP STAGE-II
1	Type of mill reject system	Pneumatic Pressure Conveying
2	Material handled	Coal Mill reject
3	No of mills/Unit	9
4	Reject generation design rate	0.80 TPH
5	Mill layout	Side Mill Arrangement
6	Elevation of Mill Reject Spout (wrt FFL in Mill Area)	3.0 M from 0.0M elevation
7	Type of Mills	HP 1103 BOWL MILL WITH PLANETARY GEARBOX
8*	Silo Location	Refer Layout
9	Compressor Location	Refer Layout, Main Compressor house
10	Water spray system (Pyrite quenching)	Required
11	No of compressors	2x100% (1W+1S), non-lubricated reciprocating type compressor.(Each sized to cater air requirement of two units)
12	Sump Pumps	4 Nos. Fixed Type (1 per mill bay).
13	Type of control/ Main control panel location	DCS based control system (In BHEL Scope)
14	Pneumatic/ local control panel	Yes with DOP of IP 55
15	Mandatory spares	Applicable

	<b>TITLE:</b> <b>TECHNICAL SPECIFICATION FOR  MILL REJECT HANDLING SYSTEM</b>  <b>2X660MW MAUDA STPP STAGE-II</b>	BHEL DOCUMENTS NO.: PE-TS-385-160-A001	
		VOLUME <b>II-B</b>	
		SECTION -C	
		REV. NO. 00	DATE:
		Page	

**ANNEXURE – II**

**EQUIPMENT DESIGN/SELECTION CRITERIA**



TITLE:  
**TECHNICAL SPECIFICATION FOR  
MILL REJECT HANDLING SYSTEM**  
  
**2X660 MW MAUDA TPS STAGE-II**

BHEL DOCUMENTS NO.: PE-TS-385-160-A001

VOLUME **II-B**

SECTION -C

REV. NO. 00

DATE:

Page

## EQUIPMENT DESIGN/SELECTION CRITERIA FOR 2X660 MW MAUDA TPS – MILL REJECT HANDLING SYSTEM

S. No.	Equipment	Design/Selection/Sizing Criteria
01	Conveying Air Compressor	<p>Each compressor shall be selected to meet the following requirements:</p> <ul style="list-style-type: none"><li>a) 2x100 % (1W + 1SB) compressors shall be provided to cater air requirement of two units.</li><li>b) A margin of 50 % shall be considered over and above the required/ calculated/ minimum compressor capacity arrived for conveying of total reject generated.</li><li>c) Guaranteed reject conveying rate 800 kg/hr per mill.</li><li>d) RH – 75%</li><li>e) Air Temperature – 45 deg C</li><li>f) Height above MSL- 310 Meter</li><li>g) Noise level- Shall be limited to 85dBA at a distance of 1.0 m in horizontal direction from the nearest surface of the machine and at a height of 1.5 m from the floor level in elevation. Noise level measurement shall be carried out using applicable and internationally acceptable standards. The measurement shall be carried out with calibrated integrating sound level meter meeting the requirement of IEC 651 or BS: 5969 or IS 9779.</li></ul>
02	Air Receiver	<p>As per IS 2825 class II/ equivalent as per any other international standard</p> <p>Capacity: The air receiver capacity shall be selected to convey one complete cycle with a minimum margin of 25% provided over and above the arrived air receiver capacity.</p>
03	Pyrite Hopper & Accessories	<ul style="list-style-type: none"><li>a) Number of outlet – Three (3)</li><li>b) Capacity – 2-3 times Denseveyor / transporter vessel capacity.</li><li>c) MOC for plates – MS as per IS 2062 Gr. B (min)/equivalent as per any other international standard, min 10 mm thk with sizing grid.</li><li>d) Explosion vent<ol style="list-style-type: none"><li>1) Rupture Disc type (One no. per hopper)</li><li>2) Rupture Disc Bursting Pressure – 0.5 kg /cm<sup>2</sup> (g)</li><li>3) Sizing Grid Details – Shall be made from minimum 10 mm dia./thk MS bars/flats with opening suitable for entrapping reject larger than 40 mm in size.</li><li>4) Surface Temperature – The surface temperature of the equipment shall be maintained within 60 °C. Insulation, if required, to achieve the same shall be provided by the bidder without any commercial implication.</li></ol></li></ul>



TITLE:

**TECHNICAL SPECIFICATION FOR  
MILL REJECT HANDLING SYSTEM**

**2X660 MW MAUDA TPS STAGE-II**

BHEL DOCUMENTS NO.: PE-TS-385-160-A001

VOLUME **II-B**

SECTION -C

REV. NO. 00

DATE:

Page

		<p>5) Water Spraying arrangement with Solenoid Valve and fog jet nozzle – Yes</p> <p>e) Valves</p> <ol style="list-style-type: none"> <li>1) Inlet valve – Pneumatically Operated KGV with expansion joint and deflection cone with open/closed limit switch for inter lock purpose</li> <li>2) Maintenance valve – Pneumatically operated KGV with open/closed limit switch for inter lock purpose</li> <li>3) Over size chute – Pneumatically Operated KGV with open/closed limit switch for inter lock purpose</li> <li>4) Emergency chute –Pneumatically operated KGV with open/closed limit switch for inter lock purpose</li> </ol> <p>f) Min. instruments required</p> <ol style="list-style-type: none"> <li>1) Two nos. of level switches (High/High-High)</li> <li>2) One (1) no. of temperature switch</li> </ol>
04	Denseveyor (transporter vessel) & its Accessories	<p>a) MOC</p> <ol style="list-style-type: none"> <li>1) Denseveyor – Mild Steel IS – 2062, Gr B/ equivalent as per any other international standard</li> <li>2) Dome Valve / Inlet Valve – Refer S.No.08 below</li> </ol> <p>b) Quantity of material to be conveyed per hour by each denseveyor/ transporter vessel – Refer Datasheet-A</p> <p>c) Capacity of denseveyor/ transporter vessel - To suit the conveying rate with 85% filling</p> <p>d) Any cooling envisaged for dome valve – Bidder to decide</p> <p>e) Air supply pressure available – Bidder to decide</p> <p>f) Distance over which material is to be conveyed and the lift – Refer Layout Drawing</p>
05	Bunker & its Accessories	<p>a) Effective Storage Capacity – 114 T (min)</p> <p>b) Number of outlet - One</p> <p>c) Minimum free board – 500 mm</p> <p>d) Bunker Plate – 10 mm thk. MS Plate conforming to IS 2062 Gr A/B</p> <p>e) Liner – 3 mm SS 304 Liner in complete bunker (conical as well as cylindrical portion of bunker)</p> <p>f) Minimum Valley Angle - 60 Degrees</p> <p>g) Discharge Gate</p> <ol style="list-style-type: none"> <li>i. Size – 400 mm x 400 mm (clear open) (min)</li> <li>ii. Type – Twin Sector, Manually operated.</li> <li>iii. MOC – CI to IS 210/ MS 10 mm thick (min) to IS 2062 (Gr. A min) with 8 mm thick SAILHARD/TISCRAL LINER on complete inner surface.</li> </ol> <p><b>h) There shall be no dedicated staircase for MRS silo. Various platforms of MRS silo shall be accessed from TP staircase. Interconnection between TP staircase and silo platform shall be done by bidder.</b></p> <p>i) Level probe (high) shall be as per C&amp;I specification requirement.</p> <p>j) Pressure relief valve designed for max. pressure subjected.</p> <p><b>Bag Filter</b></p>



TITLE:

**TECHNICAL SPECIFICATION FOR  
MILL REJECT HANDLING SYSTEM**

**2X660 MW MAUDA TPS STAGE-II**

BHEL DOCUMENTS NO.: PE-TS-385-160-A001

VOLUME **II-B**

SECTION -C

REV. NO. 00

DATE:

Page

		<p>Each Bag filter shall be sized considering simultaneous firing of one normal and one emergency cycle.</p> <p>a) Material of Filter Cloth – Polyester felt needle suitable for prolonged operation up to a temperature of 200°C without losing its collection efficiency &amp; durability.</p> <p>b) Air to Cloth Ratio – 1.5 m/min (Further 10 % additional bags shall be provided)</p> <p>c) Bag – MS, IS 2062, Gr. A (min), 3.0 mm thick (min)</p> <p>d) Bag Cage – MS, IS 1079 galvanized.</p> <p>e) Outlet Air Quality – 50 mg/nm<sup>3</sup> (max)</p> <p>f) Bag Cleaning Mechanism – Automatic and shall comprise of solenoid valves, air nozzles, adjustable solid state timer, pressure switches, piping and fittings etc.</p> <p>g) Test on bag filter casing: In case bag filter is assembled in casing at site, smoke/ bubble test shall be carried out on the bag filter casing to ensure that the casing is free of welding defect. However, if assembly of bag filter &amp; casing is done at shop, relevant NDT shall be carried out as per approved MQP for checking the soundness of weld.</p> <p>h) Chain Pulley Block over bag filter: Shall have 25% margin over weight of bag filter, but in no case the capacity shall be lower than 1.0 T, same shall be as per IS 3832</p>
06	Lines for Various Services	As per the LP Piping Specifications given under Annexure VI
07	Knife Gate/Plate Valve (pyrite hopper inlet, oversize discharge, emergency discharge, hopper isolation/maintenance)	<p>Operation: Pneumatic .</p> <p>Material of Construction</p> <p>Body – CI to IS 210 Gr FG 260</p> <p>Gate/Plate – Min 10 mm Thk SS (ASTM A 240 type 304) with wearing parts provided with abrasion resistant material of hardness 350-400 BHN</p> <p>Size – 200 NB (min) for all valves</p> <p>(All knife gate valve shall be provided with open &amp; close limit switches for interlock and control purpose)</p> <p>Deflection cone : Required before the pyrite hopper inlet knife gate valve</p>
08	Dome Valve/Swing Disk Inlet Valve	<p>Material of construction</p> <p>Body – CI to IS 210 Gr. FG 260</p> <p>Dome – Alloy CI with hardness as 225 BHN with leak proof seat.</p> <p>Shaft – SS 304</p> <p>Disk – SS 304/ Alloy CI, hardness of 500 BHN (min)</p>
09	Conveying pipe bend	MOC & Hardness – Alloy CI, 400 BHN min with min 2% Ni End connection- Flanged
10	Fittings, Flanges, Fasteners & Gaskets	As per the LP Piping Specifications given under Annexure VI
11	Valves for Air &	As per the LP Piping Specifications given under Annexure VI



TITLE:  
**TECHNICAL SPECIFICATION FOR  
MILL REJECT HANDLING SYSTEM**  
  
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BHEL DOCUMENTS NO.: PE-TS-385-160-A001

VOLUME **II-B**


SECTION -C

REV. NO. 00

DATE:


Page

Water Lines		
12	Sump Pumps	Capacity – To meet system requirement but not less than 10 m <sup>3</sup> /hr MOC and 10 MWC Head i. Casing & suction bell – 2.5 % Ni-CI to IS 210, FG260 ii. Impeller – 2.5 % Ni-CI to IS 210 , FG260 iii. Shaft/Sleeves – EN-8
13	Hand Operated Chain Pulley Block with Geared Trolley	i. Capacity (In Kg) - To suit the heaviest equipment lifting on silo top ii. Service condition - Class II outdoor iii. No. of CPB - Four Nos. iv. Lift (m) - To suit the requirement/16 m (min.) v. Type of suspension- Traveling Trolley vi. Head Room - As per Vendor data vii. Type of gear in CPB - Spur Gear viii. Type of bearing - Ball/Roller ix. Grade of Load Chain - Alloy Steel /Gr. 80. x. Grade of Hand Chain - Steel / Gr. 30 xi. Factor of Safety - As per Relevant IS

	TITLE:	BHEL DOCUMENTS NO.: PE-TS-385-160-A001	
		VOLUME <b>II-B</b>	
		SECTION -C	
		REV. NO. 00	DATE:
		Page	
	<b>TECHNICAL SPECIFICATION FOR MILL REJECT HANDLING SYSTEM</b>  <b>2X660MW MAUDA STPP STAGE-II</b>		

### ANNEXURE – III

## MANUFACTURING QUALITY PLANS AND CUSTOMER INSPECTION REQUIREMENT

		S/Contactor :			Manufacturing Quality Plan			Project:-					
		Mfr:- Works:-			Item :-Local Panels QAP No. LOI Nos:-			Package :- Mill Rejects System Client :-					
					Contractor :- M/s BHEL			Consultant :-					
Sl. No.	Components / Operations	Characteristics Checked	Category	Type/Method of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Records		Agency for Checking			Remarks
1	2	3	4	5	6	7	8	9		10			11
								TYPE	D	M	C	N	
1	<b>Materials</b> CRCA Sheet	Visual  Chem. & Physical.  Thickness	Major  Major  Major	Visual  Chem.& Physical.  Measurement	100%  100%  100%	Appr. Drg / IS: 513  Do  App. Drawing	Appr. Drg / IS: 513  Do  App. Drawing	IR  TC  IR/TC	-  √  √	P  V  V	-  V  V	-  V  V	
2	<b>Bought outs</b> Verification of type, size & Make of FLV unit, PG, PS, SV	Visual	Major	Visual	100%	Appr. Drawing / Data Sheet	Approved Drawing / Data Sheet	IR/TC	√	V	V	V	
3	<b>Painting</b> Pre Treatment 7 tank process	Physical	Major	DFT / Shade / Finish	100%	Appr. Painting Schedule	Appr. Painting Schedule	IR/TC	√	V	V	V	
4	<b>Final Inspection</b>	Visual	Major	Visual	100%	Appr. Drawing / Data Sheet	Appr. Drawing / Data Sheet	IR/TC	√	P	<b>W</b>	V	
		Dimension	Major	Measurement	100%	Appr. Drawing / Data Sheet	Appr. Drawing / Data Sheet	IR/TC	√	P	<b>W</b>	V	
		Check for Pneumatic Circuit	Major	Visual	100%	Appr. Drawing / Data Sheet	Appr. Drawing / Data Sheet	IR/TC	√	P	<b>W</b>	V	
		Check for Wiring / Mountings / Terminations	Major	Visual / Continuity	100%	Appr. Drawing / Data Sheet	Appr. Drawing / Data Sheet	IR/TC	√	P	<b>W</b>	V	
		Functional Check for Solenoid Valve	Major	Functional	100%	Appr. Drawing / Data Sheet	Appr. Drawing / Data Sheet	IR/TC	√	P	<b>W</b>	V	
5	<b>QA Documents</b>	Review	Major	verification	100%	-	-	-					
Manufacturer / Sub Vendor		Contractor		<b>LEGENDS:-</b> Records identified by √ shall be essentially included in QA documentation. TC-Test Certificate , IR - Insp. Report M-> Manufacturer/Sub Contractor, C-> Contractor (BHEL) or their nominated agency & N ->CLIENT <b>P-&gt;Perform, V-&gt; Verification, W-&gt; Witness</b>			For Client Use:-		Document. No.:				
							Name & Signature of Approving Authority with Seal						
<b>SIGNATURES</b>													





**S/Contactor :**  
  
**Mfgr:-**  
**Works:-**


**Manufacturing Quality Plan**  
**Item :- Transport vessel**  
**QAP No.**  
**LOI Nos:-**  
  
**Contractor :- M/s BHEL**


**Project:-**  
**Package :- Mill Rejects System**  
**Client :**  
  
**Consultant :-**

Sl. No.	Components / Operations	Characteristics Checked	Category	Type/Method of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Records		Agency for Checking			Remarks
								9	10	11	12	13	
								TYPE	D	M	C	N	
1	<b>Raw Materials</b>												
1.1	Dome & dome Valve Body	Dimensions Surface Defects Physical Check Chemical Check	Major	Measurement Visual TS & Hardness Chemical Comp.	100% 100% 1/Heat 1/Heat	App. Drg. / Data Sheet / Standard	App. Drg. / Data Sheet / Standard	- - TC TC	- - √ √	P P P/V P/V	- - V V	- - V V	
1.2	Plates for Vessel	Dimensions Surface Defects Physical Check Chemical Check	Major	Measurement Visual TS & Elongation Chemical Comp.	100% 100% 1/Heat 1/Heat	App. Drg. / Data Sheet / IS Standard	App. Drg. / Data Sheet / IS Standard	- - TC TC	- - √ √	P P P/V P/V	- - V V	- - V V	
1.3	Insert Seal	Surface Defects Hardness	Major	Visual Measurement	100% 1/Lot	Mfr's Drg. / Std	Mfr's Drg. / Std	- IR	- √	P P/V	- V	- V	
1.4	Shaft	Physical Check Chemical Check	Major	TS & Elongation Chemical Comp.	1/Heat 1/Heat	App. Drg. / IS Std.	App. Drg. / IS Std.	TC	√	P/V	V	V	
2	<b>In - Process Insp.</b>												
2.1	Welders & Welding	WPS / PQR / WPQ Welding Defects	Major Major	Procedure / Qualification DPT on Root run DPT on Final run	100% 100% 10%	ASME sec - IX ASTM E-165 ASTM E-165	ASME sec - IX ASTM E-165 ASTM E-165	WPS / PQR IR IR	√ √ √	P/V P/V P/V	V V V	V V V	Welders to be approved by BHEL / CLIENT
2.3	Machining of Dome & dome Valve	Visual & Dimension	Minor	Visual, Measurement	100%	Mfr's Drg / Standard	Mfr's Drg / Standard	-	-	P	-	-	
2.4	Hydotest of Vessel	Soundness / Leakage	Major	Visual, Hydro Pressure Test	100%	App. Drg. / Data sheet	App. Drg. / Data sheet	IR	√	P/V	W	W	
3	<b>Final Inspection</b>												
3.1	Final Assly	Completeness & Dimension	Major	Visual / Measurement	100%	App. Drg. / Data sheet	App. Drg. / Data sheet	IR	√	P/V	W	W	At Painted Condition
3.2	Run Test / Performance	Operation of Dome Valve	Minor	Visual, 5 times Cycle operation	100%	Mfr's Standard	Mfr's Standard	IR	√	P/V	W	W	
3.3	Painting	Finish / DFT	Major	Visual, Measurement	100%	App. Painting Schedule	App. Painting Schedule	IR	√	P/V	W	W	
4	<b>QA Documentation</b>												
4.1	TC & IR	Completeness	Major	Verification & approval	100%	App. Quality Plan	App. Quality Plan	-	-	P/V	V	V	
Manufacturer / Sub Vendor		Contractor		<b>LEGENDS:-</b> Records identified by √ shall be essentially included in QA documentation. TC-Test Certificate , IR - Insp. Report M-> Manufacturer/Sub Contractor, C-> Contractor (BHEL) or their nominated agency & N -> CLIENT P->Perform, V-> Verification, W-> Witness				For Client Use:-		Document No.			
<b>SIGNATURES</b>								Name & Signature of Approving Authority with Seal					


		S/Contactor :			Manufacturing Quality Plan			Project:-					
		Mfr:-			Item :- Pyrite Hopper			Package :- Mill Rejects System					
		Works:-			QAP No.			Client :-					
					LOI Nos			Contractor :- M/s BHEL					
Sl. No.	Components / Operations	Characteristics Checked	Category	Type/Method of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Records		Agency for Checking			Remarks
1	2	3	4	5	6	7	8	9		10			11
								TYPE	D	M	C	N	
1	<b>Raw Materials</b>												
1.1	Plates for Body	Dimensions Surface Defects Physical Check Chemical Check	Major	Measurement Visual TS & Elongation Chemical Comp	100% 100% 1/Heat 1/Heat	App. Drg. / Data Sheet / IS Standard	App. Drg. / Data Sheet / IS Standard	- - MTC MTC	- - √ √	P P P/V P/V	- - V V	- - V V	
1.2	Spray Nozzle	Surface Defects Chemical Check Dimensions	Major	Visual Chemical Comp. Measurement	100% 1/Lot 100%	Mfr's Drg. / IS Standard	Mfr's Drg. / IS Standard	- MTC IR	- √ √	P P/V P	- V V	- V V	
2	<b>In - Process Insp.</b>												
2.1	Welders & Welding	WPS / PQR / WPQ Welding Defects	Major	Procedure / Qualification DPT on Root run DPT on Final run	100% 100% 10%	ASME sec - IX ASTM E-165 ASTM E-165	ASME sec - IX ASTM E-165 ASTM E-165	WPS / PQR IR IR	√ √ √	P/V P/V P/V	V V W	V V W	Welders to be approved by BHEL
2.2	Fabrication	Fit up, Marking, Cutting, Grinding	Minor	Visual, Measurement	100%	Mfr's Standard	Mfr's Standard	-	-	P	-	-	
3	<b>Final Inspection</b>												
3.1	Final Assly	Completeness & Dimension	Major	Visual	100%	App. Drg. / Data sheet	App. Drg. / Data sheet	IR	√	P/V	W*	W*	* -> Witness10%
3.2	Painting	Finish / DFT	Major	Visual, Measurement	100%	App. Painting Schedule	App. Painting Schedule	IR	-	P/V	W	-	Painting shall be Heat Resistance
4	<b>QA Documentation</b>												
4.1	TC & IR	Completeness	Major	Verification & approval	100%	App. Quality Plan	App. Quality Plan		-	P/V	V	V	
Manufacturer / Sub Vendor		Contractor		<b>LEGENDS:-</b> Records identified by √ shall be essentially included in QA documentation. TC-Test Certificate , IR - Insp. Report M-> Manufacturer/Sub Contractor, C-> Contractor (BHEL) or their nominated agency & N -> Client <b>P-&gt;Perform, V-&gt; Verification, W-&gt; Witness</b>				For Client Use:-		Document No.:-			
<b>SIGNATURES</b>						Name & Signature of Approving Authority with Seal							

		<b>S/Contactor :-</b>			<b>Manufacturing Quality Plan</b>			<b>Project:-</b>						
		Mfg:-			Item :- Terminal Box QAP No. :- LOI Nos:-			Package :- Mill Rejects System Client :-						
					Contractor :- M/s BHEL			Consultant :- .						
Sl. No.	Components / Operations	Characteristics Checked	Category	Type/Method of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Records		Agency for Checking			Remarks	
1	2	3	4	5	6	7	8	9		10			11	
								TYPE	D	M	C	K		
1	<b>Raw Materials</b>													
1.1	Plates for Body	Dimensions Surface Defects Physical Check Chemical Check	Major	Measurement Visual TS & Elongation Chemical Comp.	100% 100% 1/Heat 1/Heat	App. Drg. / Data Sheet / IS Standard	App. Drg. / Data Sheet / IS Standard	- - MTC MTC	- - √ √	P P P/V P/V	- - V V	- - V V	- - V V	
2	<b>In - Process Insp.</b>													
2.1	Welders Qualification & Welding	WPS / PQR / WPQ Welding Defects	Major	Procedure / Qualification DPT on Root run DPT on Final run	100% 100% 10%	ASME sec - IX ASTM E-165 ASTM E-165	ASME sec - IX ASTM E-165 ASTM E-165	WPS / PQR IR IR	√ √ √	P/V P/V P/V	V V W	V V V	V V V	Welders to be approved by BHEL / KPCL
2.2	Flange Machining and Drilling	Dimensions	Major	Measurement	100%	Mfr/Appr. Drg	Mfr/Appr. Drg	IR	-	P	-	-	-	
2.3	Connection -pipe to flange, pipe to body	Fit up	Major	Joint set up, PCD, Orientation	100%	Mfr/Appr. Drg	Mfr/Appr. Drg	IR	-	P	-	-	-	If Applicable
2.4	Fabrication	Fit up, Marking, Cutting, Grinding	Minor	Visual, Measurement	100%	Mfr's Standard	Mfr's Standard	-	-	P	-	-	-	
3	<b>Final Inspection</b>													
3.1	Final Assly	Completeness & Dimension	Major	Visual	100%	App. Drg. / Data sheet	App. Drg. / Data sheet	IR	√	P/V	W	W	W	
3.2	Painting	Finish / DFT	Major	Visual, Measurement	100%	App. Painting Schedule	App. Painting Schedule	IR	-	P/V	W	-	-	Painting before disp.
4	<b>QA Documentation</b>													
4.1	TC & IR	Completeness	Major	Verification & approval	100%	App. Quality Plan	App. Quality Plan	-	-	P/V	V	V	V	
Manufacturer / Sub Vendor		Contractor		<b>LEGENDS:-</b> Records identified by √ shall be essentially included in QA documentation. TC-Test Certificate , IR - Insp. Report M-> Manufacturer/Sub Contractor, C-> Contractor (BHEL) or their nominated agency & N -> CLIENT <b>P-&gt;Perform, V-&gt; Verification, W-&gt; Witness</b>				For Client Use:-			<b>Document No.:-</b>			
<b>SIGNATURES</b>						Name & Signature of Approving Authority with Seal								


		<b>S/Contractor :-</b>			<b>Manufacturing Quality Plan</b>			<b>Project:-</b>					
		<b>Mfgr:-</b>			<b>Item :- Bunker Discharge Gate</b>			<b>Package :- Mill Rejects System</b>					
		<b>Works:-</b>			<b>QAP No. :-</b>			<b>Client :-</b>					
					<b>Contractor :- M/s BHEL</b>			<b>Consultant :-</b>					
Sl. No.	Components / Operations	Characteristics Checked	Category	Type/Method of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Records		Agency for Checking			Remarks
1	2	3	4	5	6	7	8	9		10			11
								TYPE	D	M	C	K	
1	<b>Raw Materials</b>												
1.1	Plates for Body	Dimensions Surface Defects Physical Check Chemical Check	Major	Measurement Visual TS & Elongation Chemical Comp.	100% 100% 1/Heat 1/Heat	App. Drg. / Data Sheet / IS Standard	App. Drg. / Data Sheet / IS Standard	- - TC	- - √	P P P/V	- - V	- - V	
1.2	Shaft	Physical Check Chemical Check UT If Dia > 50 mm	Major	TS & Elongation Chemical Comp. Internal defect	1/Heat 1/Heat 100%	do	do	TC TC IR	√ √ √	P/V P/V P/V	V V V	V V V	
1.3	Cylinder / Actuator	Visual / Specification	Major	Visual	100%	do	do	Mfr's TC	√	V	V	V	
2	<b>In - Process Insp.</b>												
2.1	Welders & Welding	WPS / PQR / WPQ Welding Defects	Major Major Major	Procedure / Qualification DPT on Root run DPT on Final run	100% 100% 10%	ASME sec - IX ASTM E-165 ASTM E-165	ASME sec - IX ASTM E-165 ASTM E-165	WPS / PQR IR IR	√ √ √	P/V P/V P/V	V V W	V V V	Welders to be approved by BHEL / CLIENT
3	<b>Final Inspection</b>												
3.1	Final Assly	Completeness & Dimension	Major	Visual	100%	App. Drg. / Data sheet	App. Drg. / Data sheet	IR	√	P/V	W	W	
3.2	Operation with job / shop actuator	Opening & Closing of Gate	Major	Visual	100%	Proper Working	Smooth Operation	IR	√	P/V	W	W	
3.3	Painting	Finish / DFT	Major	Visual, Measurement	100%	App. Painting Schedule	App. Painting Schedule	IR	-	P/V	W	-	Painting before disp.
4	<b>QA Documentation</b>												
4.1	TC & IR	Completeness	Major	Verification & approval	100%	App. Quality Plan	App. Quality Plan		-	P/V	V	V	
Manufacturer / Sub Vendor		Contractor		<b>LEGENDS:-</b>				For Client Use:-		Document No.:-			
				Records identified by √ shall be essentially included in QA documentation. TC - Test Certificate, IR - Insp. Report M-> Manufacturer/Sub Contractor, C-> Contractor (BHEL) or their nominated agency & N-> CLIENT P->Perform, V-> Verification, W-> Witness									
<b>SIGNATURES</b>								Name & Signature of Approving Authority with Seal					

		<b>S/Contactor :-</b>			<b>Manufacturing Quality Plan</b>			<b>Project:-</b>					
		Mfgr:- Works:-			Item :- Pressure Relief Valve QAP No. : LOI Nos:- Contractor :- M/s BHEL			Package :- Mill Rejects System Client :- . Consultant :-					
Sl. No.	Components / Operations	Characteristics Checked	Category	Type/Method of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Records		Agency for Checking			Remarks
1	2	3	4	5	6	7	8	9		10			11
								TYPE	D	M	C	K	
1	<b>Raw Materials</b>												
1.1	Plates for Body	Dimensions Surface Defects Physical Check Chemical Check	Major	Measurement Visual TS & Elongation Chemical Comp.	100% 100% 1/Heat 1/Heat	App. Drg. / Data Sheet / IS Standard	App. Drg. / Data Sheet / IS Standard	- - MTC MTC	- - √ √	P P P/V P/V	- - V V	- - V V	
2	<b>In - Process Insp.</b>												
2.1	Welders & Welding	WPS / PQR / WPQ Welding Defects	Major Major	Procedure / Qualification DPT on Root run DPT on Final run	100% 100% 10%	ASME sec - IX ASTM E-165 ASTM E-165	ASME sec - IX ASTM E-165 ASTM E-165	WPS / PQR IR IR	√ √ √	P/V P/V P/V	V V W	V V V	Welders to be approved by BHEL / KPCL
2.2	Fabrication	Fit up, Marking, Cutting, Grinding	Minor	Visual, Measurement	100%	Mfr's Standard	Mfr's Standard	- -	- -	P P	- -	- -	
3	<b>Final Inspection</b>												
3.1	Final Assly	Completeness & Dimension	Major	Visual	100%	App. Drg. / Data sheet	App. Drg. / Data sheet	IR	√	P/V	W	W	
3.2	Painting	Finish / DFT	Major	Visual, Measurement	100%	App. Painting Schedule	App. Painting Schedule	IR	-	P/V	W	-	Painting before disp.
4	<b>QA Documentation</b>												
4.1	TC & IR	Completeness	Major	Verification & approval	100%	App. Quality Plan	App. Quality Plan	-	-	P/V	V	V	
Manufacturer / Sub Vendor		Contractor		<b>LEGENDS:-</b> Records identified by √ shall be essentially included in QA documentation. TC-Test Certificate , IR - Insp. Report M-> Manufacturer/Sub Contractor, C-> Contractor (BHEL) or their nominated agency & N -> CLIENT P->Perform, V-> Verification, W-> Witness			For Client Use:-		Document No.:-				
				SIGNATURES							Name & Signature of Approving Authority with Seal		


Sl. No.		Components / Operations	Characteristics Checked	Category	Type/Method of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Records		Agency for Checking			Remarks			
1		2	3	4	5	6	7	8	9		10			11			
									TYPE	D	M	C	K				
<b>1 Raw Materials</b>																	
1.1	Plates for Shell, Dished End & Flange	Dimensions Surface Defects Physical Check Chemical Check	Major	Measurement Visual TS & Elongation Chemical Comp.	100% 100% 1/Heat 1/Heat	App. Drg. / Data Sheet / IS Standard	App. Drg. / Data Sheet / IS Standard	- - TC TC	- - √ √	P P P/V P/V	- - V V	- - V V	- - V V				
1.2	Formed Dished End	Dimensions Thickness/Thinning DPT of Knuckle	Major	Measurement Measurement DP Test	100% 100% 100%	App. Drg. / Data Sheet ASTM E-165	App. Drg. / Data Sheet ASTM E-165	IR IR TC	√ √ √	P P P/V	- - V	- - V	- - V				
<b>2 In - Process Insp.</b>																	
2.1	Welders & Welding	WPS / PQR / WPQ  Welding Defects do do	Major Major Critical	Procedure / Qualification DPT on Root run DPT on Final run Radiography Test on all C/S & L/S including T & X	100% 100% 100%	ASME sec - IX ASTM E-165 ASTM E-165 IS 2825 Class-II / ASME Sec VIII	ASME sec - IX ASTM E-165 ASTM E-165 IS 2825 Class II / ASME Sec VIII	WPS / PQR IR IR RT Film / Report	√ √ √ √	P/V P/V P/V P/V	V V V V	V V W V	V V W V	Welders to be approved by BHEL / CLIENT			
2.2	Fabrication	Marking, Cutting, Rolling, Edge Preparation, Joint & Nozzle set up	Major	Visual, Measurement (Ovality, off set orientation)	100%	Mfr's Standard / Approved Drg.	Mfr's Standard / Approved Drg.	IR	-	P	-	-	-				
<b>3 Final Inspection</b>																	
3.1	Final Assly	Completeness & Dimension	Major	Visual / Measurement	100%	App. Drg. / Data sheet	App. Drg. / Data sheet	IR	√	P/V	W	W	W				
3.2	Hydotest of Vessel	Soundness / Leakage	Major	Visual, Hydro Pressure Test	100%	App. Drg. / Data sheet	App. Drg. / Data sheet	IR	√	P/V	W	W	W				
3.3	Painting	Finish / DFT	Major	Visual, Measurement	100%	App. Painting Schedule	App. Painting Schedule	IR		P/V	W	-	-	Painting before disp.			
<b>4 QA Documentation</b>																	
4.1	TC & IR	Completeness	Major	Verification & approval	100%	App. Quality Plan	App. Quality Plan	-	-	P/V	V	V	V				
Manufacturer / Sub Vendor			Contractor			<b>LEGENDS:-</b> Records identified by √ shall be essentially included in QA documentation. TC -> Test Certificate, IR - Inspection Report M-> Manufacturer/Sub Contractor, C-> Contractor (BHEL) or their nominated agency & N-> CLIENT <b>P-&gt;Perform, V-&gt; Verification, W-&gt; Witness</b>			For Client Use:-			Document No.:-			Name & Signature of Approving Authority with Seal		
<b>SIGNATURES</b>																	

		<b>S/Contactor :-</b> <b>Manufacturer :-</b>			<b>Manufacturing Quality Plan</b> <b>Item :- Rupture Disc</b> <b>QAP No. :-</b> <b>LOI Nos:-</b> <b>Contractor :- M/s BHEL</b>			<b>Project:-</b> <b>Package :- Mill Rejects System</b> <b>Client :-</b> <b>Consultant :-</b>					
		<b>Sl. No.</b>	<b>Components / Operations</b>	<b>Characteristics</b>	<b>Classification</b>	<b>Type of Check</b>	<b>Quantum of Check</b>	<b>Reference Documents</b>	<b>Acceptance Norms</b>	<b>Format of Records</b>		<b>Agency for Checking</b>	
<b>1</b>	<b>2</b>	<b>3</b>	<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>TYPE</b>	<b>D</b>	<b>M</b>	<b>C</b>	<b>K</b>	
1	<b>Materials</b> -> Rupture Disc Material	Physical & Chemical Properties	Major	Chemical Analysis, YTS & UTS	1 per Heat	ASTM A240 Type - 304 / Appved Data Sheet / Drg.	ASTM A240 Type - 304 / Appved Data Sheet	MTC	√	V	V	V	
2	<b>Final Inspection</b> -> Dimension -> Burst Test of Rupture Disc	Measurement Functional	Major Major	Mesurement Burst Test @ 200 Degree Centigrade	100% 1 per lot offered	App. Drawing Approved drawing / Datasheet	App. Drawing Min 0.4 bar (g) @ 200 degree C Max 0.6 bar (g) @ 200 degree C / App. Data Sheet	IR IR / Burst Test Certificate	√ √	P P	W W	W W	
Manufacturer / Sub Vendor		Contractor		<b>LEGENDS:-</b> Records identified by √ shall be essentially included in QA documentation. TC- Test Certificate, IR - Insp. Report M-> Manufacturer/Sub Contractor, C-> Contractor (BHEL) or their nominated agency & K ->Client <b>P-&gt;Perform, V-&gt; Verification, W-&gt; Witness</b>			For Client Use:-		Document No.:-				
<b>SIGNATURES</b>													Name & Signature of Approving Authority with Seal

**Note :- In case of any difference in parameters specified in Drawing / Data Sheet & QAP, Value specified in Drg / Data Sheet shall be Final**

		S/Contactor :-			Manufacturing Quality Plan			Project:-				
		Manufacturer :-			Item:- CHAIN PULLY BLOCK			Package :- Mill Rejects System				
					QAP No. :-			Client :-				
					LOI Nos:-			Contractor :- M/s BHEL				
								Consultant :-				
Sl. No.	Components / Operations	Characteristics	Classification	Type of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Records		Agency for Checking		Remarks
1	2	3	4	5	6	7	8	9		10		11
								TYPE	D	M	C	K
1	<b>Materials</b>											
->	Load Chain	Mech. Properties Breaking Load Test, Proof Load test	Major	Review of Mfr's Test Certificate	1 per Lot	IS:6216 /Appr. Drg / Appr. Data sheet	IS:6216 /Appr. Drg / Appr. Data sheet	MTC	√	P/V	V	V
->	Load Sheave	Mech. Properties Chemical Composition	Major	Lab Analysis	1 per Heat	IS:1865 /Appr. Drg / Data sheet	IS:1865 /Appr. Drg / Data sheet	MTC	√	P/V	V	V
->	Gear & Pinion	Chemical Composition	Major	Lab Analysis	1 per Heat	IS:4432/Appr. Drg / Data sheet	IS:4432/Appr. Drg / Data sheet	MTC	√	P/V	V	V
->	Hook	Mech. Properties Chemical Composition	Major	Lab Analysis	1 per Heat	IS:8610 / IS:1875 /Appr. Drg / Data sheet	IS:8610 / IS:1875 /Appr. Drg / Data sheet	MTC	√	P/V	V	V
2	<b>In Process</b>											
->	Hook	Proof Load Test	Major	Load Test	100%	IS:8610 /Appr. Drg / Appr. Data sheet	IS:8610 /Appr. Drg / Appr. Data sheet	MTC / IR	√	P	V	V
		DPT after Load Test	Major	DPT	100%	ASTM E-165	ASTM E-165 / No Defects	IR	√	P	V	V
3	<b>Final Inspection</b>											
->	Assembly	Operation Check	Major	Visual	100%	Smooth Operation / IS 3832 Appr. Drg / App. Data Sheet	Smooth Operation / IS 3832 Appr. Drg / App. Data Sheet	IR	√	P	W	V
		Functional Test	Major	Visual	100%			IR	√	P	W	V
		Load Test & Over Load Test	Major	Load Test	100%			IR	√	P	W	V
		Overall Dimensions	Major	Measurement	100%			IR	√	P	W	V
		Visual (After Load Test)	Major	Visual	100%	IS 3832	IS 3832	IR	√	P	W	V
Manufacturer / Sub Vendor		Contractor		<b>LEGENDS:-</b> Records identified by √ shall be essentially included in QA documentation. TC- Test Certificate, IR - Insp. Report M-> Manufacturer/Sub Contractor, C-> Contractor (BHEL) or their nominated agency & N -> CLIENT <b>P-&gt;Perform, V-&gt; Verification, W-&gt; Witness</b>			For Client Use:-		Document No.:-			
<b>SIGNATURES</b>								Name & Signature of Approving Authority with Seal				


Note :- In case of any difference in parameters specified in Drawing / Data Sheet & QAP, Value specified in Drg / Data Sheet shall be Final

SI. No.		Components / Operations	Characteristics	Classification	Type of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Records		Agency for Checking			Remarks
1		2	3	4	5	6	7	8	9		10			11
									TYPE	D	M	C	K	
<div style="display: flex; justify-content: space-between;"> <div style="width: 15%;">  </div> <div style="width: 35%;"> <p><b>S/Contractor :-</b></p> <p><b>Manufacturer :-</b></p> </div> <div style="width: 35%;"> <p><b>Manufacturing Quality Plan</b></p> <p><b>Item :- Bag Filter (Without Enclosure)</b></p> <p><b>QAP No. :-</b></p> <p><b>LOI Nos:-</b></p> <p><b>Contractor :- M/s BHEL</b></p> </div> <div style="width: 15%;"> <p><b>Project:-</b></p> <p><b>Package :- Mill Rejects System</b></p> <p><b>Client :-</b></p> <p><b>Consultant :-</b></p> </div> </div>														
1	<b>Materials</b>													
1.1	Manifold Body / Casings (MS Plate / Sheet / Pipe)	Chemical & Physical	Major	Chemical & Mechanical	1 per Lot	App. Drawing / Data Sheet / IS:2062 Gr. A / IS:1079 Gr. 0 / IS: 1239 Class Med.	App. Drawing / Data Sheet / IS:2062 Gr. A / IS:1079 Gr. 0 / IS : 1239 Class Med.	MTC	√	V	V	V		
1.2	Bag Cages (Inserts)	Chemical & Physical	Major	Chemical & Mechanical	1 per Lot	App. Drawing / data sheet / IS:7887 Gr.8 / IS:1079 Gr. 0	App. Drawing / data sheet / IS:7887 Gr.8 / IS:1079 Gr. 0	MTC	√	V	V	V		
1.3	Solenoid Valves	Functional	Major	Operational	100%	Approved Drawing / Appr. Data Sheet	Approved Drawing / Appr. Data Sheet	MTC	√	P	V	V		
1.4	Sequence Controller	Functional	Major	Operational	100%	Approved Drawing / Appr. Data Sheet	Approved Drawing / Appr. Data Sheet	MTC	√	P	V	V		
1.5	Filter Bags (Make :- Charminar / Supreme)	Physical	Major	Visual / Measurement	100%	Approved Drawing / Appr. Data Sheet	Approved Drawing / Appr. Data Sheet	MTC	√	P	V	V		
2	<b>In Process</b>													
2.1	Manifold	Dimensional & Visual	Minor	Dimensional & Visual	100%	As per Mfr's Drg.	As per Mfr's Drg.	IR	√	P	V	V	** -> DPT & Hydro -Test of Manifold to be witnessed by vendor	
2.2		Welding	Major	DPT on Final Weld	100%	ASTM E-165	No Defect	IR	√	P	V**	V		
2.3		Hydro Test for 30 Minutes	Major	Leakage	100%	Appr. Data sheet	No Leakage	IR	√	P	V**	V		


Document No.:-

Sl. No.	Components / Operations	Characteristics	Classification	Type of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Records		Agency for Checking			Remarks	
1	2	3	4	5	6	7	8	9		10			11	
								TYPE	D	M	C	K		
3	<b>Final Inspection</b>													
3.1	Assembly \$-> Pneumatic Test at 1.1 times W/Pressure	Dimensional Pne. test \$of Manifold in Assly. Functional Test of Pulsing System	Major Major Major	Measurement Leakage by soap solution Pulse Sequence	100% 100% 100%	Appr. Drawing Appr. Data Sheet Appr. Data sheet / Testing Procedure	Appr. Drawing No Leakage Appr. Data sheet / Testing Procedure	IR IR IR	√ √ √	P P P	W W W	V V V	<b>Pressure Drop across Filter Bags &amp; Emission Level at Filter outlet shall be checked at Site</b>	
4	<b>Painting</b>	Measurement & Visual	Major	DFT / Finish	100%	Appr. Painting Schedule	Appr. Painting Schedule	IR	√	P	-	-		
<b>TESTING PROCEDURE TO BAG FILTER</b>														
1-> Functional test through compressed air , Sequential pulsing through valves and sequential controller on <b>No - Load Condition</b> to be conducted. 2-> The Soenoid valve shall be connected to the sequential timer and suitable electric supply shall be provided. Air header to be connected to supply of compressed air. The Timer is set and Sequential operation of Solenoid operated valve is observed.														
Manufacturer / Sub Vendor		Contractor		<b>LEGENDS:-</b> Records identified by √ shall be essentially included in QA documentation. TC- Test Certificate, IR - Insp. Report M-> Manufacturer/Sub Contractor, C-> Contractor (BHEL) or their nominated agency & N -> CLIENT <b>P-&gt;Perform, V-&gt; Verification, W-&gt; Witness</b>			For Client Use:-		Document No.:-					
<b>SIGNATURES</b>												Name & Signature of Approving Authority with Seal		


**Note :- In case of any difference in parameters specified in Drawing / Data Sheet & QAP, Value specified in Drg / Data Sheet shall be Final**

		S/Contactor :-			Manufacturing Quality Plan			Project:-					
		Manufacturer :-			Item :- MS GI ERW Pipes (IS:1239/IS3589) QAP No. :- LOI Nos:-			Package :- Mill Rejects System Client :-					
					Contractor :- M/s BHEL			Consultant :-					
Sl. No.	Components / Operations	Characteristics	Classification	Type of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Records		Agency for Checking			Remarks
1	2	3	4	5	6	7	8	9		10			11
								TYPE	D	M	C	K	
1	Final Inspection of Finished Pipes	Physical Dimensional Mechanical Properties Chemical Hydro Test	Major Major Major Major	Visual Measurement Tensile, elongation, Bend or Flattening Chemical Analysis Pressure Testing	100% 100% IS: 4711 1 per heat 100%	IS:1239 / IS:3589 / Approved Data Sheet	IS:1239 / IS:3589 / Approved Data Sheet	IR IR / TC TC IR / TC	- √ √ √	P P / V P / V P	W* V V W*	V V V W*	* -> Random 5% of offered lot irrespective of size
2	Galvanising (For GI Pipes)	Uniformity & mass of Zinc Coating, Adhesion test, Free bore test	Major	As per IS:4736	As per IS:4736	As per IS:4736 / Approved Data Sheet	As per IS:4736 / Approved Data Sheet	IR	√	P	W #	V	# one sample for each size
3	Identification	Verification of Batch No. / Mfg stamp / Heat No.	Major	Visual	100%	Mfgr Practise / IS 1239 / IS 3589	Mfgr Practise / IS 1239 / IS 3589	IR	√	P	W	V	
4	Review of QA Documents	-----	-----	-----	-----	As per QAP	As per QAP	-----	√	V	V	V	
<b>NOTES :-</b>													
For SAIL Pipes verification of reports for the tests mentioned in Sl. No. 1 & 2 by BHEL & KPCL.													
For GI Pipes, Galvanising Check as per relevant standard shall be done.													
All material shall be as per approved data sheet in case of ambiguity in QAP, material as data sheet shall be final.													
Manufacturer / Sub Vendor		Contractor		<b>LEGENDS:-</b>				For Client Use:-		Document No.:-			
				Records identified by √ shall be essentially included in QA documentation. TC- Test Certificate, IR - Insp. Report M-> Manufacturer/Sub Contractor, C-> Contractor (BHEL) or their nominated agency & N -> CLIENT P->Perform, V-> Verification, W-> Witness									
SIGNATURES								Name & Signature of Approving Authority with Seal					


Note :- In case of any difference in parameters specified in Drawing / Data Sheet & QAP, Value specified in Drg / Data Sheet shall be Final

		<b>S/Contactor :-</b>			<b>Manufacturing Quality Plan</b>			<b>Project:-</b>					
		<b>Manufacturer :-</b>			<b>Item :- ACI Bends</b>			<b>Package :- Mill Rejects System</b>					
					<b>QAP No. :-</b>			<b>Client :-</b>					
					<b>LOI Nos:-</b>			<b>Contractor :- M/s BHEL</b>					
								<b>Consultant :-</b>					
Sl. No.	Components / Operations	Characteristics	Classification	Type of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Records		Agency for Checking			Remarks
1	2	3	4	5	6	7	8	9		10			11
								TYPE	D	M	C	K	
1	<b>Raw Material</b>												
1.1	Scrap Receipt	Chemical	Major	Lab Analysis	Random Sample / Lot	Mfg's Std	Mfg's Std	Mfg's Log Sheet	-	P	-	-	
1.2	Ferro Alloys	Chemical	Major	Lab Analysis	Random Sample / Lot	Mfg's Std	Mfg's Std	Mfg's Log Sheet	-	P	-	-	
2	<b>Final Inspection</b>												
2.1	Product Analysis	Chemical Analysis	Major	Chemical	1 / heat	Mfg's Standard	Mfg's Standard	MTC	√	P	V**	V	** Chemical. Analysis to be Witnessed by Vendor
2.2	Leakage	Hydro Test	Major	Pressure Test	100%	Approved Drg / Data Sheet	No Leakage	IR	√	P	W*	W*	* 10% by Vendor / BHEL / CLIENT
2.3	Dimension	Dimension	Major	Measurement	100%	Approved Drg / Data Sheet	Approved Drg / Data Sheet	IR	√	P	W*	W*	
2.4	Hardness	Hardness	Major	Measurement	100%	Approved Drg / Data Sheet	Approved Drg / Data Sheet	IR/TC	√	P	W*	W*	
<b>Manufacturer / Sub Vendor</b> <b>SIGNATURES</b>		<b>Contractor</b>	<b>LEGENDS:-</b> Records identified by √ shall be essentially included in QA documentation. TC- Test Certificate, IR - Insp. Report M-> Manufacturer/Sub Contractor, C-> Contractor (BHEL) or their nominated agency & N -> CLIENT <b>P-&gt;Perform, V-&gt; Verification, W-&gt; Witness</b>				<b>For Client Use:-</b>		<b>Document No.:-</b>				
			Name & Signature of Approving Authority with Seal										


**Note :- In case of any difference in parameters specified in Drawing / Data Sheet & QAP, Value specified in Drg / Data Sheet shall be Final**

		<b>S/Contactor :-</b>			<b>Manufacturing Quality Plan</b>			<b>Project:-</b>					
		<b>Manufacturer :-</b>			Item :- Knife Gate Valve [Manual / Pneumatic] QAP No. : LOI Nos:-			<b>Package :- Mill Rejects System</b>					
					<b>Contractor :- M/s BHEL</b>			<b>Client :-</b>					
								<b>Consultant :-</b>					
Sl. No.	Components / Operations	Characteristics	Classification	Type of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Records		Agency for Checking			Remarks
1	2	3	4	5	6	7	8	9		10			11
								TYPE	D	M	C	K	
1	<b>Raw Material / Bought Out's</b>												
1.1	Body	Chemical & Mechanical	Major	Foundary TC	1 per Heat	Relevant IS / Appr. Drg / Data Sheet	Relevant IS / Appr. Drg / Data Sheet	TC	√	P/V	V	V	
1.2	Gate	do	Major	Lab Analysis	1 per lot	do	do	Mill / Lab TC	√	P/V	V	V	
1.3	Stem (For Manual Valve)	do	Major	Lab Analysis	1 per batch	do	do	do	√	P/V	V	V	
1.4	Pneumatic Cylinder (For Pneu. Valve)	Visual & Functional	Major	Mfr's TC Review	100%	Smooth Operation	Smooth Operation	Mfr's TC	√	P/V	V	V	
2	<b>In - Process Inspection</b>												
2.1	Body, Gate	Dimensional	Major	Measurement	100%	Mfr's Drawing	In-Process Insp. Record	-		P	V	V	# -> Test Pressure as per Data Sheet
2.2	Body Shell Test	Leak Tightness	Major	Hydro Static Test #	100%	Approved Drg / Data Sheet	No Leakage	IR	√	P	V	V	
3	<b>Final Inspection</b>												
3.1	Assembled Valve	Dimension	Major	Measurement	100%	Approved Drg / Data Sheet	Approved Drg / Data Sheet	IR	√	P	W	W	BHEL / Vendor/CLIENT to Witness 10 % of Quantity.
3.2	do	Function	Major	Operation	100%	Smooth Operation	Smooth Operation	IR	√	P	W	W	
3.3	do	Seat Leakage	Major	Hydro Static Test #	100%	Approved Drg / Data Sheet	Approved Drg / Data Sheet	IR	√	P	W	W	
Manufacturer / Sub Vendor		Contractor		<b>LEGENDS:-</b>			For Client Use:-			Document No.:-			
				Records identified by √ shall be essentially included in QA documentation. TC- Test Certificate, IR - Insp. Report			M-> Manufacturer/Sub Contractor, C-> Contractor (BHEL) or their nominated agency & N -> CLIENT						
<b>SIGNATURES</b>		<b>P-&gt;Perform, V-&gt; Verification, W-&gt; Witness</b>			Name & Signature of Approving Authority with Seal								

**Note :- In case of any difference in parameters specified in Drawing / Data Sheet & QAP, Value specified in Drg / Data Sheet shall be Final**

		<b>S/Contactor :-</b>			<b>Manufacturing Quality Plan</b>			<b>Project:-</b>				
		<b>Manufacturer :-</b>			<b>Item :- Compressor</b>			<b>Package :- Mill Rejects System</b>				
						<b>QAP No. :-</b>			<b>Client :-</b>			
						<b>LOI Nos:-</b>			<b>Contractor :- M/s BHEL</b>			
									<b>Consultant :-</b>			
Sl. No.	Components / Operations	Characteristics	Classification	Type of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Records	Agency for Checking			Remarks
1	2	3	4	5	6	7	8	9		10		11
								TYPE	D	M	C	K
1	<b>Raw Material / Bought Out's</b>											
1.1	Cylinder	Chemical & Mechanical	Major	Mfr's TC	1 per Heat or Lot	Relevant IS / Appr. Drg / Data Sheet	Relevant IS / Appr. Drg / Data Sheet	TC	√	P/V	V	V
1.2	Frame Head	do	Major	do	do	do	do	do	√	P/V	V	V
1.3	Outer Head	do	Major	do	do	do	do	do	√	P/V	V	V
1.4	Crank Shaft	do	Major	do	do	do	do	do	√	P/V	V	V
1.5	Connecting Rod	do	Major	do	do	do	do	do	√	P/V	V	V
1.6	Temp. Switch	Mfr's TC	Major	Visual Review	100%	do	do	do	√	V	V	V
1.7	Control Panel	Mfr's TC	Major	Visual Review	100%	do	do	do	√	V	V	V
2	<b>In - Process Inspection</b>											
2.1	Cylinder, Frame Head & Outer Head	Leak Tightness	Major	Hydro Static Test	100%	Appr drg. / Data Sheet	No Leakage	IR	√	P	V	V
2.2	After Cooler	Leak Tightness	Major	Hydro Static Test	100%	Approved Drg / Data Sheet	No Leakage	IR	√	P	V	V
3	<b>Final Inspection</b>											
3.1	After Cooler	Dimension / Visual	Major	Measurement	100%	Approved Drg / Data Sheet	Approved Drg / Data Sheet	IR	√	P	W	W
3.2	Control Panel	Dimension / Visual	Major	Measurement	100%	Approved Drg / Data Sheet	Approved Drg / Data Sheet	IR	√	P	W	W
3.3	Compressor Assly	Nozzle Test (Mech. Run Test)	Major	Performance	100%	Approved Drg / Data Sheet / BS 1571 Part-2	Approved Drg / Data Sheet	IR	√	P	W	W
Manufacturer / Sub Vendor		Contractor		<b>LEGENDS:-</b>			For Client Use:-		Document No.:-			
				Records identified by √ shall be essentially included in QA documentation. TC- Test Certificate, IR - Insp. Report M-> Manufacturer/Sub Contractor, C-> Contractor (BHEL) or their nominated agency & N -> CLIENT P->Perform, V-> Verification, W-> Witness								
<b>SIGNATURES</b>							Name & Signature of Approving Authority with Seal					

Note :- In case of any difference in parameters specified in Drawing / Data Sheet & QAP, Value specified in Drg / Data Sheet shall be Final


		<b>S/Contactor :-</b> Manufacturer :-			<b>Manufacturing Quality Plan</b> Item :- Sump Pump QAP No. :- LOI Nos:- Contractor :- M/s BHEL			<b>Project:-</b> Package :- Mill Rejects System Client - Consultant :-						
Sl. No.	Components / Operations	Characteristics	Classification	Type of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Records		Agency for Checking			Remarks	
1	2	3	4	5	6	7	8	9	10					11
								TYPE	D	M	C	K		
1	<b>Raw Material / Bought Out's</b>													
1.1	Casing	Chemical, Mechanical, Hardness, Surface Defect	Major	Chem. Comp. Mechanical Hardness Visual	1 per Heat 1 per Heat 1 Per Heat 100 %	Relevant IS / Appr. Drg / Data Sheet	Relevant IS / Appr. Drg / Data Sheet	TC	√	P/V	V	V		
1.2	Impeller	do	Major	do	do	do	do	do	√	P/V	V	V		
1.3	Shaft	Chemical, Mechanical, Surface Defect	Major	Chem. Comp. Mechanical Visual & UT if Dia >50 mm	1 per Heat 1 per Heat 100 %	Relevant IS / Appr. Drg / Data Sheet / ASTM E 388 for UT	Relevant IS / Appr. Drg / Data Sheet / ASTM E 388	do	√	P/V	V	V		
1.4	Shaft Sleeve	Chemical Hardness	Major	Chem. Comp. Hardness	do	do	do	do	√	P/V	V	V		
2	<b>In - Process Inspection</b>													
2.1	Casing	Soundness of Casting / Leakage	Major	Hydro Static Test	100%	Appr drg. / Data Sheet / IS 5120	No Leakage	IR	√	P	V	V	Hyd. Test at 200% of pump rated head or 150% of Shut off head which ever is higher for 30 min.	
2.2	Impeller	Residual unbalance	Major	Dyanamic / Static Balancing	100%	Approved Drg / Data Sheet / ISO 1940 Gr. 6.3	ISO 1940 Gr. 6.3	IR	√	P	V	V		

Sl. No.	Components / Operations	Characteristics	Classification	Type of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Records	Agency for Checking	Remarks			
1	2	3	4	5	6	7	8	9	10	11			
								TYPE	D	M	C	K	

3	<b>Final Inspection</b>												
3.3	Performance Test with Calibrated Test Lab Motor	Q Vs Head, Power & Efficiency, Noise & Vibration	Major	Measurement & Curves	100%	Approved Drg / Data Sheet / HIS	Approved Drg / Data Sheet / HIS	IR	√	P	W	W	Noise - 85 db max. & Vibration - 50 microns max.
3.2	Pump strip test in case of doubt due to abnormal sound	Undue Wear	Major	Visual / Strip Test	100%	Mfr's Standard	No Undue Wear	IR	√	P	W	W	
3.3	Painting	Visual & Measurement	Major	Visual & Measurement	100%	As per approved Painting Schedule	As per approved Painting Schedule	IR	-	P	-	-	

Manufacturer / Sub Vendor	Contractor	<b>LEGENDS:-</b>	Records identified by √ shall be essentially included in QA documentation. TC- Test Certificate, IR - Insp. Report	For Client Use:-	Document No.:-
		M-> Manufacturer/Sub Contractor, C-> Contractor (BHEL) or their nominated agency & N -> CLIENT			
<b>SIGNATURES</b>		<b>P-&gt;Perform, V-&gt; Verification, W-&gt; Witness</b>		Name & Signature of Approving Authority with Seal	

**Note :- In case of any difference in parameters specified in Drawing / Data Sheet & QAP, Value specified in Drg / Data Sheet shall be Final**

		S/Contactor :-			Manufacturing Quality Plan			Project:-					
		Manufacturer :-			Item :-EXPANSION BELLOW			Package :- Mill Rejects System					
					QAP No. :-			Client :-					
					LOI Nos:-								
					Contractor :- M/s BHEL			Consultant :-					
Sl. No.	Components / Operations	Characteristics	Classification	Type of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Records		Agency for Checking			Remarks
1	2	3	4	5	6	7	8	9		10			11
								TYPE	D	M	C	K	
1	<b>Raw Material</b>												
1.1	Bellows	physical & Chemical	Major	Lab Analysis	1 per Heat	AS204 TP304/ Approved Drg.	AS204 TP304/ Approved Drg.	MTC	√	V	V	V	
1.2	Flanges/ End Pipe	physical & Chemical	Major	Lab Analysis	1 per lot	IS 2062 / Approved Drg.	IS 2062 / Approved Drg.	MTC	√	V	V	V	
2	<b>In - Process Inspection</b>												
2.1	Bellows & Pipe ** For Bellows	Dimension Soundness Of Weld of L-Seam	Major major	Measurement DPT **(Before & After Forming)	100% 100%	Approved Drg. ASTM E- 165	Approved Drg. No Cracks/ Linear Indication	IR IR	√	P P	V V	V V	
3	<b>Final Inspection</b>												
3.1	Assembly	DP Test of Fillet Weld of Bellows to Pipe & Pipe to Flange	Major	visual	100%	ASTM E-165	No Crack / Linear Indication	IR	√	P	W	V	
3.2	Testing	Dimensions pressure	Major Critical	Measurement Hydraulic	100% 100%	Approved Drg EJMA D.3.2.1/ Data sheet	Approved Drg EJMA D.3.2.1/ Approved Drg.	IR IR	√ √	P P	W W	W W	
		Spring Rate Test (Axial )	Critical	Stiffness Test	100%	EJMA / Data Sheet	EJMA / Data Sheet	IR	√	P	W	W	
		Deflection	Critical	Deflection Test	100%	EJMA / Data Sheet	EJMA/Data Sheet	IR	√	p	W	W	
3.30	Painting	Visual/ Measurement	Major	DFT	100%	Approved Painting Schedule	Approved Painting Schedule	IR	√	p	-	-	
				<b>LEGENDS:-</b>			For Client Use:-		Document No.:-				
				Records identified by √ shall be essentially included in QA documentation. TC- Test Certificate, IR - Insp. Report									
Manufacturer / Sub Vendor		Contractor		M-> Manufacturer/Sub Contractor, C-> Contractor (BHEL) or their nominated agency & N -> CLIENT									
<b>SIGNATURES</b>		<b>P-&gt;Perform, V-&gt; Verification, W-&gt; Witness</b>			Name & Signature of Approving Authority with Seal								

Note :- In case of any difference in parameters specified in Drawing / Data Sheet & QAP, Value specified in Drg / Data Sheet shall be Final

Manufacturer's Name & Address :		<b>MANUFACTURING QUALITY PLAN</b>					Project :						
		Item : MS Plates & Structures			QP No. :		BHEL Ref. :						
		Sub-System :			Rev. No. : 0		Contract No.:						
					Date :		Contractor : BHEL SUB-CONTRACTOR-						
					Page No.: 11 of 1								
Sl. No.	Components & Operations	Characteristic/Item	Class	Type/method of check	Extent of Check	Reference Document	Acceptance	Format of Record		Agency			Remarks
										P	W	V	
1	2	3	4	5	6	7	8	9	D	10			11
	<b>RAW MATERIAL</b>												
1	Steel Plates	Chemical composition and Mechanical test	Major	Review of corelated MTC	One/heat	IS:2062	IS:2062	Mfgr. TC	√	3		2,1	Refer Note Below
2		Visual and dimensional Check	Major	Visual and measurement	100%	Mfgr. TC	Mfgr. TC IS 1852	Mfgr. TC	√	3	2,1		
3		Identification / Marking	Major	Co-relation establish	100%	AS per manufacturing practice	AS per manufacturing practice IS 2062	Mfgr. TC	√	3	2	1	
		<b>LEGEND :</b>					BHEL Doc. No.					Rev. 0	
		1 - BHEL / CUSTOMER			P - Agency Performing the Test		REVIEWED BY					NAME & SIGNATURE OF APPROVING AUTHORITY	
		2 - VENDOR			W - Agency Witnessing the Test								
		3 - Manufacturer			V - Agency Verifying the Test								
<b>MANUFACTURER/ SUBCONTRACTOR</b>		<b>CONTRACTOR</b>			CR - Critical Characteristics								
					MA - Major Characteristics								
					MI - Minor Characteristics								
SIGNATURE													

**Notes:**

- 1 In case material is despatched directly from SAIL/TISCO plant/stockyard or procured from dealer against co-related TC's witnessing by BHEL is waived off and material will be accepted based on MTC of SAIL/TISCO.
- 2 In case material is procured from dealer and co-related TC's are not available, check on 100% quantity of plates will be performed on sample drawn from each plate at NABL certified/ approved laboratory or any govt approved laboratory for chemical & physical properties, However dimensional check shall be witnessed by BHEL.
- 3 There will not be any inspection by CUSTOMER.



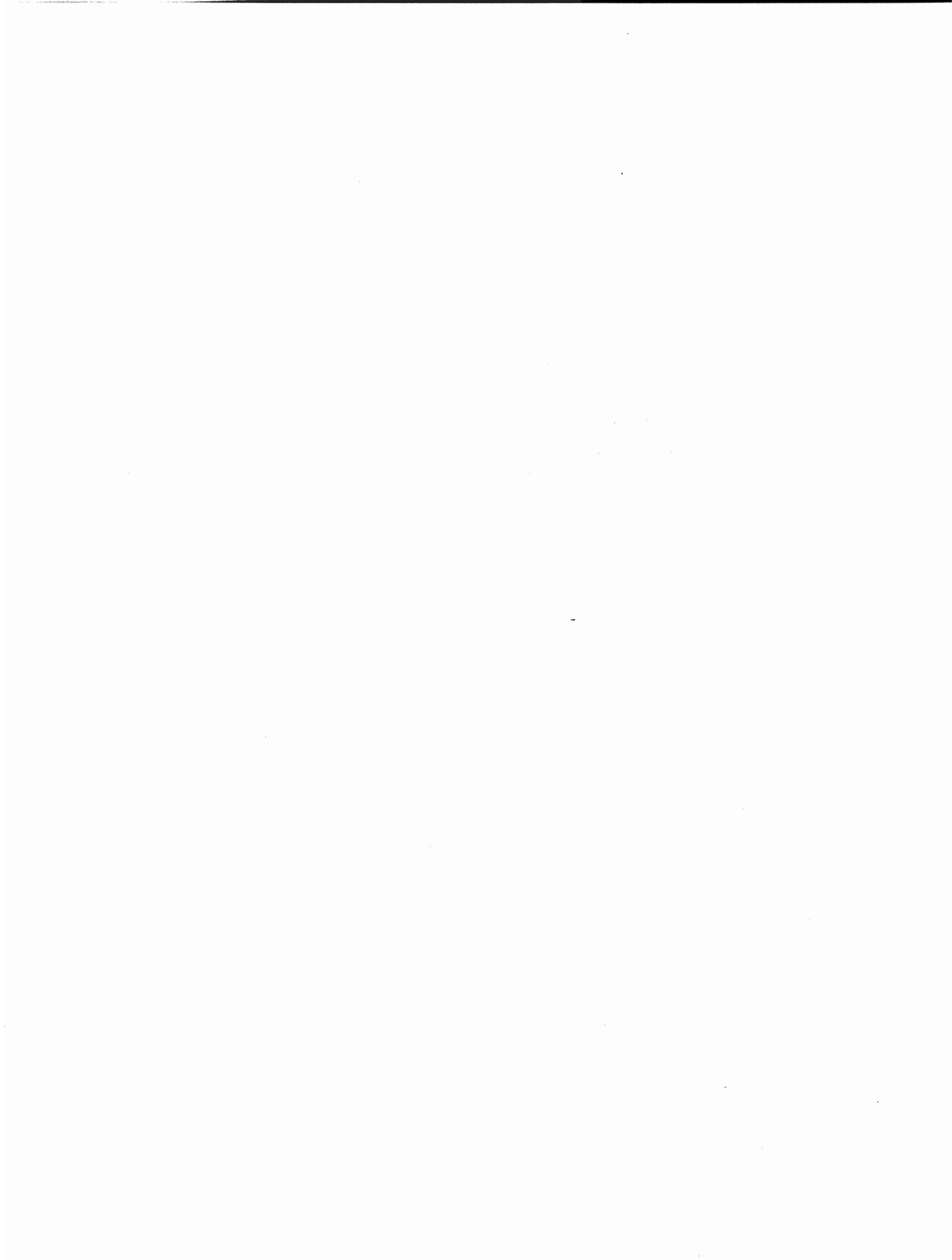
**SUB-SECTION-VII:QM5**

**MILL REJECT HANDLING SYSTEM**

**MOUDA STPP-II (2x660MW) / SOLAPUR STPP (2 x 660MW) /  
NABINAGAR STPP (3x 660MW) / MEJA TPP-I (2 x 660MW) /  
RAGHUNATHPUR TPP PHASE-II (2 x660MW)  
STEAM GENERATOR PACKAGE**

**TECHNICAL SPECIFICATION  
SECTION-VI**

**BID DOC NO.: CS-9575/ 9571/ 0370/ 0360/ 9586-102-2**



CLAUSE NO.	QUALITY ASSURANCE		
1.00.00	<b>PNEUMATIC CONVEYING SYSTEM FOR MILL REJECT</b>		
1.01.00	<b>PIPING, VALVES, STRAINERS AND FITTINGS</b> (a) All pipes and fittings shall be tested as per applicable code. (b) All valves shall be hydraulically tested for body, seat and back seat (if applicable) as per relevant Standard. Check valves shall also be tested for leak tightness test at 25% of the specified seat test pressure. Valves shall be offered in unpainted condition only. (c) Functional checks of the valves for smooth opening and closing shall also be done. (d) Strainer body shall be hydraulically tested. One of each type and size of Strainer shall be tested for Pressure drop v/s flow rate, if not tested earlier.		
1.02.00	<b>PRESSURE AND STORAGE VESSELS :</b> (a) Atmospheric Tank (i) All weld joints shall be DP tested and complete tanks shall be water fill tested. (ii) All atmospheric storage tanks fabricated and erected at site shall be subjected to all tests (Hydro, NDT and Vacuum) according to design code as applicable. (b) Pressure Vessel (1) NDT on weld joint shall be as per respective code requirements or the minimum as specified as below: (i) 100% DPT on root run of butt weld, nozzle welds and finished fillet welds. (ii) 10% DPT on all finished butt welds (iii) 10% RT (covering all 'T'/cross joints) of butt welds (2) Butt Welds of dished ends shall be stress relieved and subjected to 100% RT. (3) Each finished vessels shall be hydraulically tested to 150% of the design pressure for a duration of 30 minutes.		
1.03.00	<b>PACKAGE AIR COMPRESSOR</b> In addition to Hydraulic tests of pressure parts, performance test of the compressor shall be done for FAD, pressure, power consumption, as per relevant code. Noise and vibration shall also be measure.		
1.04.00	<b>BAG FILTERS :</b>		
1.04.01	Leakage test shall be carried out for casing and other pressure parts		
MOUDA STPP-II (2x660MW) / SOLAPUR STPP (2 x 660MW) / NABINAGAR STPP (3x 660MW) / MEJA TPP-I (2 x 660MW) / RAGHUNATHPUR TPP PHASE-II (2 x660MW) STEAM GENERATOR PACKAGE	TECHNICAL SPECIFICATION SECTION-VI BID DOC NO.: CS-9575/ 9571/ 0370/ 0360/ 9586-102-2	PART-B SUB-SECTION-VII:QM5 MILL REJECT HANDLING SYSTEM	PAGE 1 OF 2

CLAUSE NO.	QUALITY ASSURANCE		
1.04.02	Pulsing and sequential test on bag filter cages shall be done.		
1.05.00	<b>MANO RAIL HOIST/CHAIN PULLEY BLOCKS:</b>		
1.05.01	Chain pulley blocks shall be tested as per IS:3832		
1.05.02	UT & MPI/DPT shall be done on gear blank, pinion shaft, axles.		
1.05.03	Proof Load Test on hooks shall be carried out followed by DPT.		
1.05.04	100% Radiography on weld joints under tension and 25% radiography on compression butt joints followed by 100% DPT shall be done for rope drum, girder, end carriage etc.		
1.05.05	Complete hoists shall be tested for load and overload test as per IS:3177		
1.06.00	<b>VENTILATION SYSTEM :</b>		
1.06.01	Shop Run Test for all Centrifugal Fans to check noise, temp. rise & vibration.		
1.06.02	Performance test on one fan of each type for capacity, pressure, efficiency and power consumption.		
MOUDA STPP-II (2x660MW) / SOLAPUR STPP (2 x 660MW) / NABINAGAR STPP (3x 660MW) / MEJA TPP-I (2 x 660MW) / RAGHUNATHPUR TPP PHASE-II (2 x660MW) STEAM GENERATOR PACKAGE	<b>TECHNICAL SPECIFICATION SECTION-VI</b> BID DOC NO.: CS-9575/ 9571/ 0370/ 0360/ 9586-102-2	<b>PART-B SUB-SECTION-VII:QM5 MILL REJECT HANDLING SYSTEM</b>	PAGE 2 OF 2



TITLE:  
**TECHNICAL SPECIFICATION FOR  
MILL REJECT HANDLING SYSTEM**  
  
**2X660MW MAUDA STPP STAGE-II**

BHEL DOCUMENTS NO.: PE-TS-385-160-A001

VOLUME **II-B**

SECTION -C

REV. NO. 00

DATE:

Page

**ANNEXURE – IV**  
**SUB-VENDOR LIST**

**2x660 MW MAUDA STPP STAGE-II - MILL REJECT HANDLING SYSTEM**

**VENDOR LIST**

Sl. No	ITEM/SERVICE	QAP/ INSP.CAT.	Scope of supply/manufacturer	Place	Remarks by BHEL
<b>I</b>	<b>SELF MFG ITEMS</b>				
1	Pyrite Hopper	I	Self manufacturer		
2	Blow Tank	I	Self manufacturer		
3	Bunker Discharge Gate (Sector Gate)	I	Self manufacturer		
4	Pressure Relief Valve	I	Self manufacturer		
5	Local Control Panel with accessories	I	Self manufacturer		Pneumatic
6	Mill Reject Conveying fittings/Bends	I	Self manufacturer		
7	Swing Valve(Pneumatic operated)	I	Self manufacturer		
<b>II</b>	<b>BOUGHT OUT ITEMS</b>				
<b>A</b>	<b>MECHANICAL</b>				
1	Terminal Box	I	BHEL/NTPC Approved Fabricators	INDIA	
2	Air Receiver	I	PARKARE	DELHI	
		I	UNITED ENGG WORKS	NASIK	
		I	INTEGRATED ENGINEERS	PUNE	
		I	TEMASME VESELLEX	NOIDA	
		I	DIAMOND FABRICATIONS	PUNE	
3	DRAIN TRAP	III	SPIRAX MARSHAL	MUMBAI	
		III	GREAVES COTTON	MUMBAI	
		III	TRIDENT	COIMBOITORE	
4	Gate, Globe, Check valves/ NRV - C.I up to 600NB PN16	III	LEADER	JULLANDHAR	
		III	BANKIM	HOWRAH	
		III	H SARKAR	HOWRAH	
		III	KBL	KONDHAPURI	
		III	AV VALVES	AGRA	Upto 300 NB
5	Gate, Globe, Check valves/ NRV - G.M	III	LEADER	JULLANDHAR	
		III	BOMBAY METALS & ALLOYS (GG)	MUMBAI	
		III	SANT VALVES	JULLANDHAR	
6	Knife Gate/Plate Valve (H/W Operated & Cylinder Optd)	I	FOURESS	MUMBAI	
		I	VASS	CHENNAI	
		I	ORBINOX	COIMBATORE	
7	Ball Valves	III	Weir BDK	HUBLI	
		III	FLOW CHEM	KALOL	
		III	PRECISION ENGG	MUMBAI	
		III	LEADER	JULLANDHAR	
8	Safety Relief Valve	III	LEADER	JULLANDHAR	
		III	KAYSTONE(TYCO FLOW CONTROL)	HALOL	
		III	BHEL	TRICHY	
9	M.S G.I / ERW PIPES	III	SPIRAX MARSHAL	AGRA	
		I	JINDAL	GHAZIABAD	UPTO 350 NB
		I	SURYA ROSHINI	BAHADURGARH	
		II	SAIL	ROURKELA	
		I	WELLSPUN	ANJAR	
		I	INDUS	GB NAGAR	UPTO 300 NB
		II	TISCO	JAMSHEDPUR	UPTO 150 NB
10	Metallic Expansion Bellow(Metallic)	I	MAHARASHTRA SEAMLESS	MAHARASHTRA	200NB TO 400NB IS 3589
		I	METALLIC BELLOWS	CHENNAI	
		I	SUR INDUSTRIES	KOLKATA	
		I	LONESTAR	CHENNAI	
11	Rupture Disc	II	BS & B SAFETY SYSTEM	CHANNAI	
		II	HERCULES (INDEF)	MUMBAI	
12	Chain Pulley Block (1 Ton)	II	TRACTEL	FARIDABAD	
		II	LIFTING EQUIPMENTS & ACESSORIES	DELHI	
		II	KIRLOSKAR PNEUMATIC	PUNE	
13	Conveying Air Compressor (Reciprocating Type)	I	INGERSOLL RAND	AHMEDABAD	
		II	KSB PUMP	PUNE	
14	Sump Pump (Water Service)	II	MATHER & PLATT	PUNE	
		II	B & C	CHENNAI	
		II	SAM	COIMBOITORE	
		II	KIRLOSKER	PUNE	
		II	FLOWMORE	GHAZIABAD	
		II	WORTHINGTON	GHAZIABAD	
		III	SCHRADDER	MUMBAI	
		III	NUCON	HYDERABAD	
15	Pneumatic Actuator/Cylinder(Metallic)	III	ROTEX	MUMBAI	
		III	VAAS	CHENNAI	
		III	INDIANA	PUNE	
16	GRATING	III	BRANDED		
17	Tools & Trackles	III	SAIL		
		III	JSW STEEL LTD.		
		III	TISCO		
		III	ESSAR STEEL		
		III	IISCO		
		III	LLOYDE STEEL INDUSTRIES LTD.		
		III	JINDAL STEEL & POWER LTD.		
		III	RINL	VIZAG	

19	Bag Filter	I	ORIENT FANS (ACCO)	KOLKATA	
		I	THERMAX	PUNE	
		I	FLAKT	MUMBAI	
		I	BATLIBOI	DELHI	
<b>B</b>	<b>ELECTRICAL &amp; INSTRUMENTATION</b>				
1	Motor (LT)	I	MARATHON	KOLKATA	Refer Note:3 Upto 15kw, refer Note:3 HUBLI upto 90kw, refer Note:3 Refer Note:3 FARIDABAD upto 55kw, BANGALORE above 55 kw & upto 200kw, refer Note:3 Upto 160kw, refer Note:3
		I	SIEMENS	MUMBAI	
			NGEF	BANGLORE	
		I	KEC	BANGALORE/HUBLI	
		I	CGL	AHMED NAGAR	
		I	ABB	FARIDABAD/BANGLORE	
		I	BBL	MUMBAI	
2	Air Filter/Lubricator/Regulator	III	SHAVONORGAN	MUMBAI	
		III	PLACKA	CHENNAI	
3	Level Probes(RF)/Capacitance type	II	EIP ENVIRO LEVEL CONTROL	NOIDA	For RF type only
		II	NIVO CONTROL	INDORE	For capacitance type only
		III	E&H	GERMANY/AURANGABAD	
		II	FLOW STAR	FARIDABAD	For RF type only
4	Annunciator	III	IIC	MUMBAI	
		III	PECON	AHEMDABAD	
		III	PROCON	CHENNAI	
5	Solenoid Valves	III	NUCON	HYDERABAD	For Nucon cylinder only
		III	JEFFERSON	ARGENTINA	
		III	HARION	GERMANY/AURANGABAD	
		III	ASCO(I)	CHANNAI	
		III	SCHRADER DUNCAN LTD.	MUMBAI	For Schrader Duncan Cylinder only.
		III	AVCON CONTROLS	MUMBAI	
6	Pressure Switch ,DP Switch/ Temp.Switch	III	ROTEX AUTOMATION	BARODA/VV NAGAR	
		II	SWITZER	CHENNAI	Except 900 series
		II	TRAFAG	RANIPETH	
		II	GAUGE BOURDON (FOR PRESSURE SWITCH)	PANVEL	Not for temp switch
		II	ASHCROFT	GANDHINAGAR	
7	Pressure Gauge & DP Gauge	II	ASHCROFT	USA/GERMANY	
		III	GAUGE BOURDON	PANVEL	
		III	MANOMETER INDIA	MUMBAI	
		III	AUXITROL	UK	
		III	BUNDENBURG	UK	
		III	GOA THERMOSTATIC	GOA	
		III	GUCK INDIA	MUMBAI	
		III	WIKA	PUNE	
		III	SWITZER(DP INDICATOR)	CHENNAI	
		III	AN INSTRUMENTS	KOLKATA	
		III	H GURU (SI)	BANGALORE	
		8	Temperature Gauge	III	AN INSTRUMENTS
III	WIKA			PUNE	
III	GIC			MUMBAI/GOA	
III	BUDENBURG			UK	
III	GOA THERMOSTATIC			GOA	
III	H GURU (SI)			BANGALORE	
9	Pulse Jet Valves	III	WAREE	MUMBAI	
		III	ASCO	CHENNAI	
10	Cable Lug	III	MANIK	CHENNAI	
		III	BILLET (3D)	VALSAD	
		III	DOWELLS	MUMBAI	
11	Limit Switch	III	COMETT	NASIK	
		III	JAIBALAJI	CHANNAI	
12	Junction Boxes & Earthing Material ROD, FLAT etc.	III	SIEMENS	MUMBAI	
		III	NTPC/BHEL APPROVED VENDOR		main contractor approved sources with galvanizin at NTPC accepted source.
	INSTRUMENT CABLE	I	DELTON CABLES	BANGLORE	
		I	PARAMOUNT CABLES	FARIDABAD	

14		I	POLYCAB	DAMAN	
		I	UNIVERSAL CABLES	SATNA	
		I	NICCO	KOLKATTA	
		I	CORDS	BHIWADI	
15	Cable Tray	I	INCAB	PUNE	
		II	MJ ENGG	DELHI/BHIWADI	
		II	JAMUNA METALS	DELHI/SONEPAT	
		II	INDUSRIAL PERFORATION	KOLKATA	
		II	INAR PROFILES	ANAKAPLLI	
		II	INDIANA	MUMBAI	
16	Cable Gland	II	TECHNO	CHANDIGARH	
		III	COMMET	MUMBAI	
		III	SUNIL & CO	KOLKATA	
		III	ARUN ENGG.	KOLKATA	
17	Local Panel/LPBS	III	QUALITY PRECISION	KOLKATA	LOCALPANEL CAT I & LPBS CAT III
		I	CONTROL DEVICES	KOLKATA	
		I	PYROTECH	UDAIPUR	
		I	C&S	NOIDA/HARIDWAR	
		I	INDUS CONTROL AND APPLIANCE	MUMBAI	
		I	POSITRONICS	BARODA	
		I	SWITCHING CIRCUITS	KOLKATA	
18	FRP JUNCTION BOXES	I	JACKSON	GR. NOIDA	
		I	JOLLY ENGG.	KOLKATA	
19	LEVEL INDICATOR/GAUGE	III	NTPC/BHEL APPROVED VENDOR	INDIA	
		III	SBEM PVT. LTD.	PUNE	
		III	PUNE CONTROL	PUNE	
		III	LEVCON	KOLKATA	
		III	SIGMA	MUMBAI	
		III	DK INSTRUMENTS	KOLKATA	
<b>LEGENDS</b>					
<p>1. QP/INSPN CATEGORY :</p> <p>CAT-I : For these items the Quality Plans are approved by NTPC and the final acceptance will be on physical inspection witness by NTPC.</p> <p>CAT-II : For these items the Quality Plans approved by NTPC. However no physical inspection shall be done by NTPC. The final acceptance by NTPC shall be on the basis review of documents as per approved QP.</p> <p>CAT-III : For these items Main Supplier approves the Quality Plans. The final acceptance by NTPC shall be on the basis certificate of conformance by the main supplier</p> <p>UNIT/WORKS : Place of manufacturing Place of Main Supplier of multi units/works.</p>					
<p>NOTE-1 For steel following modalities to be adopted (Rev.-01)</p> <p>a) Steel plate, structural steel and section shall be procured from main producers like SAIL/TISCO/ISSCO/RINL/JINDAL/ESSAR/ISPAT/LLOYD'S STEE;/JSW.</p> <p>b) Material will be delivered directly from manufacturer's plant/stock yard/ godown to NTPC project site.</p> <p>c) Correction of material with MTC will be done by Main Contractor before delivery and Correlated MTC along with delivery challan will be NTPC-RIO for issuance of MDCC.</p> <p>NOTE-2 It that the same Quality Plans as approved for main equipment and identified in the vendor list shall be applicable for the type of control measure i.e. make test/check the procurement of mandatory spares. However, for those spares which are not covered in the approved QP, main supplier shall furnish Certificate of Conformance (COC) along with guarantee and interchangeability certificate duly signed by the main contractor. However, in both cases, the Interchangeability certificate shall be generated by the main item manufacturer, for which the spares are made.</p> <p>NOTE-3 A) LESS THAN 30 KW:- Acceptance of Motor less than 30 KW is based on COC of the manufacturer &amp; the contractor confirming as follows: it is here confirmed that the above mentioned motor/motors was /were manufacture taking care of NTPC specific requirements regarding ambient temp., voltage &amp; frequency variation, hot starts, pull out torque, starting KVA/KW, temp. rise , distance between centre of stud &amp; gland plate, space heater and tested in accordance with approved drawing/data sheet</p> <p>B) 30 KS AND ABOVE &amp; upto 50KW:- Acceptance of Motor rating between 30 KW &amp;50 KW is based on NTPC review of Routine Test inspection report as per IS 325 witnessed by main contractor along with COC of the manufacturer &amp; the contractor confirming as follows: It is hereby confirmed that the above mentioned motor /motors was/were manufactured taking care of NTPC specific requirements regarding ambient temp., voltage &amp; frequency variation, hot starts, pull out torque, starting KVA/KW, temp. rise , distance between centre of stud &amp; gland plate, space heater and tested in accordance with approved drawing/data sheet</p>					



TITLE:  
**TECHNICAL SPECIFICATION FOR  
MILL REJECT HANDLING SYSTEM**  
  
**2X660MW MAUDA STPP STAGE-II**

BHEL DOCUMENTS NO.: PE-TS-385-160-A001

VOLUME **II-B**

SECTION -C

REV. NO. 00

DATE:

Page

**ANNEXURE – V**  
**PAINING SCHEDULE**

Client :  
LOI/Order Ref. No. :

Job No. : 385

BHEL Doc. Ref. No.:

Project : 2X660MW MAUDA STPP STAGE-II

**PAINING SCHEDULE**

Sl. No.	Equipments	Surface Preparation	Primer Coat			Intermediate coat			Finish Coat			Total DFT (Micron)	Colour Shade	Remarks
			Type	No of coats	DFT per coat (Micron)	Type	No of coats	DFT per coat (Micron)	Type	No of coats	DFT per coat (Micron)			
I A)	<b>Self Manufactured (Fabricated Items)</b> Denseveyor ,Pyrite Hopper	Degreasing & Mechanical cleaning with wire brushing/Hand tool (Sa1/St2/St3 as applicable)	Heat resistant aluminium paint	2	20	~	~	~	Heat resistant aluminium paint	2	20	~ 80		
	B) Air Receiver, Bunker Discharge Gate , Pressure Relief Valve, Terminal Box.	Degreasing & Mechanical cleaning with wire brushing/Hand tool (Sa1/St2/St3 as applicable)	HB Zinc Phosphate (Alkyd medium)	2	35-45	~	~	~	Synthetic enamel (Alkyd medium) as per IS:2392	2	20-25	~ 110-140	Ref. Annexure-I enclosed	
	C1) Pneumatic Panel for Denseveyor	Seven Tank Process	HB Zinc Phosphate (Alkyd medium)	2	35-45	~	~	~	Synthetic enamel (Alkyd medium) as per IS:2392	2	20-25	~ 110-145	Ref. Annexure-I enclosed	
	C2) Compressor Panel, Main Control Panel	Seven Tank Process	HB Zinc Phosphate (Alkyd medium)	2	35-45	~	~	~	Synthetic enamel (Alkyd medium) as per IS:2392	2	20-25	~ 110-145	Ref. Annexure-I enclosed	
II	<b>Bought Out Items</b>													
1	Conveying air compressor, Motors	Degreasing & Mechanical cleaning with wire brushing/Hand tool (Sa1/St2/St3 as applicable)	HB Zinc Phosphate (Alkyd medium)	2	35-45	~	~	~	Synthetic enamel (Alkyd medium) as per IS:2392	2	20-25	~ 110-140	Ref. Annexure-I enclosed	
2	Plate Valves (Cylinder Optd. & Hand Wheel Optd.) , Metallic Expansion Bellow .	Degreasing & Mechanical cleaning with wire brushing/Hand tool (Sa1/St2/St3 as applicable)	Heat resistant aluminium paint	2	20	~	~	~	Heat resistant aluminium paint	2	20	~ 80		
3	C.I valves , Rupture Disc , Chain Pulley Block & Bag Filter Casing	Degreasing & Mechanical cleaning with wire brushing/Hand tool (Sa1/St2/St3 as applicable)	Red Oxide Zinc Chromate as per IS:2074 (Alkyd medium)	2	25-35	~	~	~	Synthetic enamel (Alkyd medium) as per IS:2392	3	20-25	~ 110-145	Ref. Annexure-I enclosed	
4	Structural Steel works including mill rejects storage bunker	SA 2 1/2	Inorganic Zinc Silicate Primer	1	75	Epoxy based Titanium di-oxide	1	75	Epoxy based two pack finish paint	2	35	~ 250	Ref. Annexure-I enclosed	Site Painting Work
									Final coat of PU paint	1	30			
5	Compressed air piping, Mill Rejects conveying piping, cooling water piping, service water piping, pipe fittings and ACI Bends.	Degreasing & Mechanical cleaning with wire brushing/Hand tool (Sa1/St2/St3 as applicable)	Red Oxide Zinc Chromate as per IS:2074 (Alkyd medium)	2	25-35	~	~	~	Synthetic enamel (Alkyd medium) as per IS:2392	3	20-25	~ 110-145	Ref. Annexure-I enclosed	Site Painting Work

Notes:

- 1 Surface preparation shown is as per Swedish standard SIS 05-5900. Degreasing will be as per Standard SSPC-SP1
- 2 GM / SS Valves and Galvanised Instrument Air Pipes will not be painted.
- 3 All instruments shall be painted as per manufacturer standard practice.
- 4 Method of painting application shall be as per paint manufacturer's recommendation.
- 5 Colour coding will be as per NTPC document no.QS-01-DIV-W-04 , Rev-1
- 6 Item/Material as per s.no 4 & 5 shall be painted at site.

## ANNEXURE - A

## COLOUR AND CODING SCHEME

Sl. No.	Equipment Description	Ground Colour		Identification Tag/Band			Legend	Remarks
		Colour	RAL	Colour	ISC No.	Equivalent RAL No.		
1	Air Receiver	Blue	5012	White		9010		
2	Motor	Blue	5012					Enamel Paint to be used
3	Pneumatic panel for Denseveyor	Blue & Grey	5012 9002					Front & Rear panels in Grey. End Panels sides in Blue
4	Conveying Air Compressor/After Cooler	Blue	5012	White		9010		Identifying legends to be used
5	Compressor panel, main control panel	Grey	9002					
6	Rupture Disc, Bag filter casing, Bunker Discharge gate, Pressure Relief Valve, Terminal box	Grey	9002					
7	Structural steel works including mill rejects storage bunker	Blue & Grey	5012 9002					Primary strl members (columns & beams) in Blue Secondary members in Grey
8	Compressed air piping, Valves & Fittings.	Grey	9002	Sky Blue	101		PA	
9	Mill rejects convey piping valves & fittings, ACI Bends	Grey	9002	White		9010		
10	Service water lines, valves & fittings	Grey	9002	Sea Green	217		RW/SW	
11	DMCW water lines, valves & fittings	Grey	9002	Sea Green	217		DMW	
12	Chain Pulley Block with Monorail	Golden Yellow	1004					
13	Hook	Signal Red	3001					

	<b>TITLE:</b> <b>TECHNICAL SPECIFICATION FOR  MILL REJECT HANDLING SYSTEM</b>  <b>2X660MW MAUDA STPP STAGE-II</b>	BHEL DOCUMENTS NO.: PE-TS-385-160-A001	
		VOLUME <b>II-B</b>	
		SECTION -C	
		REV. NO. 00	DATE:
		Page	

**ANNEXURE – VI**

**LOW PRESSURE PIPING SPECIFICATION**



**LOW PRESSURE PIPING**

1.00.00

**EQUIPMENT SIZING CRITERIA**

1.01.00

All the piping systems and equipment supplied under this package shall be designed to operate without replacement and with normal maintenance for a plant service life of 30 years, and shall withstand the operating parameter fluctuations and cycling which can be normally expected during this period.

1.02.00

For all L.P. piping system covered under this specification, sizing and system design shall be to the requirements of relevant codes and standard indicated elsewhere. In addition to this, requirements of any statutory code as applicable shall also be taken into consideration.

1.03.00

Inside diameters of piping shall be calculated for the flow requirements of various systems. The velocities for calculating the inside diameters shall be limited to the following:

a) **Water Application**


	Pipe Size	Water Velocity in m/sec		
		Below 50 mm	50-150 mm	200 mm & above
(a)	Pump suction	-----	1.2-1.5	1.2-1.8
(b)	Pump discharge and recirculation	1.2-1.8	1.8-2.4	2.1-2.5
(c)	Header	-----	1.5-2.4	2.1-2.4


Pipe line under gravity flow shall be restricted to a flow velocity of 1 m/sec generally. Channels under gravity flow shall be sized for a maximum flow velocity of 0.6 m/sec.


WILLIAM & HAZEN formula shall be used for calculating the friction loss in piping systems with the following "C" value:

(i)	Carbon steel pipe	100
(ii)	C.I Pipe/ Ductile Iron.	100
(iii)	Rubber lined steel pipe	120
(iv)	Stainless steel pipe	100


For calculating the required pump head for pump selection, at least 10% margin shall be taken over the pipe friction losses and static head shall be calculated from the minimum water level of the tank/ sump/ reservoir from which the pumps draw water.


CLAUSE NO.	TECHNICAL REQUIREMENTS																																											
	<p>(b) <b>Compressed Air Application</b></p> <p>Compressed air 15.0 m/sec.(under Average Pressure &amp; Temp. conditions)</p> <p>1.04.00 The pipes shall be sized for the worst (i.e. maximum flow, temp. and pressure values) operating conditions.</p> <p>1.05.00 Based on the inside dia. so established, thickness calculation shall be made as per ANSI B 31.1 OD and thickness of pipes shall than be selected as per ANSI B 36.10/IS-1239 Heavy grade/IS-3589/ASTM-A-53/API-5L/ANSI B 36.19 as the case may be.</p> <p>1.06.00 Corrosion allowance of 1.6 mm will be added to the calculated thickness being considered.</p> <p>1.07.00 Bend thinning allowance/manufacturing allowance etc. shall be as per the requirement of the design code provision.</p> <p>1.08.00 High points in piping system shall be provided with vents along with valves as per the system requirement. Low points shall be provided with drains along with drain valves as per the system requirement. Drain lines shall be adequately sized so as to clear condensate in the lines. Material for drain and vent lines shall be compatible with that of the parent pipe material.</p> <p>1.09.00 Material of construction for pipes carrying various fluids shall be as specified elsewhere.</p> <p>1.10.00 Compressed air pipe work shall be adequately drained to prevent internal moisture accumulation and moisture traps shall be provided at strategic locations in the piping systems.</p> <p>1.11.00 Depending upon the size and system pressure, joints in compressed air pipe work shall be screwed or flanged. The flange shall be welded with the parent pipe at shop and shall be hot dip galvanized before dispatch to site. Alternatively, the flanges on GI pipes may be screwed-on flanges also.</p> <p>1.12.00 Threaded joints shall be provided with Teflon sealant tapes.</p> <p>1.13.00 Following types of valves shall be used for the system/service indicated.</p> <table border="1"> <thead> <tr> <th>SYSTEM</th> <th colspan="6">TYPES OF VALVES</th> </tr> <tr> <th></th> <th>Butterfly</th> <th>Gate</th> <th>Globe</th> <th>Check</th> <th>Ball</th> <th>Plug</th> </tr> </thead> <tbody> <tr> <td>Water</td> <td>x</td> <td>x</td> <td>x</td> <td>x</td> <td>x</td> <td></td> </tr> <tr> <td>Air</td> <td></td> <td>x</td> <td>x</td> <td>x</td> <td>x</td> <td></td> </tr> <tr> <td>Drains &amp; vents</td> <td></td> <td>x</td> <td>x</td> <td>x</td> <td></td> <td></td> </tr> <tr> <td>Fuel oil (if any)</td> <td></td> <td>x</td> <td>x</td> <td>x</td> <td>x</td> <td>x</td> </tr> </tbody> </table> <p>1.14.00 Recirculation pipes along with valves, breakdown orifices etc. shall be provided for important pumping systems as indicated in respective process and instrumentation diagrams (P&amp;IDs).</p>	SYSTEM	TYPES OF VALVES							Butterfly	Gate	Globe	Check	Ball	Plug	Water	x	x	x	x	x		Air		x	x	x	x		Drains & vents		x	x	x			Fuel oil (if any)		x	x	x	x	x	
SYSTEM	TYPES OF VALVES																																											
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MOUDA STPP-II (2x660MW) / SOLAPUR STPP (2 x 660MW) / NABINAGAR STPP (3x 660MW) / MEJA TPP-I (2 x 660MW) / RAGHUNATHPUR TPP PHASE-II (2 x660MW) STEAM GENERATOR PACKAGE	TECHNICAL SPECIFICATION SECTION-VI BID DOC NO.: CS-9575/ 9571/ 0370/ 0360/ 9586-102-2	PART-B SUB-SECTION-II:M3 POWER CYCLE PIPING SYSTEM & LPP	PAGE 30 OF 54																																									


CLAUSE NO.	<b>TECHNICAL REQUIREMENTS</b> 		
	<p>The recirculation pipe shall be sized for minimum 30% design flow of single pump operation or the recommended flow of the pump manufacturer whichever is higher.</p>		
2.00.00	<p><b>TECHNICAL SPECIFICATION</b></p>		
2.01.00	<p><b>GENERAL</b></p>		
	<p>Specific technical requirements of low-pressure piping, fittings, supports, valves, specialties and tanks etc. have been covered under this Sub-section. It includes details pertaining to design and material of construction for piping, fittings, valves, equipment, etc. cleaning/surface preparation application of primer and painting on over ground piping. It also includes detailed technical requirement of laying underground/buried piping including water proofing/anti corrosive protection. It also covers design, engineering, manufacturing, fabrication, technical details of piping, valves, specialties, piping hangers / supports, tanks etc.</p>		
2.02.00	<p><b>Pipes and fittings</b></p>		
2.02.01	<p>All low pressure piping systems shall be capable of withstanding the maximum pressure in the corresponding lines at the relevant temperatures. However, the minimum thickness as specified in the following clauses and or respective codes for pipes and fittings shall be adhered to. The bidder shall furnish the pipe sizing/ thickness calculation as per the criteria mentioned above under LP piping equipment sizing criteria of this Technical Specification.</p>		
2.02.02	<p>Piping and fittings coming under the purview of IBR shall be designed satisfying the requirements of IBR as a minimum.</p>		
2.02.03	<p>Supporting arrangement of piping systems shall be properly designed for systems where hydraulic shocks and pressure surges may arise in the system during operation. Bidder should provide necessary protective arrangement like anchor blocks/anchor bolt etc. for the safeguard of the piping systems under above mentioned conditions. The requirement will be, however, worked out by the contractor and he will submit the detailed drawings for thrust/anchor block to the Employer. External, and internal, attachments to piping shall be designed so as not to cause flattening of pipes and excessive localized bending stresses.</p>		
2.02.04	<p>Bends, loops, off sets, expansion or flexible joints shall be used as required in order to prevent overstressing the piping system and to provide adequate flexibility. Flexibility analysis (using software packages such as Caesar-II etc.) shall be carried out for sufficiently long piping (straight run more than 300M).</p>		
2.02.05	<p>Wherever Bidder's piping coming under this specification, terminates at an equipments or terminal point not included in this specification, the reaction and the thermal movement imposed by bidder's piping on equipment terminal point shall be within limits to be approved by the Employer.</p>		
2.02.06	<p>The hot lines shall be supported with flexible connections to permit axial and lateral movements. Flexibility analysis shall be carried out for pipelines which have considerable straight run as indicated above and necessary loops/ expansion joint etc. shall be provided as may be necessary depending on layout.</p>		
2.02.07	<p>Piping and fittings shall be manufactured by an approved manufacturer of repute. They should be truly cylindrical of clear internal diameter, of uniform thickness, smooth and strong, free from dents, cracks and holes and other defects.</p>		
<p>MOUDA STPP-II (2x660MW) / SOLAPUR STPP (2 x 660MW) / NABINAGAR STPP (3x 660MW) / MEJA TPP-I (2 x 660MW) / RAGHUNATHPUR TPP PHASE-II (2 x660MW) STEAM GENERATOR PACKAGE</p>	<p>TECHNICAL SPECIFICATION SECTION-VI BID DOC NO.: CS-9575/ 9571/ 0370/ 0360/ 9586-102-2</p>	<p>PART-B SUB-SECTION-II:M3 POWER CYCLE PIPING SYSTEM &amp; LPP</p>	<p>PAGE 31 OF 54</p>


CLAUSE NO.	TECHNICAL REQUIREMENTS												
2.02.08	For rubber lined ERW pipes, beads shall be removed.												
2.02.09	Inspection holes shall be provided at suitable locations for pipes 800 Nb and above as required for periodic observations and inspection purposes.												
2.02.10	At all intersection joints, it is Contractor's responsibility to design and provide suitable reinforcements as per the applicable codes and standards.												
2.02.11	<p>For large size pipes/ducts, at high point and bends/change of direction of flow, air release valves shall be provided as dictated by the system requirement and operation philosophy &amp; tripping conditions of pumping system. Sizing criteria for air release valves shall be generally on the basis of valve size to pipe diameter ratio of 1:8. Requirement shall be decided as per relevant code.</p> <p>Transient analysis /surge analysis where ever specified and required shall be conducted in order to determine the location , number and size of the Air-Release valve on certain long distance/high volume piping systems, if applicable within the scope of work of the package.</p>												
2.03.00	<b>Material</b>												
2.03.01	Alternate materials offered by Bidder against those specified. shall either be equal to or superior to those specified, The responsibility for establishing equality or superiority of the alternate materials offered rests entirely with the Bidder and any standard code required for establishing the same shall be in English language.												
2.03.02	No extra credit would be given to offers containing materials superior to those specified. Likewise no extra credit would be given to offers containing pipe thickness more than specified.												
2.03.03	All materials shall be new and procured directly from the manufacturers. Materials procured from traders or stockists are not acceptable.												
2.03.04	All materials shall be certified by proper material test certificates. All material test certificates shall carry proper heat number or other acceptable references to enable identification of the certificate that certifies the material.												
2.03.05	<p>Material of construction for pipes carrying various fluids shall be as follows:</p> <table border="0"> <tr> <td style="vertical-align: top;">1</td> <td style="vertical-align: top;">Raw water, ash water, circulating Water, aux. cooling water, clarified Water, service water, air pre-heater Wash water, clarifier sludge and Equipment cooling water including Both primary &amp; secondary circuit (DMCW pH-corrected &amp; ACW drain water</td> <td style="vertical-align: top;">IS-2062 Gr. B/ASTM A-36/ASTM A-53 type 'E' Gr.B / IS-3589 Gr. 410 /IS-1239 Heavy. For equipment cooling water system wherever DM water is used or alkaline solution is used for pipes 50NB and below, pipe material shall be stainless steel</td> </tr> <tr> <td></td> <td></td> <td style="vertical-align: top;">to ASTM A312 Gr. 304 sch. 40 Seamless.</td> </tr> <tr> <td style="vertical-align: top;">2</td> <td style="vertical-align: top;">Dematerialized water, (condenser Make up water, Boiler fill and Deaerator Fill water, equipment cooling Water piping from overhead tank to</td> <td style="vertical-align: top;">Stainless steel to ASTM A-312, Gr.304 welded for sizes above 50mm NB</td> </tr> </table>			1	Raw water, ash water, circulating Water, aux. cooling water, clarified Water, service water, air pre-heater Wash water, clarifier sludge and Equipment cooling water including Both primary & secondary circuit (DMCW pH-corrected & ACW drain water	IS-2062 Gr. B/ASTM A-36/ASTM A-53 type 'E' Gr.B / IS-3589 Gr. 410 /IS-1239 Heavy. For equipment cooling water system wherever DM water is used or alkaline solution is used for pipes 50NB and below, pipe material shall be stainless steel			to ASTM A312 Gr. 304 sch. 40 Seamless.	2	Dematerialized water, (condenser Make up water, Boiler fill and Deaerator Fill water, equipment cooling Water piping from overhead tank to	Stainless steel to ASTM A-312, Gr.304 welded for sizes above 50mm NB	
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MOUDA STPP-II (2x660MW) / SOLAPUR STPP (2 x 660MW) / NABINAGAR STPP (3x 660MW) / MEJA TPP-I (2 x 660MW) / RAGHUNATHPUR TPP PHASE-II (2 x660MW) STEAM GENERATOR PACKAGE	TECHNICAL SPECIFICATION SECTION-VI BID DOC NO.: CS-9575/ 9571/ 0370/ 0360/ 9586-102-2	PART-B SUB-SECTION-II:M3 POWER CYCLE PIPING SYSTEM & LPP	PAGE 32 OF 54										


CLAUSE NO.	TECHNICAL REQUIREMENTS			एनटीपीसी NTPC
	<p>Suction header of DMCW pumps and chemical dosing system to Primary circuit of equipment Cooling water (DMCW System), ECW overhead tank make-up water</p> <p>3 Drinking water</p> <p>4. Instrument air &amp; plant air.</p> <p>5. (Condensate) spill water/ Deaerator Drain</p> <p>6. Oil piping</p>	<p>Stainless steel to ASTM A312, Gr. 304 sch. 40 Seamless for sizes 50mm and below</p> <p>ASTM A-53 type E Gr. B galvanized/ IS 1239 heavy galvanized/IS 3589 Gr 410 Galvanized to IS- 4736 or equivalent.</p> <p>ASTM A-53 type E Gr. B galvanized/ IS 1239 heavy galvanized/IS 3589 Gr 410 galvanized to IS- 4736 or equivalent.</p> <p>ASTM A 106 Gr. B</p> <p>API 5L</p>		
2.03.06	In water lines, pipes upto 150mm Nb shall conform to ANSI B36.10/ASTM-A-53, Type-E Gr.B /IS:1239 Gr. Heavy and minimum selected thickness shall not be less than IS:1239 Grade Heavy except for dematerialized water, drinking water and condensate spill lines.			
2.03.07	Pipes of above 150mm Nb shall be to AWWA-C200/ANSI B 36.10/ASTM A-53/IS 3589 Gr.410. Pipe to be fabricated by the bidder shall be rolled and butt welded from plates conforming to ASTM A-53 type 'E' Gr. B/IS 2062 Gr.B/ASTM-A-36. However, larger pipes, i.e. 1000mm Nb and above shall be made from plates conforming to ASTM A 36/IS 2062 Gr.B and shall meet the requirements of AWWA-M-11 (for deflection & buckling criteria considering water filled pipe as well as vacuum condition that may prevail during transient/surge conditions, truck-load, rail-load and weight density for compacted soil or any other load as the case may be).			
2.03.08	<p>In dematerialized water service, the pipes upto 50 Nb shall be of stainless steel ASTM A 312, Gr. 304 sch. 40 Seamless. The size for these pipes shall be to ANSI B 36.19. These shall be socket welded. The material for pipe from 65mm NB upto and including 400 NB shall be to ASTM A 312, Gr. 304 (welded). In no case the thickness of fittings shall be less than parent pipe thickness.</p> <p>Bidder/Contractor shall note that pipes offered as per a particular code shall conform to that code in all respects i.e. Dimension, tolerances, manufacturing methods, material, heat treatment, testing requirements, etc. unless otherwise mentioned elsewhere in the specification.</p>			
2.03.09	Instrument air, Plant (service) air lines and Drinking water lines shall be to ASTM A 53 type E grade B/ANSI B 36. 10/IS 3589, Gr. 410 / IS: 1239 Heavy (in case thickness calculated is more than gr. Heavy, ANSI B 36.10 Schedule numbers shall be followed) and galvanized to IS 4736 or any equivalent internationally reputed standard. The material of the pipes shall be to ASTM A 53 type 'E' Gr. B / IS: 3589, Gr. 410 / IS: 1239 Gr. Heavy. The fittings shall be of either same as parent material or malleable iron to IS-1879 (galvanized).			
MOUDA STPP-II (2x660MW) / SOLAPUR STPP (2 x 660MW) / NABINAGAR STPP (3x 660MW) / MEJA TPP-I (2 x 660MW) / RAGHUNATHPUR TPP PHASE-II (2 x660MW) STEAM GENERATOR PACKAGE	<b>TECHNICAL SPECIFICATION SECTION-VI</b> <b>BID DOC NO.: CS-9575/ 9571/ 0370/ 0360/ 9586-102-2</b>	<b>PART-B SUB-SECTION-II:M3 POWER CYCLE PIPING SYSTEM &amp; LPP</b>	<b>PAGE 33 OF 54</b>	


CLAUSE NO.	<div style="text-align: right;"></div> <b>TECHNICAL REQUIREMENTS</b>		
2.03.10	Spiral welded pipes as per API-5L/IS-3589 are also acceptable for pipe of size above 150 NB. However minimum thickness of the pipes shall be as elaborated in above clauses.		
2.03.11	Condensate lines shall be to ASTM A 106 Gr. B and dimension to ANSI B 36.10 schedule "standard" as minimum to be maintained.		
2.03.12	If carbon steel plates of thickness more than 12 mm are used for manufacture of pipes, fittings and other appurtenances, then the same shall be control-cooled or normalized as the case may be following the guidelines of the governing code.		
2.04.00	<b>Piping layout</b>		
2.04.01	Piping shall be grouped together where practicable and routed to present a neat appearance.		
2.04.02	Piping routing shall be such as to provide sufficient clearance for removal and maintenance of equipment, easy access to valves, instruments and other accessories. The piping shall not encroach on the withdrawal space of various equipments.		
2.04.03	Over head piping shall have a normal minimum vertical clearance of 2.5 meters above walkways and working areas and 8m above roadways/railways. When several pipe lines are laid parallel, flanged joints must be staggered. Welded and flanged joints should as far as possible be located at one third span from supports. if the support is situated right under the welded joints this joint must be reinforced with a strap. Flanged and welded joints must be avoided in the middle of the span. Valves should be located in such a manner so as to ensure their convenient operation from the floor or the nearest platform.		
2.04.04	Pipe lines of NB 50 size and below are regarded as field run piping. It is Bidder's responsibility to plan suitable layouts for these system insitu. Bidder shall prepare drawings indicating the layout of field run pipe work. These drawings shall be approved by Project Manager to the installation of the field run pipe work. Based on these approved layouts the Bidder shall prepare the BOQ of field run-pipes and submit to Employer for approval.		
2.04.05	All piping shall be routed so as to avoid interference with other pipes and their hangers and supports, electrical cable trays, ventilation ducting, structural members, equipment etc. Adequate clearance shall be ensured with respect to the above to accommodate insulation and pipe movements, if any.		
2.04.06	Piping shall generally be routed above ground but where specifically indicated/approved by the Project Manager the pipes may be arranged in trenches or buried. Pipes at working temperature above the ambient shall however not be buried.		
2.04.07	Sufficient up stream and down stream lengths shall be provided for flow measuring devices, control valves and other specialties.		
2.04.08	All local instruments shall be located on pipe lines as to render them observable from the nearest available platforms.		
2.04.09	Openings provided in the wall for pipelines must be closed with bricks and mortar with 10-12 mm clearance between brick work and pipe after taking care of insulation and thermal movement, if any. The clear space must be filled with felt or asbestos or approved filling compound.		
MOUDA STPP-II (2x660MW) / SOLAPUR STPP (2 x 660MW) / NABINAGAR STPP (3x 660MW) / MEJA TPP-I (2 x 660MW) / RAGHUNATHPUR TPP PHASE-II (2 x660MW) STEAM GENERATOR PACKAGE	<b>TECHNICAL SPECIFICATION SECTION-VI</b> <b>BID DOC NO.: CS-9575/ 9571/ 0370/ 0360/ 9586-102-2</b>	<b>PART-B SUB-SECTION-II:M3 POWER CYCLE PIPING SYSTEM &amp; LPP</b>	<b>PAGE 34 OF 54</b>


CLAUSE NO.	<div style="text-align: right;"></div> <b>TECHNICAL REQUIREMENTS</b>		
2.05.00	<b>Slope/Drains and Vents</b>		
2.05.01	<p>Suitable slope shall be provided for all pipelines towards drain points. It is Bidder responsibility to identify the requirements of drains and vents, and supply the necessary pipe work, valves, fittings, hangers and supports etc. As per the system requirement low points in the pipelines shall be provided with suitable draining arrangement and high points shall be provided with vent connections where air or gas pockets may occur. Vent for use during hydrostatic test shall be plugged after the completion of the test. Vent shall not be less than 15mm size. Drains shall be provided at low points and at pockets in piping such that complete drainage of all systems is possible. Drain shall not be less than 15mm for line size up to 150mm, not less than 20mm up to 300mm and not less than 25mm for 350mm to 600mm pipes and not less than 50mm for 600mm and above pipes.</p>		
2.05.02	<p>Air piping shall be sloped so that any part of the system can be drained through the shut-off drain valve or drain plugs.</p>		
2.06.00	<p><b>Pipe Joints</b></p> <p>In general all water lines 65mm NB and above, are to be joined generally by butt welding except the locations where valves/fittings are to be installed with flanged connections and 50mm and below by socket welding unless mentioned otherwise specifically. All air lines shall be of screwed connection and rubber lined pipes of flanged connections.</p>		
2.06.01	<p><b>Screwed</b></p> <p>(a) Threading of pipes shall be carried out after bending, heat treatment etc. If not possible, threading may be done prior to these operations but proper care should be taken to protect them from damage. Threads shall be to ANSI B 2.1 (taper) NPT/IS: 554 unless specified otherwise.</p> <p>(b) Galvanized pipe shall generally be joined by screwing into sockets. The exposed threaded portion on the outside of the pipes shall be given a zinc silicate coating. Galvanized pipes shall not be joined by welding. Screwed ends of GI pipes shall be thoroughly cleaned and painted with a mixture of red and white lead before jointing. For galvanized pipe sizes above 150 mm NB, screw &amp; socket jointing as per ASTM-A-865 shall be employed for both pipe-to-pipe and pipe-to-fitting jointing. For pipe to fitting connection since no direct threading can be done on the fittings (supplied as per ASTM-A-234 Gr. WPB and ANSI B-16.9) necessary straight pipe lengths acting as match pieces shall be welded to the fitting at both ends and subsequently the free ends of the straight lengths shall be threaded as per ASTM A-865 for jointing with main pipe. Once welding of fittings with match pieces and threading of free ends of match pieces are over, the entire fabricated piece shall be galvanized, or in case match pipes and fittings are already galvanized before the above mentioned fabrication then suitable application of Zinc-Silicate paste adequately at the welded surface (both in side &amp; out side) after welding with zinc rich electrode, along with the nascent threaded metal portions at both free ends given the same application of Zinc Silicate paste. Alternatively flanged jointing may be employed for pipe sizes 100 NB and above. However, the bidder shall ensure the galvanized pipe joints do not fail during hydro test.</p> <p>(c) Teflon tapes shall be used to seal out screwed joints and shall be applied to the male threads only. Threaded parts shall be wiped clean of oil or grease with appropriate solvent if necessary and allowing proper time for drying before applying the sealant. Pipe ends shall be reamed and all chips shall be removed. Screwed flanges shall be</p>		
MOUDA STPP-II (2x660MW) / SOLAPUR STPP (2 x 660MW) / NABINAGAR STPP (3x 660MW) / MEJA TPP-I (2 x 660MW) / RAGHUNATHPUR TPP PHASE-II (2 x660MW) STEAM GENERATOR PACKAGE	<b>TECHNICAL SPECIFICATION SECTION-VI</b> <b>BID DOC NO.: CS-9575/ 9571/ 0370/ 0360/ 9586-102-2</b>	<b>PART-B SUB-SECTION-II:M3 POWER CYCLE PIPING SYSTEM &amp; LPP</b>	<b>PAGE 35 OF 54</b>


CLAUSE NO.	<b>TECHNICAL REQUIREMENTS</b> 		
	<p>attached by screwing the pipe through the flange and the pipe and flange shall be refaced accurately.</p> <p>(d) For pipe sizes from 350 mm NB to 550 mm NB (including 350 NB &amp; 550 NB) the GI pipes shall be of flanged connection. However, the pipes after welding of flanges shall be completely galvanized. Any site welding done on galvanized pipes shall be done with zinc-rich special electrodes and the welded surfaces whether inside or outside shall be coated with zinc-silicate paste. Seal welding of flanges with zinc-rich electrode will be permitted only when any flange is leak-prone during hydro testing.</p> <p>(e) For pipe sizes 600 mm NB and above, the GI pipes shall be of welded connection (with zinc-rich special electrodes) followed by application of zinc silicate coating at welded surfaces both inside and outside the pipe, except for the last blank/blind flange, or, equipment connection where application of zinc-silicate paste after welding cannot be done due to inaccessibility of the inside welded surface and where galvanic protection has been impaired due to welding of pipe-to-pipe joint. Thus the last erection joint shall be flanged joint.</p>		
2.06.02	<p><b>Welded</b></p> <p>(a) For making up welded joints (butt weld or socket weld) the welding shall be performed by manual shielded metal arc process in accordance with the requirements specified elsewhere in the spec. Any welder employed for carrying butt welding shall be qualified as per ASME section IX for the type of joints he is going to weld. Jointing by butt weld, or socket weld shall depend upon the respective piping material specifications.</p>		
2.06.03	<p><b>Flanged</b></p> <p>(a) Flanged connections for pipes are to be kept to the minimum and used only for connections to vessel, equipments, flanged valves and other fittings like strainer/traps/orifices etc. for ease of connection and maintenance etc. Rubber lined pipes shall be flange joined only.</p> <p>(b) All flanged valves intended for installation on steel piping system, shall have their flanges drilled to ANSI B 16.5 (or equivalent) and according to the pressure class stated in their respective piping material specification.</p> <p>(c) Drilling on flanges of flanged valves must correspond to the drilling of flanges on the piping system on which the valves are installed.</p>		
2.07.00	<p><b>Bends/elbows/mitre bends/ Tees/ Reducers &amp; other fittings</b></p>		
2.07.01	<p>Unless otherwise specified elbows shall be of long radius type.</p>		
2.07.02	<p>For pipe sizes up to 65Nb, long radius forged elbows or seamless pipe bends shall be used. Pipe bends, if used, shall be cold bent to a radius measured to the centre line of pipe of 3 to 5 times the pipe diameter.</p>		
2.07.03	<p>For steel pipes 80 Nb and above, seamless long radius forged elbows shall be used. For pipe size 350Nb and above mitre bends may be used for all pipes except rubber lined pipes. The bend radius shall be 1½ times the nominal pipe diameter. 90 deg. bends (mitre) shall be in 4 pieces (3 cuts) and 45 deg. mitre bends shall be in 3 pieces 22½ deg. Fabrication of mitre bends shall be as detailed in BS 2633/BS534.</p>		
2.07.04	<p>Mitre bends are not acceptable in case of rubber lined mild steel pipes.</p>		
MOUDA STPP-II (2x660MW) / SOLAPUR STPP (2 x 660MW) / NABINAGAR STPP (3x 660MW) / MEJA TPP-I (2 x 660MW) / RAGHUNATHPUR TPP PHASE-II (2 x660MW) STEAM GENERATOR PACKAGE	<b>TECHNICAL SPECIFICATION SECTION-VI</b> <b>BID DOC NO.: CS-9575/ 9571/ 0370/ 0360/ 9586-102-2</b>	<b>PART-B SUB-SECTION-II:M3 POWER CYCLE PIPING SYSTEM &amp; LPP</b>	<b>PAGE 36 OF 54</b>


CLAUSE NO.	<div style="text-align: right;"></div> <b>TECHNICAL REQUIREMENTS</b>		
2.07.05	<p>For pipe fittings such as reducers and tees, the material shall be to astm-a-234 gr. WPB up to 300 NB. For pipe reducers and tees above 300 NB, the fittings may be fabricated conforming to parent pipe material. Provision of compensation pads shall be kept as per ANSI B 31.1. The fitting shall conform to the dimensional standard of ANSI B-16.9. However, for pipes up to 150 NB, pipe fittings may be supplied with material and dimension conforming to IS 1239 in case parent pipes also conform to IS 1239.</p> <p>For pipes, above 1200 NB, reducer and tees shall be to dimensional standard of AWWA-C-208.</p>		
2.07.06	<p>Stainless steel fittings shall conform to either ASTM-A-182, Gr. 304 (316 for Sea water application, if any) or ASTM-A-403, Gr. WP 304 (316 for Sea water application, if any) Class-S, for sizes up to and including 50mm NB, i.e., the fitting shall be of seamless construction. However, for stainless steel fittings above 50mm NB, the same shall conform to ASTM-A-403, Gr. WP 304 (316 for Sea water application, if any), Class W i.e. the fittings shall be of welded construction strictly in accordance with ASTM-A-403.</p>		
2.07.07	<p>In no case, the thickness of fittings shall be less than the thickness of parent pipe, irrespective of material of construction.</p>		
2.08.00	<p><b>Flanges</b></p>		
2.08.01	<p>Flanges shall be slip on type. Welding of flanges in tension is not permitted.,</p>		
2.08.02	<p>All flanges and-flanged drilling shall be to ANSI B 16.5/BS EN-1092 of relevant pressure/temperature class. Flanges shall be fabricated from steel plates conforming to ASTM A 105/IS 2062 Gr. B. However stainless steel flanges shall be fabricated from SS plates to ASTM-A-240, Gr. 304 (316 for Sea water application, if any) or equivalent.</p>		
2.09.00	<p><b>Specific technical requirement of laying buried pipe with anti corrosive treatment</b></p> <p>The pipe in general shall be laid with the top of the pipe minimum 1.0 (one) meter below finished general ground level.</p>		
2.09.01	<p><b>Trenching</b></p> <p>(a) The trench shall be cut true to the line and level and shall follow the gradient of the pipeline. The width of the trench shall be sufficient to give free working space on each side of the pipe. Trenches shall conform to IS 5822.</p> <p>(b) Free access shall be provided for the welding of the circumferential joints by increasing the width and depth of the trench at these points. There should be no obstruction to the welder from any side so that good welded joint is obtained.</p> <p>(c) The free working space shall conform to IS: 5822. The trench shall be excavated so as to provide minimum cover of 1000mm between the top of the pipe and finished grade.</p> <p>(d) Prior to lowering and laying pipe in any trench, the bidder shall backfill and compact the bottom of the trench or excavation in accordance with is: 5822 to provide an acceptable bed for placing the pipe.</p> <p>(e) Coating and Wrapping shall be done as under</p>		
MOUDA STPP-II (2x660MW) / SOLAPUR STPP (2 x 660MW) / NABINAGAR STPP (3x 660MW) / MEJA TPP-I (2 x 660MW) / RAGHUNATHPUR TPP PHASE-II (2 x660MW) STEAM GENERATOR PACKAGE	<b>TECHNICAL SPECIFICATION SECTION-VI</b> <b>BID DOC NO.: CS-9575/ 9571/ 0370/ 0360/ 9586-102-2</b>	<b>PART-B SUB-SECTION-II:M3 POWER CYCLE PIPING SYSTEM &amp; LPP</b>	<b>PAGE 37 OF 54</b>


CLAUSE NO.	<b>TECHNICAL REQUIREMENTS</b> 		
2.09.02	<p><b>Preparation and cleaning of piping</b></p> <p>(a) The pipeline shall be thoroughly cleaned of all rust, grease, dirt, weld scales and weld burrs etc. moisture or other foreign matter by power cleaning method such as sand blasting, power tool cleaning, etc. Grease or heavy oil shall be removed by washing with a volatile solvent such as gasoline. Kerosene will not be permitted for cleaning. This cleaning operation shall be immediately followed by priming with the mechanical priming machine.</p> <p>(b) Certain inaccessible portions of the pipeline (which otherwise not possible to be cleaned by power cleaning methods) may be scrubbed manually with a stiff wire brush and scrapped where necessary with specific permission of the Project Manager.</p> <p>(c) The cleaning and priming operation shall be carried out at site. The entire pipe length shall be cleaned but the ends of the pipes shall be left without coating for a distance of 230mm for joints, which shall be coated manually at site after laying, welding and testing the pipe.</p> <p>(d) On the internal surface for pipes 1000 Nb and above, a coat of primer followed by a hot coal-tar enamel or coal tar epoxy painting (cold) shall be applied.</p>		
2.09.03	<p><b>Coating and wrapping</b></p> <p>(a) Buried piping shall be coated and wrapped, as per specification, after completion of welded and/or flanged connections, and after completion and approval of Hydro testing. Materials to be used for coating and wrapping of underground pipelines are:</p> <ol style="list-style-type: none"> <li>(1) Coating primer (coal tar primer)</li> <li>(2) Coating enamel (coal tar enamel)</li> <li>(3) Wrapping materials.</li> </ol> <p>(b) All primer/coating/wrapping materials and methods of application shall conform to IS: 10221 except asphalt/bitumen material. Materials (primer/coating/wrapping) as per AWWA-C-203 are also acceptable.</p> <p>(c) Protective coating shall consist of coal tar primer, coal tar enamel coating, glass fiber, tissue inner wrap followed by glass fiber or coal tar impregnated Kraft outer wrap or finish coat</p> <p>(d) Number of coats and wraps, minimum thickness for each layer of application shall be as per IS-10221. Number of. Coats and wraps shall be decided based on soil corrosivity/resistivity as indicated in IS-10221. Soil data-for this purpose shall be made available.</p> <p>(e) Total thickness of completed coating shall not be less than 4.0 mm.</p> <p>(f) Alternatively, the anti-corrosive protection can consist of anti-corrosive protection Coal-tar tapes. Material and application of tapes shall conform to AWWA-C-203. These-tapes shall be applied hot over the cold coal tar primer preferably in steps of 2mm thickness so as to cover the spiral edges of the first tape by the application of second tape. The total thickness of the finished protective coating shall be 4.0 mm minimum.</p>		
MOUDA STPP-II (2x660MW) / SOLAPUR STPP (2 x 660MW) / NABINAGAR STPP (3x 660MW) / MEJA TPP-I (2 x 660MW) / RAGHUNATHPUR TPP PHASE-II (2 x660MW) STEAM GENERATOR PACKAGE	<b>TECHNICAL SPECIFICATION SECTION-VI</b> <b>BID DOC NO.: CS-9575/ 9571/ 0370/ 0360/ 9586-102-2</b>	<b>PART-B SUB-SECTION-II:M3 POWER CYCLE PIPING SYSTEM &amp; LPP</b>	<b>PAGE 38 OF 54</b>


CLAUSE NO.	<div style="text-align: right;"></div> <b>TECHNICAL REQUIREMENTS</b>		
2.09.04	<p><b>Trench bed preparation and back filling</b></p> <p>Prior to lowering and laying pipe in any excavated trench, the bottom of the trench may require to be back filled and compacted (or as the case may be) to provide an acceptable bed for placing the pipe. Bed preparation in general shall be as per IS: 5822.</p>		
2.09.05	<p><b>Laying of galvanized steel (GI) pipes</b></p> <p>All the joints shall be screwed with socket or flanged. Screwed ends of GI pipes shall be thoroughly cleaned and painted with a mixture of red and white lead before jointing. Threaded portion on either side of the socket joint shall be applied with Zinc silicate paste.</p> <p>All the provisions for trenching' bed preparation' laying the pipe application of primer' coating' wrapping with tapes and back filling etc. as indicated for "laying of buried piping" and "anti corrosive protection for buried piping" are applicable for buried galvanized steel (GI) pipes also.</p>		
2.10.00	<p><b>Cleaning and flushing</b></p>		
2.10.01	<p>All piping shall be cleaned by the Bidder before and after erection to remove grease, dirt, dust, scale and welding slag.</p>		
2.10.02	<p>Before erection all pipe work, assemblies, sub-assemblies, fittings, and components, etc. shall be thoroughly cleaned internally and externally by blast cleaning or by power driven wire brushes and followed by air-blowing. The brushes shall be of the same or similar material as the metal being cleaned. Cleaning of Galvanized pipes shall be done in such a manner that the coating on MS pipe is not affected.</p>		
2.10.03	<p>After erection, all water lines shall be mass flushed with water. The cleaning velocities in water lines shall be 1.2-1.5 times the operating velocities in the pipelines.</p>		
2.10.04	<p>All compressed air pipe work shall be cleaned by blowing compressed air.</p>		
2.11.00	<p><b>Surface preparation and painting</b></p> <p>Pipes shall be cleaned both internally and externally thoroughly by blast-cleaning or power tool cleaning method as indicated above.. In case of oil piping, cleaning will have to be done by pickling. No painting is required on stainless steel pipe / equipment surface, galvanized pipe surface or galvanized steel surface. However, necessary color banding for identification as per color code shall be done. External surface of piping shall be cleaned and prepared as indicated below.</p>		
2.11.01	<p><b>Primer painting</b></p> <p>(a) After the surface is prepared two coats of red oxide (zinc chromate/zinc phosphate) primer conforming to IS-2074/IS-12744 or equivalent shall be applied. Primer coat shall be immediately applied without any time lag after the surface preparation.</p> <p>(b) Any equipment which has been given the shop coat of primer shall be carefully examined after its erection in the field and shall be treated with a touch up coat of primer wherever the shop coat has been abraded, removed or damaged during transit/erection, or defaced during welding.</p>		
MOUDA STPP-II (2x660MW) / SOLAPUR STPP (2 x 660MW) / NABINAGAR STPP (3x 660MW) / MEJA TPP-I (2 x 660MW) / RAGHUNATHPUR TPP PHASE-II (2 x660MW) STEAM GENERATOR PACKAGE	<b>TECHNICAL SPECIFICATION SECTION-VI</b> <b>BID DOC NO.: CS-9575/ 9571/ 0370/ 0360/ 9586-102-2</b>	<b>PART-B SUB-SECTION-II:M3 POWER CYCLE PIPING SYSTEM &amp; LPP</b>	<b>PAGE 39 OF 54</b>


CLAUSE NO.	<b>TECHNICAL REQUIREMENTS</b> 		
2.11.02	<p><b>Finish painting</b></p> <p>(a) Paint to be used shall be synthetic enamel paint conforming to IS-2932 or equivalent. Finish painting shall be carried out in three coats consisting of one intermediate coat and two finishing coats. Dry film thickness (DFT) of painting inclusive of primer thickness shall be at least 150 micron.</p> <p>(b) The primed surface shall be cleaned of dust/dirt/grease etc. without scratching or in any way damaging the primer coat. The intermediate coat shall be allowed to dry before applying the finish coat or as recommended by paint manufacturer.</p> <p>(c) Paint shall be applied by brushing. It shall be ensured that brush marks are a minimum and the requirements of workmanship is as specified in IS-1477.</p> <p>(d) Paint used shall be stirred frequently to keep the pigment in suspension. Paint shall be of the ready mix type in original sealed containers as packed by the paint manufacturer. No thinners shall be permitted.</p> <p>(e) No painting shall be done in frost/foggy weather or when the humidity is high to cause-condensation on the surface to be painted.</p> <p>(f) The dry film thickness (DFT) after the painting shall not be less than 150 microns.</p>		
2.11.03	<p><b>Other requirements</b></p> <p>(a) Paint manufacturers instructions shall be followed in method of application, handling, drying time etc.</p> <p>(b) The color of the finish paint shall be as per approved color-coding.</p> <p>(c) If finish paint was applied in shop, one coat of finish paint shall be applied at site.</p> <p>(d) The dry film thickness of paint shall not be less than 0.15 mm.</p>		
2.11.04	<p><b>Color code for identification</b></p> <p>The pipes shall be color painted/banded for identification as per the approved color-coding scheme and shall be generally as per IS-9404.</p>		
2.12.00	<p><b>Specification for hangers and supports</b></p>		
2.12.01	<p>All supports and parts shall conform to the requirement of power piping code ANSI B 31.1 or approved equivalent.</p>		
2.12.02	<p>While designing supports for rubber lined pipes special consideration should be given. Any kind of welding on these pipes is not allowed after rubber lining.</p>		
2.12.03	<p>Hanger for piping 65mm Nb and larger and all spring support assemblies regardless of size shall be completely engineered in conformance with the provisions of power piping code ANSI B 31.1.</p>		
2.12.04	<p>Hangers, saddles, supports etc. shall be fabricated from plates/pipes sections conforming to ASTM A 53/IS: 2062/IS: 226/or equivalent. They shall be designed to provide the required supporting effects and allow pipe line movements as necessary. The structural steel work</p>		
MOUDA STPP-II (2x660MW) / SOLAPUR STPP (2 x 660MW) / NABINAGAR STPP (3x 660MW) / MEJA TPP-I (2 x 660MW) / RAGHUNATHPUR TPP PHASE-II (2 x660MW) STEAM GENERATOR PACKAGE	<b>TECHNICAL SPECIFICATION SECTION-VI</b> BID DOC NO.: CS-9575/ 9571/ 0370/ 0360/ 9586-102-2	<b>PART-B SUB-SECTION-II:M3</b> <b>POWER CYCLE PIPING SYSTEM &amp; LPP</b>	<b>PAGE 40 OF 54</b>


CLAUSE NO.	<b>TECHNICAL REQUIREMENTS</b> 		
	shall be as per IS: 800/BS: 4360. Insulation protection saddles shall be used at support point of all insulated piping.		
2.12.05	The support shall be so interspaced as to minimize sagging of the pipes and to keep them within in permissible limits where pipes are full with the conveying media.		
2.12.06	The maximum spans of the supports of straight length shall not exceed the recommended values indicated in ANSI B 31.1.		
2.12.07	All pipe supports shall be designed to provide an absolute minimum head room of 2.5 m from floor in passages/walkways.		
2.12.08	At all sliding surfaces of supports suitable arrangement is to be provided to minimize sliding friction.		
2.12.09	All components of hangers/supports shall be provided with two coats of primer (red oxide paint) at shop before dispatch to site. After erection they shall be given finish coat of Long Oil Synthetic enamel to IS: 2932 of total DFT 100 to 140 microns. CLH & VLH will be primed with Epoxy Zinc rich primer of 50 micron followed by finish painting of Aliphatic Acrylic Polyurethane or equivalent of DFT 65 microns.		
2.13.00	<b>Design/Construction/Material Particulars of Gate/ Globe/Check Valves/ Globe Stop Valve/Butterfly valve</b>		
2.13.01	<b>GENERAL</b> <ul style="list-style-type: none"> <li>(a) All valves shall be suitable for the service conditions i.e flow, temperature and pressure, at which they are required to operate.</li> <li>(b) The valves as well as all accessories shall be designed for easy disassembly and maintenance.</li> <li>(c) Valves to be installed outside shall be required to have the stem properly protected against atmospheric corrosion.</li> <li>(d) All rising stem valves shall be provided with back seat to permit repacking (of glands) with valves in operation. All valves shall preferably be of outside screw and yoke type.</li> <li>(e) All valves shall be closed by rotating the hand wheel in the clockwise direction when looking at the face of the hand wheel. In case where the hand wheel is not directly attached to the valve spindle suitable gearing shall be introduced.</li> <li>(f) All valves shall have indicators or direction clearly marked on the hand-wheel so that the valves opening/closing can be readily determined.</li> <li>(g) Special attention shall be given to operating mechanism for large size valves with a view to obtaining quick and easy operation ensuring that a minimum of maintenance is required. For valves of size 350mm and above either bevel or spur gearing shall be provided to facilitate manual operation.</li> <li>(h) The valves coming in vacuum lines shall be of extended gland type and/or water sealed.</li> </ul>		
MOUDA STPP-II (2x660MW) / SOLAPUR STPP (2 x 660MW) / NABINAGAR STPP (3x 660MW) / MEJA TPP-I (2 x 660MW) / RAGHUNATHPUR TPP PHASE-II (2 x660MW) STEAM GENERATOR PACKAGE	<b>TECHNICAL SPECIFICATION SECTION-VI</b> BID DOC NO.: CS-9575/ 9571/ 0370/ 0360/ 9586-102-2	<b>PART-B SUB-SECTION-II:M3 POWER CYCLE PIPING SYSTEM &amp; LPP</b>	<b>PAGE 41 OF 54</b>


CLAUSE NO.	<b>TECHNICAL REQUIREMENTS</b> 		
	<p>(i) The actuator-operated valves shall be designed on the basis of the following:</p> <ol style="list-style-type: none"> <li>(1) The internal parts shall be suitable to support the pressure caused by the actuators;</li> <li>(2) The valve-actuator unit shall be suitably stiff so as not to cause vibrations, misalignments, etc.</li> <li>(3) All actuator-operated valves shall be provided with hand operated gearing mechanism also.</li> <li>(4) All actuators operated valves shall open/ close fully within time required by the process.</li> </ol> <p>(j) Valves coming under the purview of IBR shall meet IBR requirements.</p> <p>(k) Gate/slucice valves shall be used for isolation of flow. Gate valves shall be provided with the following accessories in addition to other standard items:</p> <ol style="list-style-type: none"> <li>(1) Hand wheel</li> <li>(2) Position indicator (for above 50 mm NB valve size)</li> <li>(3) Draining arrangement wherever required.</li> </ol> <p>(l) Globe valves shall be used for regulation purposes. They shall be provided with hand wheel, position indicator, draining arrangement (wherever required) and arrow indicating flow direction.</p> <p>(m) Check valves shall be used for non-return service. They shall be swing. check type or double door (Dual plate)check type with a permanent arrow inscription on the valve body indicating the fluid flow direction. In long distance pipes lines with possibility of surge-occurrence, dual plate check valves are preferable for its spring controlled opening /closing of flaps/doors against flow reversals. However, dual plate check valves shall not be used for sizes more than 600mm NB</p> <p>(n) All gate and globe valves shall be provided with back seating arrangement to enable on line changing of gland packing.</p> <p>(o) All gate and globe valves shall be rising stem type and shall have limit switches for full OPEN and full CLOSED indication wherever required. This will include motor-operated valves also wherever required. In such cases the limit switches shall form an integral part of the valve. Stop-gap arrangement in this respect is not acceptable.</p> <p>(p) All valves shall be provided with embossed name plate giving details such as tag number, type, size etc.</p> <p>(q) Wherever required valves shall be provided with chain operator, extension spindles and floor stands or any other arrangement approved by employer so that they can be operated with ease from the nearest operating floor. Wherever necessary for safety purpose locking device shall be provided. Further, necessary small platforms for facilitating easy valve operation shall be provided by the contractor wherever necessary in consultation with project manager within the bid price at no extra cost to employer.</p>		
MOUDA STPP-II (2x660MW) / SOLAPUR STPP (2 x 660MW) / NABINAGAR STPP (3x 660MW) / MEJA TPP-I (2 x 660MW) / RAGHUNATHPUR TPP PHASE-II (2 x660MW) STEAM GENERATOR PACKAGE	<b>TECHNICAL SPECIFICATION SECTION-VI</b> <b>BID DOC NO.: CS-9575/ 9571/ 0370/ 0360/ 9586-102-2</b>	<b>PART-B SUB-SECTION-II:M3 POWER CYCLE PIPING SYSTEM &amp; LPP</b>	<b>PAGE 42 OF 54</b>


CLAUSE NO.	<b>TECHNICAL REQUIREMENTS</b> 																
<p>2.13.02</p> <p>2.13.03</p>	<p>(r) All valves except those with rising stems shall be provided with continuous mechanical position indicators; rising stem valves shall have only visual indication through plastic/metallic stem cover for sizes above 50 mm nominal bore.</p> <p>(s) For CI gate, globe and check valves wherever thickness of body/bonnet is not mentioned in the valves standards, thickness mentioned in IS- 1538 for fitting shall be applicable.</p> <p><b>VALVE BODY MATERIAL</b></p> <p>Valve body material for various services shall be as follows:</p> <p>Valve body material for water application like circulating water, Secondary circuit auxiliary cooling water of ECW system, Raw water, Ash water make-up, service water, clarified water, DM cooling water (pH corrected) &amp; drinking water shall be cast iron for sizes 65NB and above; gun-metal for sizes 50 Nb and below.</p> <p>For compressed air application, valve body material shall be cast carbon steel or forged carbon steel for sizes 65 mm NB &amp; above and Gun metal for sizes 50 NB and below.</p> <p>DM water: SS body and disc along with SS internals.</p> <p>Condensate: Cast Carbon Steel / Forged Carbon Steel.</p> <p>The design, material, construction, manufacture, inspection, testing and performance of valves shall comply with all currently applicable statutes, regulations and safety codes in the locality where the valves will be installed. The valves shall conform to the latest editions of applicable codes and standards as mentioned elsewhere. Nothing in this specification shall be construed to relieve the Bidder of his responsibility. Valves in general shall conform to the requirements of the following standards.</p> <p><b>Standards and Codes</b></p> <table border="0"> <tr> <td>AWWA-C-504</td> <td>Rubber seated butterfly valves.</td> </tr> <tr> <td>BS-5155/EN-593</td> <td>Cast iron and steel body butterfly valves for general purpose.</td> </tr> <tr> <td>IS-778</td> <td>Gun-metal gate, globe and check valves for general purpose.</td> </tr> <tr> <td>BS-5154</td> <td>Copper alloy globe/globe stop and check and gate valves for general purpose.</td> </tr> <tr> <td>IS-780</td> <td>Sluice valves for water works purpose (50-300 mm size)</td> </tr> <tr> <td>IS-2906</td> <td>Sluice valves for water works purpose (350-1200 mm size)</td> </tr> <tr> <td>IS-5150</td> <td>Cast iron wedge and double disc gate for general purpose.</td> </tr> <tr> <td>BS-5152</td> <td>Specification for cast iron globe valves.</td> </tr> </table>	AWWA-C-504	Rubber seated butterfly valves.	BS-5155/EN-593	Cast iron and steel body butterfly valves for general purpose.	IS-778	Gun-metal gate, globe and check valves for general purpose.	BS-5154	Copper alloy globe/globe stop and check and gate valves for general purpose.	IS-780	Sluice valves for water works purpose (50-300 mm size)	IS-2906	Sluice valves for water works purpose (350-1200 mm size)	IS-5150	Cast iron wedge and double disc gate for general purpose.	BS-5152	Specification for cast iron globe valves.
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CLAUSE NO.	TECHNICAL REQUIREMENTS			
2.13.04	<p>BS-5153 Cast iron check valves for general purpose.</p> <p>IS-5312 Swing check type reflux (non-return) valves.</p> <p>ANSI B 16.34 Standard for valves.</p> <p>API-594 Standard for Dual-check valves.</p> <p>API-600 Steel gate valves.</p> <p>ANSI-B-16.10 Valves face to face and other relevant dimension.</p> <p>API-598 Valves inspection test.</p> <p><b>End Connections</b></p> <p>The end connections, shall comply with the following:</p> <p>Socket welding (SW) - ANSI B 16.11</p> <p>Butt Welding (BW) - ANSI B 16.25.</p> <p>Threaded (SC) - ANSI B 2.1</p> <p>Flanged (FL) - ANSI B 16.5&amp; AWWA-C-207(steel flanges), ANSI B 16.1 (Cast Iron flanges)</p>			
2.13.05	All cast iron body valves (gate, globe and non-return) shall have flanged end connections; (screwed ends for Ductile D.2NI body valves are not acceptable).			
2.13.06	All steel and stainless steel body valves of sizes 65 mm and above shall have flanged or butt welding ends. Valves of sizes below 65mm shall have flanged or socket welded ends. Compatibility of welding between valve body material and connecting pipe material is a pre-requisite in case of butt-welded joints.			
2.13.07	All gun metal body valves shall have screwed ends.			
2.13.08	All flanged end valves/specialties. shall be furnished along with matching counter flanges, fasteners, gaskets etc. as required to complete the joints.			
2.14.00	<b>Check Valves</b>			
2.14.01	<p>Check valves shall comply with the following characteristics:</p> <p>(a) For bore greater than 2" the valves must be swing check type or dual plate check type suitable for installation in all positions (vertical and horizontal);</p> <p>(b) For bore smaller than or equal to 2" the valves must be of the piston type to be installed, in horizontal position.</p> <p>(c) In the case of swing check valves, the body seat shall be inclined at such an angle from the vertical as will facilitate closing and prevent chatter.</p>			
MOUDA STPP-II (2x660MW) / SOLAPUR STPP (2 x 660MW) / NABINAGAR STPP (3x 660MW) / MEJA TPP-I (2 x 660MW) / RAGHUNATHPUR TPP PHASE-II (2 x660MW) STEAM GENERATOR PACKAGE		TECHNICAL SPECIFICATION SECTION-VI BID DOC NO.: CS-9575/ 9571/ 0370/ 0360/ 9586-102-2	PART-B SUB-SECTION-II:M3 POWER CYCLE PIPING SYSTEM & LPP	PAGE 44 OF 54


CLAUSE NO.	<div style="text-align: right;">  </div> <b>TECHNICAL REQUIREMENTS</b>		
2.14.02	Drilling on flanges of flanged valves must correspond to the drilling on flanges of the piping system on which the valves are to be installed.		
2.14.03	All flanged valves intended for installation in steel piping systems shall have their flanges drilled to ANSI B 16.5 (or equivalent) and according to the pressure class.		
2.14.04	Counter flanges to be installed on air pipes shall be screwed-on type irrespective of size.		
2.15.00	<b>Globe Valves</b>		
2.15.01	<p>The globe valves shall have the following characteristics:</p> <p>Straight conveyed flow.</p> <p>Right angle</p> <p>Preferably, the valves shall be of the vertical stem type.</p>		
2.15.02	Globe valves shall preferably have radiused or spherical seating and discs shall be free to revolve on the spindle.		
2.15.03	The pressure shall preferably be under the disc of the valve. However, globe valves, with pressure over the disc shall also be accepted provided (i) no possibility exists that flow from above the disc can remove either the disc from stem or component from disc (ii) manual globe valves can easily be operated by hand. If the fluid load on the top of the disc is higher than 40-60 KN, bypass valve shall be provided which permits the downstream system to be pressurized before the globe valve is opened.		
2.15.04	For the regulating valves, valves with regulating plug & parabolic outline disc type is preferred.		
2.15.05	All motorized globe valves with regulating plug for which indication of percentage (%) opening are required in the control room shall be provided with necessary position transmitter.		
2.16.00	<p><b>Gate valves</b></p> <p>All gate valves shall be of the full-way type, and when in the full open position the bore of the valve shall not be constricted by any part of the gate.</p> <p>Gate valves shall be of the solid/elastic or articulated wedge disc and rising stem type.</p>		
2.17.00	<p><b>Air Release Valve</b></p> <p>(a) The air release valves shall be of automatic double air valve with two orifices and two floats. The float shall not close the valve at higher air velocities. The orifice contact joint with the float shall be leak tight joint.</p> <p>(b) The valve shall efficiently discharge the displaced air automatically from ducts/pipes while filling them and admit air automatically into the ducts/pipes while they are being emptied. The valve shall also automatically release trapped air from ducts/pipes during operation at the normal working pressure.</p> <p>(c) Body material of automatic air release valves shall comply generally with BS 1452 Gr. 14/IS: 210 Gr. FG 260. and spindle shall conform to high tensile brass.</p>		
MOUDA STPP-II (2x660MW) / SOLAPUR STPP (2 x 660MW) / NABINAGAR STPP (3x 660MW) / MEJA TPP-I (2 x 660MW) / RAGHUNATHPUR TPP PHASE-II (2 x660MW) STEAM GENERATOR PACKAGE	<b>TECHNICAL SPECIFICATION SECTION-VI</b> <b>BID DOC NO.: CS-9575/ 9571/ 0370/ 0360/ 9586-102-2</b>	<b>PART-B SUB-SECTION-II:M3 POWER CYCLE PIPING SYSTEM &amp; LPP</b>	<b>PAGE 45 OF 54</b>


CLAUSE NO.	<b>TECHNICAL REQUIREMENTS</b> 			
2.18.00 2.18.01	<p>(d) Air release valves shall not have any integral isolation device within them. Each Air release valve shall be mounted, preceded by a separate isolation gate/ butterfly valve.</p> <p><b>Butterfly valves</b></p> <p><b>Design/Construction</b></p> <p>(a) The valves shall be designed for the design pressure/temperature of the system on which it is installed and in accordance with AWWA-C-504, EN-593 or any other approved equivalent standard latest edition. Fabricated steel (IS: 2062 GR. B) butterfly valves instead of cast iron body valves are also acceptable for size above 300 mm nb diameter. In such a case, however, the bidder will have to necessarily submit thickness calculations, in order to establish the integrity of the fabricated valve body under the system operating pressure condition.</p> <p>(1) The valves shall be suitable for installation in any position (horizontal/vertical etc.) and shall be generally of double-flanged construction. However for sizes 600 NB and below the valves of Wafer construction are also acceptable</p> <p>(2) The seals, both on the body (sleeve) and on the disc shall be of the material specified. Necessary shaft seal shall be provided and adequately designed to ensure no leakage across the seal. This seal shall be designed so that they will allow replacement without removal of the valve shaft. The sealing ring on the disk shall be continuous type and easily replaceable.</p> <p>(3) For all types of valves, the design with shaft eccentric to the disc is preferred. The shaft shall be solid type and shall pivot on bushings. Bushings/sleeve type bearings shall be contained in the hub of valve body. The bearing shall be self-lubricated type with low coefficient of friction and should not have any harmful effect on water and on valve components.</p> <p>(4) The design of the shaft shall be such that it will safely sustain maximum differential pressure across the closed valve. The shaft and any key (taper pin etc.) for transmitting the torque between shaft and disc shall be capable of withstanding the maximum torque required to operate the valve. However, the shaft diameter shall not be less than the minimum shaft diameter specified in relevant code. Necessary Torque Calculation and the torque class selected on the basis of the same shall be furnished to the Employer for information.</p> <p>(5) The disc shall rotate from the full open to the tight shut position. The disc shall be contoured to ensure the least possible resistance to flow and shall be suitable for throttling operation. While the disc is in the throttled position, valve shall not create any noise or vibration.</p> <p>(6) The operating mechanism shall be mounted directly on or supported from the valve body.</p> <p>(7) All valves shall be complete with:</p> <p style="padding-left: 40px;">Position indicator (located in a visible place)</p> <p style="padding-left: 40px;">Arrow indicating the flow direction;</p>	<b>TECHNICAL SPECIFICATION</b> <b>SECTION-VI</b> <b>BID DOC NO.: CS-9575/ 9571/ 0370/</b> <b>0360/ 9586-102-2</b>	<b>PART-B</b> <b>SUB-SECTION-II:M3</b> <b>POWER CYCLE</b> <b>PIPING SYSTEM &amp;</b> <b>LPP</b>	<b>PAGE 46 OF 54</b>
<b>MOUDA STPP-II (2x660MW) / SOLAPUR STPP</b> <b>(2 x 660MW) / NABINAGAR STPP (3x 660MW) /</b> <b>MEJA TPP-I (2 x 660MW) / RAGHUNATHPUR TPP</b> <b>PHASE-II (2 x660MW)</b> <b>STEAM GENERATOR PACKAGE</b>				


CLAUSE NO.	<div style="text-align: right;"></div> <b>TECHNICAL REQUIREMENTS</b>						
2.18.02	<p>Adjustable mechanical stop limiting devices to prevent over Travel of valve disc in open/close position.</p> <p>All valves shall be "tight shut off"</p> <p>(8) Hand operated valves shall have the following</p> <p>Local hand controls</p> <p>The hand controls shall close the valve with clockwise rotation.</p> <p>The hand controls shall be dimensioned to guarantee an easy maneuver under most severe conditions.</p> <p>The hand controls shall be provided with locking systems suitable to avoid the disc assuming a non-desirable position during the operation.</p> <p>Hand wheel shall be made of malleable iron with arms and rims of adequate strength. The hand wheel of diameters 300mm or less shall be provided with handles for ease of operation. The pulling force required on the hand wheel rim shall not exceed 25 Kgf when operating the valve under full flow and operating pressure.</p> <p>Valves-350Nb and above shall have pressure equalizing bypass valves, wherever system parameters warrant the same.</p> <p>Valves-350Nb and above shall also be provided with gear operator arrangement suitable for manual operation. Manual operation of valve shall be through worm and gear arrangement having totally enclosed gearing with hand wheel diameter and gear ratio designed to meet the required operating torque It shall be designed to hold the valve disc in intermediate position between full open and full closed position without creeping or fluttering. Adjustable stops shall be provided to prevent over travel in either direction.</p> <p>Limit and torque switches (if applicable) shall be enclosed in water tight enclosures along with suitable space heaters for motor actuated valves, which may be either for On-Off operation or inching operation with position transmitter.</p> <p><b>Material of Construction (Butterfly Valves)</b></p> <p>Materials and other design details shall be as indicated below :</p> <p>(a) <b>Cast Iron Butterfly Valves</b></p> <table border="0"> <tr> <td style="padding-right: 20px;">Body &amp; Disc</td> <td>ASTM A48, Gr. 40 with 2% Ni/ IS: 210. Gr. FG-260, with 2% Ni and epoxy coated</td> </tr> <tr> <td>Shaft</td> <td>BS 970 431 S: 291 / EN 57, or AISI-410 or AWWA-permitted shaft material equivalent to EN-57/AISI-410 or better.</td> </tr> </table>			Body & Disc	ASTM A48, Gr. 40 with 2% Ni/ IS: 210. Gr. FG-260, with 2% Ni and epoxy coated	Shaft	BS 970 431 S: 291 / EN 57, or AISI-410 or AWWA-permitted shaft material equivalent to EN-57/AISI-410 or better.
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CLAUSE NO.	<div style="text-align: right;"></div> <b>TECHNICAL REQUIREMENTS</b>																				
2.18.03	<table border="0" style="width: 100%;"> <tr> <td style="width: 30%;">Seat ring</td> <td>18-8 Stainless steel</td> </tr> <tr> <td>Seal</td> <td>Nitrile Rubber</td> </tr> <tr> <td colspan="2"><b>(b) Stainless Steel Butterfly Valves</b></td> </tr> <tr> <td>Body &amp; Disc</td> <td>ASTM A 351, Gr. CF8M/ ASTM-A-182-Gr.304.</td> </tr> <tr> <td>Shaft</td> <td>ASTMA 182, Gr. 316 / ASTM-A-479 Gr.316/Equivalent</td> </tr> <tr> <td>Disc &amp; Seat Rings</td> <td>EPT/BUNA-N/Neoprene</td> </tr> <tr> <td colspan="2"><b>(c) Carbon steel Butterfly Valves</b></td> </tr> <tr> <td>Body &amp; Disc</td> <td>ASTM A 216, Gr. WCB</td> </tr> <tr> <td>Shaft</td> <td>ASTMA 182, Gr. 304 / ASTM-A-479 Gr.304/Equivalent</td> </tr> <tr> <td>Disc &amp; Seat Rings</td> <td>EPT/BUNA-N/Neoprene</td> </tr> </table> <p><b>Proof of Design Test (Type Test) for Butterfly Valves</b></p> <p>Proof of Design (P.O.D.) test certificates shall be furnished by the bidder for all applicable size-ranges and classes of Butterfly valves supplied by him, in the absence of which actual P.O.D. test shall be conducted by the bidder in the presence of Employer's representative.</p> <p>All valves that are designed and manufactured as per AWWA-C-504 shall be governed by the relevant clauses of P.O.D test in AWWA-C-504. For Butterfly valves designed and manufactured to EN-593 or equivalent, the P.O.D. test methods and procedures shall generally follow the guidelines of AWWA-C-504 in all respect except that Body &amp; seat hydro test and disc-strength test shall be conducted at the pressures specified in EN-593 or the applicable code. Actuators shall also meet requirements of P.O.D. test of AWWA-C-504.</p>	Seat ring	18-8 Stainless steel	Seal	Nitrile Rubber	<b>(b) Stainless Steel Butterfly Valves</b>		Body & Disc	ASTM A 351, Gr. CF8M/ ASTM-A-182-Gr.304.	Shaft	ASTMA 182, Gr. 316 / ASTM-A-479 Gr.316/Equivalent	Disc & Seat Rings	EPT/BUNA-N/Neoprene	<b>(c) Carbon steel Butterfly Valves</b>		Body & Disc	ASTM A 216, Gr. WCB	Shaft	ASTMA 182, Gr. 304 / ASTM-A-479 Gr.304/Equivalent	Disc & Seat Rings	EPT/BUNA-N/Neoprene
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2.19.00	<p><b>MATERIAL OF CONSTRUCTION (GATE/GLOBE/CHECK VALVE)</b></p> <p>(a) The materials shall generally comply with the following:</p> <p>(1) <b>Cast Steel Valves</b></p> <table border="0" style="width: 100%;"> <tr> <td style="width: 30%;">Body &amp; bonnet</td> <td>ASTM A 216 Gr. WCB/ ASTM A 105</td> </tr> <tr> <td>Disc for non-return Valves</td> <td>ASTM A 216 Gr. WCB/ ASTM A 105</td> </tr> <tr> <td>Trim.</td> <td>ASTM A 182 Gr. F6 or Equivalent</td> </tr> </table> <p>(2) <b>Stainless steel valves</b></p> <table border="0" style="width: 100%;"> <tr> <td style="width: 30%;">Body &amp; Bonnet</td> <td>ASTM A 351 Gr. CF 8M/ ASTM A 182 Gr. 304</td> </tr> <tr> <td>Disc</td> <td>-do-</td> </tr> </table>	Body & bonnet	ASTM A 216 Gr. WCB/ ASTM A 105	Disc for non-return Valves	ASTM A 216 Gr. WCB/ ASTM A 105	Trim.	ASTM A 182 Gr. F6 or Equivalent	Body & Bonnet	ASTM A 351 Gr. CF 8M/ ASTM A 182 Gr. 304	Disc	-do-										
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CLAUSE NO.	TECHNICAL REQUIREMENTS			
2.20.00	Trim.		ASTM 182 Gr. F. 316 /ASTM-A-479Gr.316 or Integral with body	
	(3) <b>Cast iron valves</b>			
	Body & bonnet		BS 1452 Gr. 14/ IS-210 Gr. FG 260	
	Seating surfaces and rings		13% chromium steel/ 13% Chrome overlay	
	Disc for non-return valves		BS 1452 Gr. 14/IS-210 Gr FG 260	
	Hinge pin for non-return valves		AISI 316	
	Stem for gate globe valves		13% chromium steel or Equivalent	
	Back seat		13 % chromium steel / 13% Chrome overlay	
	(4) <b>Gun Metal valves</b>			
	Body and bonnet		IS 318 Gr. 2/ Equivalent Standard	
Trim.		-do-		
(b)	Cast iron body valves shall have high alloy steel stem and seat.			
(c)	Material for counter flanges shall be the same as for the piping.			
	<b>Float operated valves</b>			
(a)	Valve shall automatically control the rate of filling and will shut off when a predetermined level is reached and close to prevent over flow on pre-set maximum water level. Valve shall also open and close in direct proportion to rise or fall of water level.			
(b)	DESIGN AND CONSTRUCTION FEATURES			
	The following design and construction feature of the valve shall be the minimum acceptable.			
(c)	Valves shall be right-angled or globe pattern.			
(d)	Valves shall be balance piston type with float ball.			
(e)	Leather liner shall not be provided.			
(f)	The body and cover material shall be cast iron conforming to ASTM-A 126 Grade 'B' or IS: 210 Grade 200 or equivalent, and Float shall be of copper with epoxy painting of two (2) coats.			
(g)	Valves shall be suitable for flow velocities of 2 to 2.5m/sec.			
(h)	The valves shall have flanged connections.			
MOUDA STPP-II (2x660MW) / SOLAPUR STPP (2 x 660MW) / NABINAGAR STPP (3x 660MW) / MEJA TPP-I (2 x 660MW) / RAGHUNATHPUR TPP PHASE-II (2 x660MW) STEAM GENERATOR PACKAGE	TECHNICAL SPECIFICATION SECTION-VI BID DOC NO.: CS-9575/ 9571/ 0370/ 0360/ 9586-102-2	PART-B SUB-SECTION-II:M3 POWER CYCLE PIPING SYSTEM & LPP	PAGE 49 OF 54	

CLAUSE NO.	<b>TECHNICAL REQUIREMENTS</b> 		
2.21.00	<p><b>PAINTING OF VALVES:</b></p> <p>Two (2) coats of primer followed by three (3) coats of enamel of approved color code/shade (usually same as that of connected piping) shall be applied to all exposed surfaces except stainless steel surface, Galvanized steel surface and gun metal surface at shop as required to prevent corrosion, before dispatch. The use of grease/oil other than light grade mineral oil, for corrosion protection is prohibited. The total DFT of painting shall be 150 micron (minimum). If during transport, unloading/unpacking or erection at site any part of the painted surface gets damaged, the same shall be made good by the contractor by repainting with compatible painting primer and enamel to the satisfaction of the project manager.</p>		
2.22.00	<p><b>Tanks and Accessories</b></p>		
2.22.01	<p>The designer and manufacturer of storage tanks shall comply with and obtain approval of all currently applicable statutory regulations and safety codes in the locality where the equipment will be installed. The tanks shall conform to IS 803/IS804/IS 805/ IS 2825/ API 650/ IS 4049/ IS 4682 (part-I) and IS 4864 to 4870/ ASME B &amp; PV code Sec.-VIII as the case may be.</p>		
2.22.02	<p><b>DESIGN AND CONSTRUCTION</b></p> <p>(a) Design of all vertical atmospheric storage tanks containing water, acid, alkali and other chemical shall conform to IS:803 &amp; API 650.</p> <p>(b) Design of all horizontal atmospheric storage tanks containing water, acid, alkali and other chemicals shall generally conform to IS:2825 as regards to fabrication and general construction taking care of combined bending, shear &amp; hoop stresses developed due to supporting arrangement.</p> <p>(c) Design temperature of vessels shall be 10 deg.C higher than the maximum temperature that any part of the vessel is likely to attain during the course of operation.</p> <p>(d) Tank shall be made from mild steel plates to BS 4360/IS-2062 Gr.B (or equivalent).</p> <p>(e) The joint efficiency factors to be adopted for design calculations shall be in accordance with the specified design code.</p> <p>(f) Tank shall be provided with suitable supporting joints. All vessels shall be provided with lifting lugs, eye bolts etc. for effective handling during erection.</p> <p>(g) The material for flanges shall be of ASTM A 105/ IS-2062 Gr.B.</p> <p>(h) For cylindrical tanks, the plates shall be cold rolled through plate bending machine by several number of passes to true curvature.</p> <p>(i) Vessel seams shall be so positioned that they do not pass through vessel connections. For cylindrical vessel consisting of more than two sections longitudinal seams shall be offset.</p>		
MOUDA STPP-II (2x660MW) / SOLAPUR STPP (2 x 660MW) / NABINAGAR STPP (3x 660MW) / MEJA TPP-I (2 x 660MW) / RAGHUNATHPUR TPP PHASE-II (2 x660MW) STEAM GENERATOR PACKAGE	<b>TECHNICAL SPECIFICATION SECTION-VI</b> <b>BID DOC NO.: CS-9575/ 9571/ 0370/ 0360/ 9586-102-2</b>	<b>PART-B SUB-SECTION-II:M3 POWER CYCLE PIPING SYSTEM &amp; LPP</b>	<b>PAGE 50 OF 54</b>

CLAUSE NO.	<p style="text-align: center;"><b>TECHNICAL REQUIREMENTS</b></p> 		
<p>2.22.03</p> <p>2.22.04</p>	<p>(j) Tanks shall be provided with float operated level indicators/level gauges/level transmitters and level switches, as required, with complete assembly. Suitable flanged pads for level switches mounting shall also be provided. The level indicator can be top or side mounted as the case may be.</p> <p>(k) In addition to inlet and outlet nozzles, the tanks shall be provided with vents, overflow, drain nozzles complete for various connections on tanks. Overflow lines from storage tanks is to be routed to the nearest surface drains. For tanks containing dm water, alkaline water or power cycle water the vent to atmosphere shall be through carbon-di-oxide absorber vessel suitably mounted on the tank. CO2 absorber vessel shall be provided with the initial fill of chemicals. Similarly for equipment cooling water overhead tank, the overflow &amp; drain from tank shall be combined together and shall be led to nearest drain (at zero level) via. a seal-trough so as not to come directly in contact with atmosphere.</p> <p>(l) Tanks shall have suitable stairs/ladders on inside and outside of the tanks, manholes/inspection covers as required and also platform suitably located.</p> <p>(m) Tank supporting arrangement as approved by Employer shall be provided with all plates/angles/joints/flats and supporting attachment including lugs, saddles, legs etc.</p> <p>(n) Piercing nozzles/pipes from tank body / dish ends shall be adequately compensated as per relevant code.</p> <p>(o) Tank fabrication drg. and design calculations shall be approved by the Project Manager.</p> <p><b>Corrosion protection</b></p> <p>(a) A corrosion allowance, applicable to surface in contact with corrosive media, when required, shall be taken into consideration.</p> <p>(b) Manholes shall be provided for easy access into the vessels. The size shall be minimum 500 mm and will be with cover plate, nuts bolts, etc. to ensure leak tightness at the test pressure.</p> <p>(c) Each tank shall be provided with drilled cleats welded to the tank for electrical grounding. Material of cleats shall be same as that of the shell.</p> <p>(d) Epoxy-coating shall be provided on the inside of vessel in three coats (minimum) resulting in total thickness of not less than 150 micron in which ever case required, such as equipment cooling water overhead tank, sodium hydroxide tank, condensate storage tank, condensate surge tank etc.</p> <p><b>Cleaning &amp; Painting</b></p> <p>(a) Inside surface of all tanks shall be protected by anti-corrosive paints as required.</p> <p>(b) For tanks/vessel requiring epoxy painting, all inside surface shall be blast cleaned using non-siliceous abrasive after usual wire brushing.</p> <p>(c) Outside surfaces of all vessels shall be provided with two coats of primer with three (3) coats of epoxy resin based paint of approved color.</p>		
<p>MOUDA STPP-II (2x660MW) / SOLAPUR STPP (2 x 660MW) / NABINAGAR STPP (3x 660MW) / MEJA TPP-I (2 x 660MW) / RAGHUNATHPUR TPP PHASE-II (2 x660MW) STEAM GENERATOR PACKAGE</p>	<p style="text-align: center;"><b>TECHNICAL SPECIFICATION SECTION-VI</b> BID DOC NO.: CS-9575/ 9571/ 0370/ 0360/ 9586-102-2</p>	<p style="text-align: center;"><b>PART-B SUB-SECTION-II:M3 POWER CYCLE PIPING SYSTEM &amp; LPP</b></p>	<p style="text-align: center;">PAGE 51 OF 54</p>

CLAUSE NO.	TECHNICAL REQUIREMENTS			
2.23.00	<b>RUBBER EXPANSION JOINTS</b>			
2.23.01	All parts of expansion joints shall be suitably designed for all stresses that may occur during continuous operation and for any additional stresses that may occur during installation and also during transient condition.			
2.23.02	The expansion joints shall be single bellow rubber expansion joints. The arches of the expansion joints shall be filled with soft rubber.			
2.23.03	The tube (i.e. inner cover) and the cover (outer) shall be made of natural or synthetic rubber of adequate hardness. The shore hardness shall not be less than 60 deg. A for outer and 50 deg. A for inner cover.			
2.23.04	The carcass between the tube and the cover shall be made of high quality cotton duck, preferably, square woven to provide equal strength in both directions of the weave. The fabric plies shall be impregnated with age resistant rubber or synthetic compound and laminated into a unit.			
2.23.05	Reinforcement, consisting of solid metal rings embedded in carcass shall be provided.			
2.23.06	Expansion joints shall be complete with stretcher bolt assembly. The expansion joints shall be suitable to absorb piping movements and accommodate mismatch between pipe lines.			
2.23.07	The expansion joints shall be of heavy duty construction made of high grade abrasion-resistant natural or synthetic rubber compound. The basic fabric for the 'duck' shall be either a superior quality braided cotton or synthetic fibre having maximum flexibility and non-set characteristic.			
2.23.08	The expansion joints shall be adequately reinforced, with solid steel rings, to meet the service conditions under which they are to operate.			
2.23.09	All expansion joints shall be provided with stainless steel retaining rings for DM water application and IS 2062 Gr B galvanized steel retaining rings for ordinary water for use on the inner face of the rubber flanges, to prevent any possibility of damage to the rubber when the bolts are tightened. These rings shall be split and beveled type for easy installation and replacement and shall be drilled to match the drilling on the end rubber flanges and shall be in two or more pieces.			
2.23.10	The expansion joints shall have integral fabric reinforced full-face rubber flanges. The bolt on one flange shall have no eccentricity in relation to the corresponding bolt hole on the flange on the other face. The end rubber flanges shall be drilled to suit the companion pipe flanges.			
2.23.11	All exposed surfaces of the expansion joint shall be given a 3 mm thick coating of neoprene. This surface shall be reasonably uniform and free from any blisters, porosity and other surface defects.			
2.23.12	Each control unit shall consist of two (2) numbers of triangular stretcher bolt plates, a stretcher bolt with washers, nuts, and lock nuts. Each plate shall be drilled with three holes, two for fixing the plate on to the companion steel flange and the third for fixing the stretcher bolt.			
2.23.13	Each joint shall have a permanently attached brass or stainless steel metal tag indicating the tag numbers and other salient design features.			
2.23.14	Bidder to note that any metallic part which comes in contact with DM /corrosive water shall be of Stainless Steel material.			
MOUDA STPP-II (2x660MW) / SOLAPUR STPP (2 x 660MW) / NABINAGAR STPP (3x 660MW) / MEJA TPP-I (2 x 660MW) / RAGHUNATHPUR TPP PHASE-II (2 x660MW) STEAM GENERATOR PACKAGE		<b>TECHNICAL SPECIFICATION SECTION-VI</b> <b>BID DOC NO.: CS-9575/ 9571/ 0370/ 0360/ 9586-102-2</b>	<b>PART-B SUB-SECTION-II:M3</b> <b>POWER CYCLE PIPING SYSTEM &amp; LPP</b>	<b>PAGE 52 OF 54</b>



CLAUSE NO.	<b>TECHNICAL REQUIREMENTS</b> 		
2.24.03	<p>(e) Thickness of the strainer element should be designed to withstand the pressure developed within the strainer due to 100% clogged condition exerting shut-off pressure on the element.</p> <p>Three shop coats of paint preceded by two coats of primer shall be applied to all exposed surfaces as required to prevent corrosion.. All parts shall be adequately protected for rust prevention. The use of grease or oil other than light grade mineral oils for corrosion protection is prohibited.</p>		
MOUDA STPP-II (2x660MW) / SOLAPUR STPP (2 x 660MW) / NABINAGAR STPP (3x 660MW) / MEJA TPP-I (2 x 660MW) / RAGHUNATHPUR TPP PHASE-II (2 x660MW) STEAM GENERATOR PACKAGE	<b>TECHNICAL SPECIFICATION SECTION-VI</b> BID DOC NO.: CS-9575/ 9571/ 0370/ 0360/ 9586-102-2	<b>PART-B SUB-SECTION-II:M3 POWER CYCLE PIPING SYSTEM &amp; LPP</b>	<b>PAGE 54 OF 54</b>



TITLE:

**TECHNICAL SPECIFICATION FOR  
MILL REJECT HANDLING SYSTEM**

**2X660MW MAUDA STPP STAGE-II**

BHEL DOCUMENTS NO.: PE-TS-385-160-A001

VOLUME **II-B**

SECTION -C

REV. NO. 00

DATE:

Page

## ANNEXURE – VII

### SPARES





**SUB-SECTION - VII**  
**MANDATORY SPARES**


MOUDA SUPER THERMAL POWER PROJECT  
STAGE-II (2x660 MW)  
STEAM GENERATOR PACKAGE


TECHNICAL SPECIFICATION  
SECTION-VI  
BID DOCUMENT NO. : CS-9575/9571/0370/0360/9586-102-2




CLAUSE NO.	SCOPE OF SUPPLY & SERVICES			
	<p>Section and should be independent of the list of the mandatory spares. The Employer reserves the right to buy any or all of the recommended spares. The recommended spares shall be delivered at project site at least two months before the scheduled date of initial operation of first unit. However, the spares shall not be dispatched before the dispatch of the main equipment.</p> <p>b) Prices of recommended spares will not be used for evaluation of the bids. The price of these spares will remain valid up to 6 months after placement of Notification of Award for the main equipment. However, the Contractor shall be liable to provide necessary justification for the quoted prices for these spares as desired by the Employer.</p>			
1.03.00	<p><b>START-UP &amp; COMMISSIONING SPARES</b></p> <p>a) Start-up &amp; commissioning spares are those spares which may be required during the start-up and commissioning of the equipment/system. All spares used till the Plant is handed over to the Employer shall come under this category. The Contractor shall provide for an adequate stock of such start up and commissioning spares to be brought by him to the site for the plant erection and commissioning. They must be available at site before the equipments are energized. The unused spares, if any, should be removed from there only after the issue of Taking Over certificate. All start up spares which remain unused at the time shall remain the property of the Contractor.</p>			
1.04.00	<p>The Bidder shall include in his scope of supply all the necessary Mandatory spares, Start-up and commissioning spares and indicate these in the relevant schedules of the Bid Forms &amp; Price Schedules. The general requirements pertaining to the supply of these spares is given below:</p>			
2.00.00	<p>The Contractor shall indicate the service expectancy period for the spare parts (both mandatory and recommended) under normal operating conditions before replacement is necessary.</p>			
3.00.00	<p>All spares supplied under this contract shall be strictly inter-changeable with the parts for which they are intended for replacements. The spares shall be treated and packed for long storage under the climatic conditions prevailing at the site e.g. small items shall be packed in sealed transparent plastic with desiccator packs as necessary.</p>			
4.00.00	<p>All the spares (both recommended and mandatory) shall be manufactured along with the main equipment components as a continuous operation as per same specification and quality plan.</p>			
5.00.00	<p>The Contractor will provide Employer with cross-sectional drawings, catalogues, assembly drawings and other relevant documents so as to enable the Employer to identify and finalize order for recommended spares.</p>			
6.00.00	<p>Each spare part shall be clearly marked or labeled on the outside of the packing with its description. When more than one spare part is packed in a single case, a general description of the content shall be shown on the outside of such case and a detailed list enclosed. All cases, containers and other packages must be suitably marked and numbered for the purposes of identification.</p>			
7.00.00	<p>All cases, containers or other packages are to be opened for such examination as may be considered necessary by the Employer.</p>			
<p><b>MOUDA SUPER THERMAL POWER PROJECT STAGE-II (2X660 MW) STEAM GENERATOR PACKAGE</b></p>	<p><b>TECHNICAL SPECIFICATION SECTION-VI BID DOC. NO. : CS-9575/9571/0360/0370/9586-102-2</b></p>	<p><b>PART-A SUB SECTION-VII MANDATORY SPARES</b></p>	<p><b>PAGE 2 OF 22</b></p>	

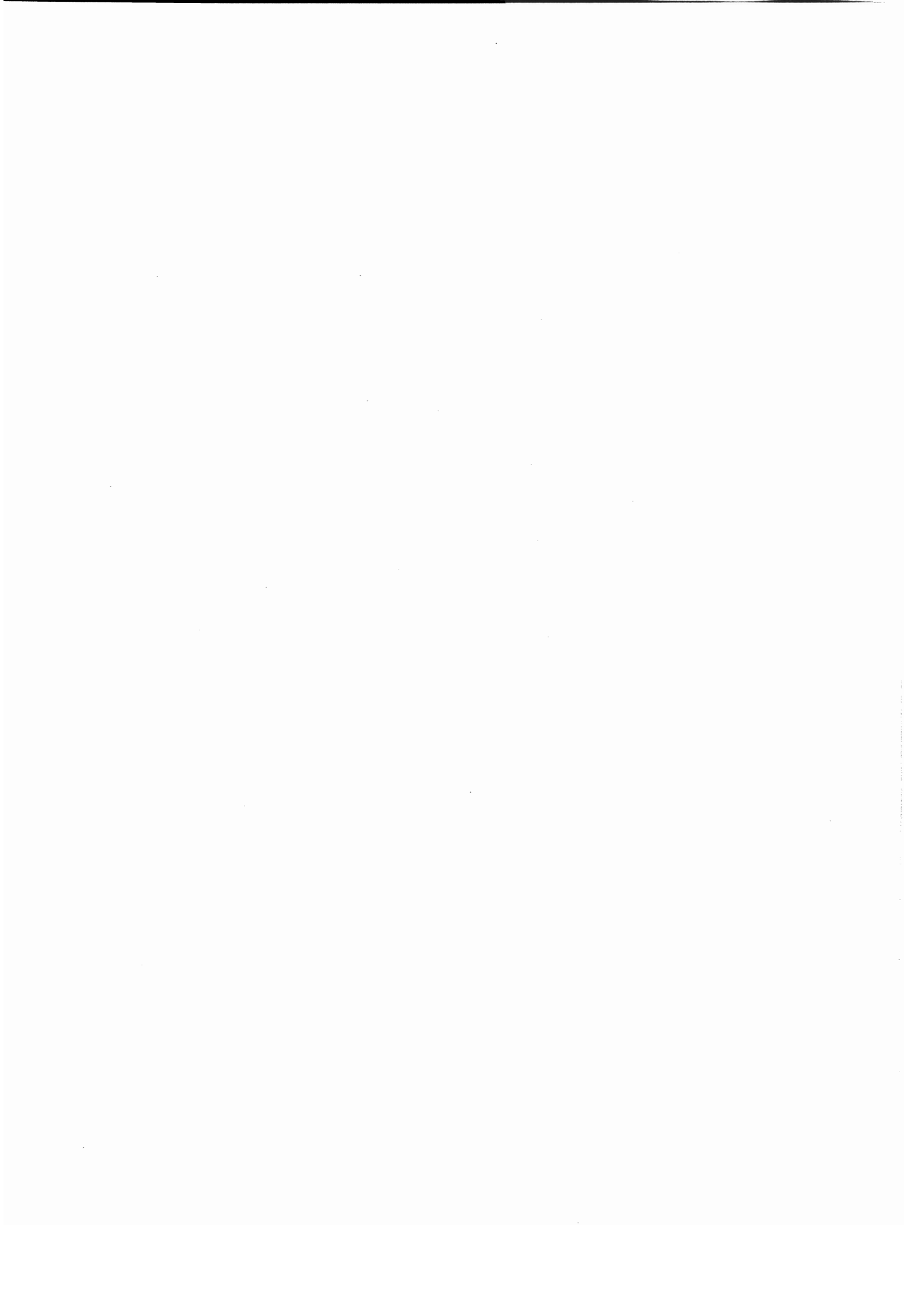
CLAUSE NO.	SCOPE OF SUPPLY & SERVICES			
8.00.00	<p>The Contractor will provide the Employer with all the addresses and particulars of his sub-suppliers while placing the order on vendors for items/components/equipments covered under the Contract and will further ensure with his vendors that the Employer, if so desires, will have the right to place order for spares directly on them on mutually agreed terms based on offers of such vendors.</p>			
9.00.00	<p>The Contractor shall warrant that all spares supplied will be new and in accordance with the Contract Documents and will be free from defects in design, material and workmanship.</p>			
10.00.00	<p>In addition to the recommended spares listed by the Contractor, if the Employer further identifies certain particular items of spares, the Contractor shall submit the prices and delivery quotation for such spares within 30 days of receipt of such request with a validity period of 6 months for consideration by the Employer and placement of order for additional spares if the Employer so desires.</p>			
11.00.00	<p>The Contractor shall guarantee the long term availability of spares to the Employer for the full life of the equipment covered under the Contract. The Contractor shall guarantee that before going out of production of spare parts of the equipment covered under the Contract, he shall give the Employer at least 2 years advance notice so that the latter may order his bulk requirement of spares, if he so desires. The same provision will also be applicable to Sub-contractors. Further, in case of discontinuance of manufacture of any spares by the Contractor and/or his Sub-Contractors, Contractor will provide the Employer, two years in advance, with full manufacturing drawings, material specifications and technical information including information on alternative equivalent makes required by the Employer for the purpose of manufacture/procurement of such items.</p>			
<b>MOUDA SUPER THERMAL POWER PROJECT STAGE-II (2X660 MW) STEAM GENERATOR PACKAGE</b>	<b>TECHNICAL SPECIFICATION SECTION-VI BID DOC. NO. : CS-9575/9571/0360/0370/9586-102-2</b>	<b>PART-A SUB SECTION-VII MANDATORY SPARES</b>	<b>PAGE 3 OF 22</b>	

CLAUSE NO.	SCOPE OF SUPPLY & SERVICES		
SI. NO.	PARTICULARS	QUANTITY	
	8. Discharge NRV	1 no.	
	9. Diaphragm / hydra tube (as the case may be)	5 nos.	
<b>1.25.00</b>	<b>EQUIPMENT COOLING SYSTEM, PLATE TYPE EXCHANGER</b>		
	<b>A. DMCW Pumps</b>	1 Complete Set	
	1. Impeller	1 No.	
	2. Shafts	2 Nos.	
	3. Shaft Sleeve	2 sets	
	4. Casing wearing rings (if applicable)	2 sets	
	5. Impeller wearing rings (if applicable)	2 Sets of each type and size	
	6. Bearings for the pumps	1 set of each type and size	
	7. Motor Bearings	2 sets of each type & size	
	8. Thrust Bearings (if applicable)	1 set of each type and size	
	9. Sleeve nuts and O-rings	2 sets of each type & size	
	10. Gland & Gland Packing (if applicable)	2 sets of each type & size	
	11. Complete Coupling (Pump and Motor)	1 set of each type and size.	
	12. Mechanical seal (if applicable)	1 Complete Set and size.	
	<b>B. Plate Type Heat Exchangers</b>		
	1. Gaskets	30% of total requirement	
	2. Plates	2% each type	
<b>1.26.00</b>	<b>Mill Reject Handling System</b>		
	<b>A. Pneumatic Conveying System</b>		
	1. Conveying System Spares		
	a) Pneumatic main valves	4 sets of each type	
	b) Pneumatic/Solenoid Two/ Three position control valve	4 sets of each type	
	c) Plate/Dome valve(including seals) with Actuators (pneumatic/hydraulic) s	6 nos.	
	d) Plate/Dome valve seals	6 sets	
	<b>B. Compressors (Reciprocating type, if applicable)</b>		
	1. Compressor	1 no of each	
<b>1.27.00</b>	<b>AIR COMPRESSORS / ADP /COMPRESSOR HOUSE CRANE</b>		
	<b>1. H. P. Stage</b> Complete HP Stage assembly consisting of high pressure element, Bearing for male and female rotors (drive end), Bearing for male and female rotors (non-drive end), Timing gears, Graphite ring shaft for compressor chamber seals or white metal labyrinth, suction valve, discharge valve, packing set, Axial thrust bearing, Labyrinth oil seal or radial seals or double acting seals for drive shafts.	1 Set of each type/rating	
	<b>2. L. P. Stage</b> Complete LP Stage assembly consisting of high pressure element, Bearing for male and female rotors (drive end),Bearing for male and female rotors	1 Set of each type/rating	
<b>MOUDA SUPER THERMAL POWER PROJECT STAGE-II (2X660 MW) STEAM GENERATOR PACKAGE</b>		<b>TECHNICAL SPECIFICATION SECTION-VI BID DOC. NO. : CS-9575/9571/0360/0370/9586-102-2</b>	<b>PART-A SUB SECTION-VII MANDATORY SPARES</b>
			<b>PAGE 16 OF 22</b>

CLAUSE NO.	SCOPE OF SUPPLY & SERVICES		
SI. NO.	PARTICULARS	QUANTITY	
	5.1 Signal Processor and interface modules	20% or 2 nos. of each type and model whichever is more	
	5.2 Sensors and Transceivers	20% or 2 nos. of each type and model which is more.	
	5.3 All Electronic Cards including Power Packs	20% or 2 nos. of each type and model which is more.	
	5.4 Seal kit for Sound Generator	20% or 2 nos. of each type and model which is more.	
	6. Furnace and Flame viewing system		
	6.1 Flame Cameras	10% or 2 nos., whichever is more	
	6.2 Electronic Modules	10% or 2 nos. of each type whichever is more	
	7. Conductivity type level monitoring system (for driplegs)		
	7.1 Electrodes	50% of population	
	7.2 Electronic Cards	20% or 2 nos. of each type and model whichever is more.	
	7.3 Lamps/LEDs of display units	100%	
	8. Separator level monitoring system	20% or 2 nos. of each type of component, whichever is more	
	9. Mill and Air heater Fire detection system.		
	9.1 Thermocouple	10%	
	9.2 Process actuator switches	10%	
	10. Acoustic Leak Protection system (ASLD) (if applicable)		
	(i) Processor and Interface modules	10% or 1 no. of each type and model, whichever is more	
	(ii) Sensors and Transceivers	10% or 1 no. of each type and model, whichever is more	
<b>3.03.00</b>	<b>MEASURING INSTRUMENTS</b> (for all systems including Air Compressor, FOPH, Dosing System, ECW System etc.)		
	1. Electronic Transmitters		
	1.1 Transmitters of all types, ranges and model no. (for the measurement of Pressure, differential pressure flow, level, etc.)	10% or 1 no. of each type and model	
	1.2 Level Transmitters (Ultrasonic/ radar type)	50% of each type and length, including sensors	
	2. Temperature elements		
	2.1 RTD's* of each type and length(with head assembly, terminal block & nipple)	10% or 2 nos. of each type and length, whichever is more	
	2.2 Thermocouples of each type like K-type, R-type, metal etc. * (with head assembly, terminal block & nipple)	10% or 2 nos. of each type and length which ever is more	
	2.3 Cold junction compensation boxes of each model (if applicable)	10% or 2 nos. whichever is more	
	2.4 Thermostatic units for each model of CJC box (if applicable)	10% or 2 nos. whichever is more	
	2.5 Thermowell for application like mill outlet temperature and SH/RH/Eco/ flue gas temp. in furnace	10% or 2 nos. of each type and length whichever is more	
<b>MOUDA SUPER THERMAL POWER PROJECT STAGE-II (2X660 MW) STEAM GENERATOR PACKAGE</b>		<b>TECHNICAL SPECIFICATION SECTION-VI BID DOC. NO. : CS-9575/9571/0360/0370/9586-102-2</b>	<b>PART-A SUB SECTION-VII MANDATORY SPARES</b>  <b>PAGE 20 OF 22</b>

CLAUSE NO.	SCOPE OF SUPPLY & SERVICES		
SI. NO.	PARTICULARS	QUANTITY	
	2.6 Temperature transmitters	10% of each type and length	
	3. Local Indicators like temperature gauges, pressure gauges, differential pressure gauges, flow gauges, flow meters etc.,	5% or 1 no. of each make, model and type whichever is more (to be divided to various ranges in proportion to main of all make, model, type population)	
	4. Process Actuated Switch Devices Includes all types of Pressure, differential pressure, flow, temperature, differential temperature, level switch Devices	5% or 1 no. of each type and model whichever is more	
	5. PD Type Flow Transmitters	1 no. of each type and model	
	6. Flue Gas Analyzer Instruments for Oxygen	1 no. each complete instrument.	
	(i) Electronic Card Assemblies of each type	10%	
	(ii) Sets of Gaskets/ "O" rings	2 sets	
	(iii) Temperature Sensor & heater Assembly	20%	
	(iv) Complete Probe with shield assembly.	2 nos.	
	(v) Consumables like filter elements.	100%	
<del>3.04.00</del>	<del><b>POWER SUPPLY SYSTEM (24 V DC power supply system) (To be provided for each system)</b></del>		
	1. Silicon controlled thyristors, diodes, power transistors	100%(1 Lot)	
	2. Capacitors	1 set	
	3. Fuse free Circuit breakers	5% or 1 no. of each type and rating, whichever is more	
	4. Electronic modules of all types.	20% or 2 nos. of each type and model, whichever is more	
	5. Cooling Fans	10% or 2 nos. of each type, whichever is more.	
<b>3.05.00</b>	<b>PROCESS CONNECTION PIPING (FOR IMPULSE PIPING/TUBING, SAMPLING PIPING / TUBING AND AIR SUPPLY PIPING AS APPLICABLE)</b>		
	1. Valves of all types and models	10% or 1 no. of each type, class, size and model whichever is more.	
	2. 2 way, 3way, 5way valve manifolds	10% or 1 no. of each type, class, size and model whichever is more.	
	3. Fittings	10% or 1 packet of each type, class, size and model whichever is more.	
	4. Purge meters	5% of each model or 1 no. whichever is more.	
	5. Filter regulators	20% of each model or 2 nos. whichever is more.	
<b>3.06.00</b>	<b>INSTRUMENTATION CABLE, INTERNAL WIRING &amp; ELECTRICAL FIELD</b>		
	1. Pre fabricated cable of each type.	10% of installed quantity	
	2. Pre fabricated cable connector of each type	10% or 1 no. of each type and model, whichever is more.	
	3. Other cables	5% of each type, pair and size of actual installed quantity	
<b>3.07.00</b>	<b>CONTROL VALVES, ACTUATORS &amp; ACCESSORIES</b>		
MOUDA SUPER THERMAL POWER PROJECT STAGE-II (2X660 MW) STEAM GENERATOR PACKAGE		TECHNICAL SPECIFICATION SECTION-VI BID DOC. NO. : CS-9575/9571/0360/0370/9586-102-2	PART-A SUB SECTION-VII MANDATORY SPARES
			PAGE 21 OF 22







TITLE:

**TECHNICAL SPECIFICATION FOR  
MILL REJECT HANDLING SYSTEM**

**2X600MW MAUDA STPP STAGE-II**

BHEL DOCUMENTS NO.: PE-TS-385-160-A001

VOLUME **II-B**

SECTION -C

REV. NO. 00

DATE:

Page

**VOLUME – II B**

**SECTION – C2  
PART-A**

**SPECIFIC TECHNICAL REQUIREMENTS**

**ELECTRICAL SPECIFICATION FOR 2X600MW MAUDA STPP STAGE-II**



**ELECTRICAL EQUIPMENT SPECIFICATION  
FOR  
MILL REJECTS SYSTEM**

SPECIFICATION NO.  
PE-TS-385-160-A001  
VOLUME NO. : II-B  
SECTION : C  
REV NO. : 00 DATE :  
SHEET : 1 OF 1

**1.0 EQUIPMENT & SERVICES TO BE PROVIDED BY BIDDER :**

- a) Services and equipment as per “Electrical Scope between BHEL and Vendor”.
- b) Any item/work either supply of equipment or erection material which have not been specifically mentioned but are necessary to complete the work for trouble free and efficient operation of the plant shall be deemed to be included within the scope of this specification. The same shall be provided by the bidder without any extra charge.
- c) Supply of mandatory spares as specified in the specifications of mechanical equipments.
- d) Erection and Commissioning spares.
- e) Erection & Maintenance tools & tackles.
- f) Electrical load requirement for MILL REJECTS SYSTEM.
- g) All equipment shall be suitable for the power supply fault levels and other climatic conditions mentioned in the enclosed project information.
- h) Bidder to furnish list of makes for each equipment at contract stage, which shall be subject to customer /BHEL approval without any commercial and delivery implications to BHEL
- i) Various drawings, data sheets as per required format, Quality plans, calculations, test reports, test certificates, operation and maintenance manuals etc shall be furnished as specified at contract stage. All documents shall be subject to customer/BHEL approval without any commercial implication to BHEL.

**2.0 EQUIPMENT & SERVICES TO BE PROVIDED BY PURCHASER FOR ELECTRICAL & TERMINAL POINTS:**  
Refer “Electrical Scope between BHEL and Vendor”.

**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 two signed and stamped copies of the following shall be furnished by the bidder as technical offer:

- a) A copy of this sheet ”Electrical equipment Specification for Mill reject system” 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

**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 :

- a) Specification AC Motors, cabling earthing & lightning protection and LT power, control cable, instrumentation cable.
- b) Data sheet of AC Motors, LT power and control cable.
- c) Quality Plan.
- d) Load data format.
- e) Datasheet-A (LV motor)

**ANNEXURE – I TO SECTION – C : STANDARD ELECTRICAL SCOPE BETWEEN BHEL AND VENDOR**  
**PACKAGE : MILL REJECT SYSTEM**

PROJECT:

<u>S.NO</u>	<u>DETAILS</u>	<u>SCOPE SUPPLY</u>	<u>SCOPE E&amp;C</u>	<u>REMARKS</u>
1	415 V Switchgear	CUSTOMER	CUSTOMER	415 V AC/240 V AC supply shall be provided by CUSTOMER based on load data provided by vendor at contract stage for all equipment supplied by vendor as part of contract. DC supply (battery bank, charger etc) and any other supply as required for PLC/control panel (as applicable) shall be provided by vendor.
2	Local Push Button Station ( for motors)	CUSTOMER	CUSTOMER	Located near the motors.
3	Power cables, control cables and screened control cables a) both end equipment in vendor's scope b) one end equipment in vendor's scope & one end in Customer's scope. c) one end equipment in Vendor's scope & one end in BHEL scope.	Vendor CUSTOMER Vendor	Vendor CUSTOMER vendor	Sizes and quantity of cables required shall be informed by vendor at contract stage (based on inputs provided by BHEL/CUSTOMER). Finalisation of cable sizes shall be done by CUSTOMER. Vendor shall provide lugs & glands accordingly.
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 a) for cables in main route b) for cables in branch route	CUSTOMER vendor	CUSTOMER vendor	
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	Cabling shall be through conduits. However vendor can use the trunk route where available for laying of cables. Conduits shall be supplied by vendor and 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	CUSTOMER	CUSTOMER	
9	Equipment grounding & lightning protection	Vendor	Vendor	
10	Below grade grounding	CUSTOMER	CUSTOMER	
11	Motors with base plate and foundation hardware	Vendor	Vendor	Makes shall be subject to customer/ BHEL approval at contract stage.

**ANNEXURE – I TO SECTION – C : STANDARD ELECTRICAL SCOPE BETWEEN BHEL AND VENDOR**  
**PACKAGE : MILL REJECT SYSTEM**

12	Mandatory spares	Vendor	-	Vendor to quote as per specification.
13	Recommended O & M spares, E & C spares, erection & maintenance tools & tackle	Vendor	-	
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 detail for the above c) Cable block diagram	Vendor Vendor Vendor	- - -	Cable listing for control cables for vendor supplied equipment (soft copies in the CUSTOMER cable schedule format) shall be furnished during detail engineering by vendor.
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 routing details marked on the drawing as per PEM interface comments. Electrical equipment layout drawing shall be to CUSTOMER approval.
17	Electrical equipment GA drawing	Vendor	-	

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. Painting : The painting for electrical equipment shall be epoxy based with suitable additives. The thickness of finish coat shall be minimum 50 microns. However in case electro static process of painting is offered for any electrical equipment, minimum paint thickness of 50 microns shall be applicable for finish coat. The vendor shall furnish the complete painting details during detailed engineering.



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

SPECIFICATION NO. PE-SS-999-506-E101
VOLUME NO. : <b>II-B</b>
SECTION : <b>D</b>
REV NO. : <b>00</b> DATE : 29/08/2005
SHEET : 1 OF 1

**GENERAL TECHNICAL REQUIREMENTS**

**FOR**

**LV MOTORS**

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



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

SPECIFICATION NO.  
PE-SS-999-506-E101  
VOLUME NO. : **II-B**  
SECTION : **D**  
REV NO. : **00** DATE : 29/08/2005  
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 for 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.



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

SPECIFICATION NO.  
PE-SS-999-506-E101  
VOLUME NO. : **II-B**  
SECTION : **D**  
REV NO. : **00** DATE : 29/08/2005  
SHEET : 2 OF 4

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.



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

SPECIFICATION NO. PE-SS-999-506-E101
VOLUME NO. : <b>II-B</b>
SECTION : <b>D</b>
REV NO. : <b>00</b> DATE : 29/08/2005
SHEET : 3 OF 4

- 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 U 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.



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

SPECIFICATION NO.  
PE-SS-999-506-E101  
VOLUME NO. : **II-B**  
SECTION : **D**  
REV NO. : **00** DATE : 29/08/2005  
SHEET : 4 OF 4

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


# SUB-SECTION-III:E1


## MOTORS


MOUDA STPP-II (2x660MW) / SOLAPUR STPP (2 x 660MW) /  
NABINAGAR STPP (3x 660MW) / MEJA TPP-I (2 x 660MW) /  
RAGHUNATHPUR TPP PHASE-II (2 x660MW)  
STEAM GENERATOR PACKAGE


TECHNICAL SPECIFICATION  
SECTION-VI  
BID DOC NO.: CS-9575/ 9571/ 0370/ 0360/ 9586-102-2



CLAUSE NO.	<p style="text-align: center;"><b>TECHNICAL REQUIREMENTS</b></p> 		
2.00.00	<p>iii) CW motors (in case of Screen protected Drip proof) - IP 23</p> <p>iv) Cable box - indoor area - IP 54</p> <p>v) Cable box - outdoor area - IP 55</p> <p><b>CODES AND STANDARDS</b></p> <p>1) Three phase induction motors : IS:325, IEC:60034</p> <p>2) Single phase AC motors : IS:996, IEC:60034</p> <p>3) Crane duty motors : IS:3177, IEC:60034</p> <p>4) DC motors/generators : IS:4722</p> <p>5) Energy Efficient motors : IS 12615</p>		
3.00.00	<b>TYPE</b>		
3.01.00	<p><b>AC Motors:</b></p> <p>(a) Squirrel cage induction motor suitable for direct-on-line starting.</p> <p>(b) Continuous duty LT motors upto 160 KW Output rating (at 50 deg.C ambient temperature) ,shall be Energy Efficient motors ,Efficiency class-Eff1, conforming to IS 12615.</p> <p>(c) Crane duty motors shall be slip ring/ squirrel cage Induction motor as per the requirement.</p>		
3.02.00	DC Motors Shunt wound.		
4.00.00	<p><b>RATING</b></p> <p>(a) Continuously rated (S1). However, crane motors shall be rated for S4 duty, 40% cyclic duration factor.</p> <p>(b) Whenever the basis for motor ratings are not specified in the corresponding mechanical specification sub-sections, maximum continuous motor ratings shall be at least 10% above the maximum load demand of the driven equipment under entire operating range including voltage and frequency variations.</p>		
5.00.00	<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>MOUDA STPP-II (2x660MW) / SOLAPUR STPP (2 x 660MW) / NABINAGAR STPP (3x 660MW) / MEJA TPP-I (2 x 660MW) / RAGHUNATHPUR TPP PHASE-II (2 x660MW) STEAM GENERATOR PACKAGE</p>	<p style="text-align: center;"><b>TECHNICAL SPECIFICATION SECTION-VI</b>          BID DOC NO.: CS-9575/ 9571/ 0370/ 0360/ 9586-102-2</p>	<p style="text-align: center;"><b>PART-B</b>          SUB SECTION-III: E1 (MOTORS)</p>	<p style="text-align: center;">PAGE 2 OF 8</p>

CLAUSE NO.	<b>TECHNICAL REQUIREMENTS</b> 		
	<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>6.00.00 OPERATIONAL REQUIREMENTS</b></p> <p><b>6.01.00 Starting Time</b></p> <p>6.01.01 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>6.01.02 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>6.01.03 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>6.01.04 Speed switches mounted on the motor shaft shall be provided in cases where above requirements are not met.</p> <p><b>6.02.00 Torque Requirements</b></p> <p>6.02.01 Accelerating torque at any speed with the lowest permissible starting voltage shall be at least 10% motor full load torque.</p> <p>6.02.02 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><b>6.03.00 Starting voltage requirement</b></p> <p>(a) 85% upto 1500KW</p> <p>(d) 80% from 1501 KW to 4000KW</p> <p>(e) 75% &gt; 4000KW</p> <p><b>7.00.00 DESIGN AND CONSTRUCTIONAL FEATURES</b></p> <p>7.01.00 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> <p>7.02.00 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>		
MOUDA STPP-II (2x660MW) / SOLAPUR STPP (2 x 660MW) / NABINAGAR STPP (3x 660MW) / MEJA TPP-I (2 x 660MW) / RAGHUNATHPUR TPP PHASE-II (2 x660MW) STEAM GENERATOR PACKAGE	<b>TECHNICAL SPECIFICATION</b> <b>SECTION-VI</b> <b>BID DOC NO.: CS-9575/ 9571/ 0370/</b> <b>0360/ 9586-102-2</b>	<b>PART-B</b> <b>SUB SECTION-III: E1</b> <b>(MOTORS)</b>	<b>PAGE 3 OF 8</b>

CLAUSE NO.	<b>TECHNICAL REQUIREMENTS</b> 		
7.03.00	<p>Winding and Insulation</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</p> <p>(c) 11kV, 3.3 kV AC motors : Thermal Class 155(F) insulation with winding temperature rise limited to thermal class 130(B). 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) 415V AC &amp; 220V DC motors : Thermal Class 130(B) or better</p>		
7.04.00	Motors rated above 1000KW shall have insulated bearings to prevent flow of shaft currents.		
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). Bearing housing vibration shall be limited within the limits prescribed in IEC 60034-14/IS:12075 . 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 duplex platinum resistance type temperature detectors preferably 2 numbers.		
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 terminal boxes. In case elastimould terminations are offered, then protective cover and trifurcating sleeves shall also be provided. In case cable terminal box is offered, then Employer shall provide termination kit. Removable gland plates of thickness 3 mm (hot/cold rolled sheet steel for three core cables) or 4 mm (non magnetic material for single core cables) shall be provided in case of cable terminal 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.		
<b>MOUDA STPP-II (2x660MW) / SOLAPUR STPP (2 x 660MW) / NABINAGAR STPP (3x 660MW) / MEJA TPP-I (2 x 660MW) / RAGHUNATHPUR TPP PHASE-II (2 x660MW) STEAM GENERATOR PACKAGE</b>	<b>TECHNICAL SPECIFICATION SECTION-VI BID DOC NO.: CS-9575/ 9571/ 0370/ 0360/ 9586-102-2</b>	<b>PART-B SUB SECTION-III: E1 (MOTORS)</b>	<b>PAGE 4 OF 8</b>

CLAUSE NO.	<p style="text-align: center;"><b>TECHNICAL REQUIREMENTS</b></p> 								
7.14.00	11kV and 3.3 kV motors Cable 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, cable glands & lugs suitable for the same.								
7.16.00	<p>The ratio of locked rotor KVA at rated voltage to rated KW shall not exceed the following (without any further tolerance).</p> <table border="0" style="width: 100%;"> <tr> <td style="width: 60%;">(a) Upto 110KW:</td> <td style="text-align: right;">11.0</td> </tr> <tr> <td>(b) Above 110KW &amp; upto 1500KW:</td> <td style="text-align: right;">10.0</td> </tr> <tr> <td>(c) Above 1500KW &amp; upto 4000KW:</td> <td style="text-align: right;">9.0</td> </tr> <tr> <td>(d) Above 4000KW:</td> <td style="text-align: right;">6 to 6.5</td> </tr> </table>	(a) Upto 110KW:	11.0	(b) Above 110KW & upto 1500KW:	10.0	(c) Above 1500KW & upto 4000KW:	9.0	(d) Above 4000KW:	6 to 6.5
(a) Upto 110KW:	11.0								
(b) Above 110KW & upto 1500KW:	10.0								
(c) Above 1500KW & upto 4000KW:	9.0								
(d) Above 4000KW:	6 to 6.5								
8.00.00	<b>TYPE TEST</b>								
8.01.00	<b>HT MOTORS</b>								
8.01.01	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.								
8.01.02	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.								
8.01.03	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 Employer 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 Employer 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.								
8.01.04	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 contract at no additional cost to the Employer either at third party lab or in presence of client/Employers representative and submit the reports for approval.								
MOUDA STPP-II (2x660MW) / SOLAPUR STPP (2 x 660MW) / NABINAGAR STPP (3x 660MW) / MEJA TPP-I (2 x 660MW) / RAGHUNATHPUR TPP PHASE-II (2 x660MW) STEAM GENERATOR PACKAGE	<b>TECHNICAL SPECIFICATION</b> <b>SECTION-VI</b> <b>BID DOC NO.: CS-9575/ 9571/ 0370/  0360/ 9586-102-2</b>	<b>PART-B</b> <b>SUB SECTION-III: E1</b> <b>(MOTORS)</b>	<b>PAGE 5 OF 8</b>						

CLAUSE NO.	TECHNICAL REQUIREMENTS		
8.01.05	<div style="float: right; border: 1px solid black; padding: 2px;">एनटीपीसी NTPC</div> <p><b>LIST OF 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 overload 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 clause 5.1.3.2, IEC-60034,Part-15.</li> <li>(g) Surge withstand voltage test on interturn insulation as per IEC 60034-15</li> </ul>		
8.01.06	<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) Fault level withstand test for each type of cable terminal box of HT motors.</li> </ul>		
8.02.00	<p><b>LT Motors</b></p>		
8.02.01	<p>LT Motors supplied shall be of type tested design. During detailed engineering, the contractor shall submit for Employer'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. 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>		
8.02.02	<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 Employer either at third party lab or in presence of client/Employers representative and submit the reports for approval.</p>		
8.02.03	<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 LT motor of above 50 KW only</p>		
MOUDA STPP-II (2x660MW) / SOLAPUR STPP (2 x 660MW) / NABINAGAR STPP (3x 660MW) / MEJA TPP-I (2 x 660MW) / RAGHUNATHPUR TPP PHASE-II (2 x660MW) STEAM GENERATOR PACKAGE	<b>TECHNICAL SPECIFICATION SECTION-VI</b> BID DOC NO.: CS-9575/ 9571/ 0370/ 0360/ 9586-102-2	<b>PART-B</b> SUB SECTION-III: E1 (MOTORS)	PAGE 6 OF 8


CLAUSE NO.	<b>TECHNICAL REQUIREMENTS</b> 		
	<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. Locked rotor readings of voltage, current and power input at a suitable reduced voltage.</li> <li>5. Full load test to determine efficiency power factor and slip .</li> <li>6. Temperature rise test .</li> <li>7. Momentary overload test .</li> <li>8. Insulation resistance test .</li> <li>9. High voltage test .</li> <li>10. Test for vibration severity of motor.</li> <li>11. Test for noise levels of motor .</li> <li>12. Test for degree of protection and</li> <li>13. Overspeed test.</li> </ol>		
8.03.00	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.		
8.04.00	The type test reports once approved for any projects shall be treated as reference. For subsequent projects of NTPC, 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.		
<b>MOUDA STPP-II (2x660MW) / SOLAPUR STPP (2 x 660MW) / NABINAGAR STPP (3x 660MW) / MEJA TPP-I (2 x 660MW) / RAGHUNATHPUR TPP PHASE-II (2 x660MW) STEAM GENERATOR PACKAGE</b>	<b>TECHNICAL SPECIFICATION SECTION-VI</b> <b>BID DOC NO.: CS-9575/ 9571/ 0370/ 0360/ 9586-102-2</b>	<b>PART-B</b> <b>SUB SECTION-III: E1 (MOTORS)</b>	<b>PAGE 7 OF 8</b>

TABLE - I

DIMENSIONS OF TERMINAL BOXES

**FOR LV MOTORS:**

Motor MCR in KW	Minimum distance between centre of stud and gland plate in mm
UP to 3 KW	As per manufacturer's practice.
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

**FOR HT MOTORS:**

The distance between gland plate and the terminal studs shall not be less than 500 mm.

**PHASE TO PHASE/ PHASE TO EARTH AIR CLEARANCE:**

NOTE: Minimum inter-phase and phase-earth air clearances for LT motors with lugs installed shall be as follows:

Motor MCR in KW	Clearance
UP to 110 KW	10mm
Above 110 KW and upto 150 KW	12.5mm
Above 150 KW	19mm



TITLE

**LV MOTORS****DATA SHEET-A**

SPECIFICATION NO.

VOLUME II B

SECTION D

REV NO. DATE

SHEET 1 OF 1

- 1.0 Design ambient temperature : 50 °C
- 2.0 Maximum acceptable kW rating of LV motor : 200KW
- 3.0 Installation (Indoors/ Outdoors) : As required
- 4.0 Details of supply system
- a) Rated voltage (with variation) : 415V ± 10%
  - b) Rated frequency (with variation) : 50 Hz +3 to -5%
  - c) Combined voltage & freq. variation : 10% (sum of absolute values)
  - d) System fault level at rated voltage : 45 kA RMS for 1 sec
  - e) Short time rating for terminal boxes
    - o 110 kW and above (Breaker controlled) : 45 KA for 0.20 sec.
    - o Below 110 kW (Contactor controlled) : 45 KA protected by fuse
  - f) LV System grounding : Solidly
- 5.0 Class of insulation : Class 'F', with temp rise limited to class B.
- 6.0 Minimum voltage for starting (As percentage of rated voltage) : 85% of rated voltage
- 7.0 Power cables data : Shall be given during Detailed engg
- 8.0 Earth Conductor Size & Material : Shall be given during Detailed engg
- 9.0 Space heater supply : 240 V, 1ϕ , 50 Hz
- 10.0 Rating up to which Single phase motor : Acceptable below 0.20 kW
- 11.0 The ratio of locked rotor KVA at rated voltage to rated KW shall not exceed the following (Without any further tolerance) : As per clause no. 7.16 of technical spec sec-VI part-B (page 6 of c10)
- 12.0 Additional tests : As per QP
- 12.1 Flame-proof motor
- a) Enclosure suitable (As per IS:2148) : As per requirement
  - b) Classification of Hazardous area (As per IS: 5572 part-I) : As per requirement
- 12.0 Makes : As per customer approved vendors

Clause No.	MOTORS		
DE-1B	..... (Bidder's Name)		
	<p><b>LT MOTORS</b></p> <p><b>A. GENERAL</b></p> <p>1. Manufacturer &amp; Country of origin. (Shall be as per approved QA make)</p> <p>2. Equipment driven by motor</p> <p>3. Motor type</p> <p>4. Quantity</p> <p><b>B. DESIGN AND PERFORMANCE DATA</b></p> <p>1. Frame size</p> <p>2. Type of duty</p> <p>3. Type of enclosure /Method of cooling/Degree of protection</p> <p>4. Applicable standard to which motor generally conforms</p> <p>5. Efficiency class as per IS 12615</p> <p>6. (a) Whether motor is flame proof <span style="float: right;">Yes/No</span></p> <p style="padding-left: 40px;">(b) If yes, the gas group to which it conforms as per IS:2148</p> <p>7. Type of mounting</p> <p>8. Direction of rotation as viewed from DE END</p> <p>9. Standard continuous rating at 40 deg.C. ambient temp. as per Indian Standard (KW)</p> <p>10. Derated rating for specified normal condition i.e. 50 deg. C ambient temperature (KW)</p>		
NAME OF THE PROJECT.....  <b>STEAMGENERATOR PACKAGE</b>	<b>TECHNICAL DATA SHEET</b> <b>SECTION-VI</b> <b>BID DOC NO.: CS-9575/ 9571/</b> <b>0370/ 0360/ 9586-102-2</b>	<b>PART-F</b> <b>CHAPTER-I</b> <b>SUB-SECTION:DE1</b> <b>(ELECTRICAL)</b>	<b>PAGE</b> <b>10 OF 16</b>

Clause No.	MOTORS		
	<p style="text-align: right;">..... (Bidder's Name)</p> <p>11. Maximum continuous load demand of driven equipment in KW</p> <p>12. Rated Voltage (volts)</p> <p>13. Permissible variation of :</p> <p style="padding-left: 20px;">a. Voltage (Volts)</p> <p style="padding-left: 20px;">b. Frequency (Hz)</p> <p style="padding-left: 20px;">c. Combined voltage and frequency</p> <p>14. Rated speed at rated voltage and frequency(RPM)</p> <p>15. At rated Voltage and frequency:</p> <p style="padding-left: 20px;">a. Full load current</p> <p style="padding-left: 20px;">b. No load current</p> <p>16. Power Factor at</p> <p style="padding-left: 20px;">a. 100% load</p> <p style="padding-left: 20px;">b. NO load</p> <p style="padding-left: 20px;">c. Starting.</p> <p>17. Efficiency at rated voltage and frequency,</p> <p style="padding-left: 20px;">a. 100% load</p> <p style="padding-left: 20px;">b. 75% load</p> <p style="padding-left: 20px;">c. 50% load</p> <p>18. Starting current (amps) at</p> <p style="padding-left: 20px;">a. 100 % voltage</p> <p style="padding-left: 20px;">b. 85% voltage</p>		
NAME OF THE PROJECT.....  <b>STEAMGENERATORPACKAGE</b>	<b>TECHNICAL DATA SHEET</b> <b>SECTION-VI</b> <b>BID DOC NO.: CS-9575/ 9571/</b> <b>0370/ 0360/ 9586-102-2</b>	<b>PART-F</b> <b>CHAPTER-I</b> <b>SUB-SECTION:DE1</b> <b>(ELECTRICAL)</b>	<b>PAGE</b> <b>11 OF 16</b>

Clause No.	MOTORS		
	<p style="text-align: right;">..... (Bidder's Name)</p> <p>c. 80% voltage</p> <p>19. Minimum permissible starting Voltage (Volts)</p> <p>20. Starting time with minimum permissible voltage</p> <p>a. Without driven equipment coupled</p> <p>b. With driven equipment coupled</p> <p>21. Safe stall time with 100% and 110% of rated voltage</p> <p>a. From hot condition</p> <p>b. From cold condition</p> <p>22. Torques :</p> <p>a. Starting torque at min. permissible voltage(kg-mtr.)</p> <p>b. Pull up torque at rated voltage.</p> <p>c. Pull out torque</p> <p>d. Min accelerating torque (kg.m) available</p> <p>e. Rated torque (kg.m)</p> <p>23. Stator winding resistance per phase (ohms at 20 Deg.C.)</p> <p>24. GD<sup>2</sup> value of motors</p> <p>25. No of permissible successive starts when motor is in hot condition</p>		
NAME OF THE PROJECT.....  <b>STEAMGENERATORPACKAGE</b>	<b>TECHNICAL DATA SHEET</b> <b>SECTION-VI</b> <b>BID DOC NO.: CS-9575/ 9571/</b> <b>0370/ 0360/ 9586-102-2</b>	<b>PART-F</b> <b>CHAPTER-I</b> <b>SUB-SECTION:DE1</b> <b>(ELECTRICAL)</b>	<b>PAGE</b> <b>12 OF 16</b>

Clause No.	MOTORS		
	<p style="text-align: right;">..... (Bidder's Name)</p> <p>26. Locked Rotor KVA Input</p> <p>27. Locked Rotor KVA/KW</p> <p>28. Vibration limit :Velocity (mm/s)</p> <p>29. Noise level limit (dBA)</p> <p><b>C. CONSTRUCTIONAL FEATURES</b></p> <p>1. Stator winding insulation</p> <p style="margin-left: 20px;">a. Class &amp; Type</p> <p style="margin-left: 20px;">b. Winding Insulation Process</p> <p style="margin-left: 20px;">c. Tropicalised (Yes/No)</p> <p style="margin-left: 20px;">d. Temperature rise over specified maximum ambient temperature of 50 deg C</p> <p style="margin-left: 20px;">e. Method of temperature measurement</p> <p style="margin-left: 20px;">f. Stator winding connection</p> <p>2. Main Terminal Box</p> <p style="margin-left: 20px;">a. Type</p> <p style="margin-left: 20px;">b. Location (viewed from NDE side)</p> <p style="margin-left: 20px;">c. Entry of cables(bottom/side)</p> <p style="margin-left: 20px;">d. Recommended cable size (To be matched with cable size envisaged by owner)</p> <p style="margin-left: 20px;">e. Fault level (MVA), Fault level duration (sec)</p> <p style="margin-left: 20px;">f. Cable glands &amp; lugs details (shall be suitable for power cable)</p>		
NAME OF THE PROJECT.....  STEAMGENERATORPACKAGE	TECHNICAL DATA SHEET SECTION-VI BID DOC NO.: CS-9575/ 9571/ 0370/ 0360/ 9586-102-2	PART-F CHAPTER-I SUB-SECTION:DE1 (ELECTRICAL)	PAGE 13 OF 16

Clause No.	MOTORS		
	<p style="text-align: right;">..... (Bidder's Name)</p> <p>3. Type of DE/NDE Bearing</p> <p>4. Motor Paint shade</p> <p>5. Weight of</p> <p style="padding-left: 20px;">a. Motor stator (KG)</p> <p style="padding-left: 20px;">b. Motor Rotor (KG)</p> <p style="padding-left: 20px;">c. Total weight (KG)</p> <p><b>D. List of accessories.</b></p> <p>1. Space Heaters (Applicable for 30 KW &amp; above motor) (Nos./Power in watts/supply voltage)</p> <p>2. Terminal Box for Space Heater (Yes/No)</p> <p>3. Speed switch (Yes/No) No of contacts and contact ratings of speed switch</p> <p>4. Insulation of bearing (Yes/No)</p> <p>5. Noise reducer(Yes/No)</p> <p>6. Grounding pads</p> <p style="padding-left: 20px;">i) No and size on motor body</p> <p style="padding-left: 20px;">ii) Nos on terminal Box</p> <p>7. Vibration pads</p> <p style="padding-left: 20px;">i) Nos and size</p> <p style="padding-left: 20px;">ii) Location</p> <p>8. Any other fitments</p>		
NAME OF THE PROJECT.....  STEAMGENERATORPACKAGE	TECHNICAL DATA SHEET SECTION-VI BID DOC NO.: CS-9575/ 9571/ 0370/ 0360/ 9586-102-2	PART-F CHAPTER-I SUB-SECTION:DE1 (ELECTRICAL)	PAGE 14 OF 16

Clause No.	MOTORS		
	<p style="text-align: right;">..... (Bidder's Name)</p> <p><b>E. List of curves.</b></p> <ol style="list-style-type: none"> <li>1. Torque speed characteristic of the motor</li> <li>2. Thermal withstand characteristic</li> <li>3. Starting. current Vs. Time</li> <li>4. Starting. current Vs speed</li> <li>5. P.F. and Effi. Vs Load</li> </ol> <p><b>F. Additional Data to be filled for each rating of DC Motor</b></p> <ol style="list-style-type: none"> <li>1. Rated armature voltage (Volt)</li> <li>2. Rated field excitation (Amp)</li> <li>3. Permissible % variation in voltage</li> <li>4. Minimum Permissible Starting voltage (volt)</li> <li>5. At rated voltage               <ol style="list-style-type: none"> <li>i) Full load Armature current.(Amp)</li> <li>ii) Full load Field current (Amp)</li> <li>iii) No load Armature current (Amp)</li> </ol> </li> <li>6. Full load Field current (Amp)</li> <li>7. No load Aramature current (Amp)</li> <li>8. Minimum permissible field current(Amp) to avoid overspeeding at               <ol style="list-style-type: none"> <li>i) Maximum permissible voltage</li> </ol> </li> </ol>		
NAME OF THE PROJECT.....  <b>STEAMGENERATOR PACKAGE</b>	<b>TECHNICAL DATA SHEET</b> <b>SECTION-VI</b> <b>BID DOC NO.: CS-9575/ 9571/</b> <b>0370/ 0360/ 9586-102-2</b>	<b>PART-F</b> <b>CHAPTER-I</b> <b>SUB-SECTION:DE1</b> <b>(ELECTRICAL)</b>	<b>PAGE</b> <b>15 OF 16</b>


Clause No.	MOTORS		
	<p style="text-align: right;">..... (Bidder's Name)</p> <p>ii) Rated voltage</p> <p>iii) Minimum Permissible Voltage</p> <p>9. Resistance (indicative Values) in ohm</p> <p>i) Armature winding (Arm + IP + Series) at 25 deg.C</p> <p>ii) Field Winding at 25 deg. C</p> <p>10. Inductance (indicative values)</p> <p>i) Armature winding</p> <p>ii) Field winding</p> <p>11. Value of trimmer resistance (ohm) to be connected in series with the shunt field to obtain rated speed at</p> <p>i) 220 V DC</p> <p>ii) 250 V DC</p> <p>iii) 187 V DC</p> <p>12. Value of the external resistance (ohm) required to be connected in series with armature during starting only</p> <p>13. Technical data sheet for external resistance box</p> <p>14. GA drawing of motor</p> <p>15. Starting time calculation</p> <p>16. Starter resistance design calculation</p> <p>17. Electrical connection diagram of motor</p>		
NAME OF THE PROJECT.....  <b>STEAMGENERATORPACKAGE</b>	<b>TECHNICAL DATA SHEET</b> <b>SECTION-VI</b> <b>BID DOC NO.: CS-9575/ 9571/</b> <b>0370/ 0360/ 9586-102-2</b>	<b>PART-F</b> <b>CHAPTER-I</b> <b>SUB-SECTION:DE1</b> <b>(ELECTRICAL)</b>	<b>PAGE</b> <b>16 OF 16</b>


# SUB-SECTION-III:E3


## LT POWER CABLES


MOUDA STPP-II (2x660MW) / SOLAPUR STPP (2 x 660MW) /  
NABINAGAR STPP (3x 660MW) / MEJA TPP-I (2 x 660MW) /  
RAGHUNATHPUR TPP PHASE-II (2 x660MW)  
STEAM GENERATOR PACKAGE


TECHNICAL SPECIFICATION  
SECTION-VI  
BID DOC NO.: CS-9575/ 9571/ 0370/ 0360/ 9586-102-2


CLAUSE NO.	TECHNICAL REQUIREMENTS			
	<b>LT POWER CABLES</b>			
<b>1.00.00</b>	<b>CODES &amp; STANDARDS</b>			
1.01.00	<p>All standards, specifications and codes of practice referred to herein shall be the latest editions including all applicable official amendments and revisions as on date of opening of bid. In case of conflict between this specification and those (IS : codes, standards, etc.) referred to herein, the former shall prevail. All the cables shall conform to the requirements of the following standards and codes:</p> <p>IS :1554 - I      PVC insulated (heavy duty) electric cables for working voltages upto and including 1100V.</p> <p>IS : 3961            Recommended current ratings for cables</p> <p>IS : 3975            Low carbon galvanised steel wires, formed wires and tapes for armouring of cables.</p> <p>IS : 4905            Methods for random sampling.</p> <p>IS : 5831            PVC insulation and sheath of electrical cables.</p> <p>IS:7098(Part-I)    Cross linked polyethylene insulated PVC sheathed cables for working voltages upto and including 1100V.</p> <p>IS : 8130            Conductors for insulated electrical cables and flexible cords.</p> <p>IS : 10418          Specification for drums for electric cables.</p> <p>IS : 10810          Methods of tests for cables.</p> <p>ASTM-D-2843      Standard test method for density of smoke from the burning or decomposition of plastics.</p> <p>IEC-754(Part-I)    Test on gases evolved during combustion of electric cables.</p> <p>IEC -332            Tests on Electric cables under fire conditions. Part-3 : Tests on bunched wires or cables (category -B)</p>			
<b>2.00.00</b>	<b>TECHNICAL REQUIREMENTS</b>			
2.01.00	The cables shall be suitable for laying on racks, in ducts, trenches, conduits and under ground buried installation with chances of flooding by water.			
2.02.00	Cables shall be flame retardant, low smoke (FRLS) type designed to withstand all mechanical, electrical and thermal stresses develop under steady state and transient operating conditions as specified elsewhere in this specification.			
2.03.00	Aluminum conductor used in power cables shall have tensile strength of more than 100 N/ sq.mm. Conductors shall be multi stranded.			
2.04.00	XLPE insulation shall be suitable for a continuous conductor temperature of 90 deg. C and short circuit conductor temperature of 250 deg.C. PVC insulation shall be suitable for continuous conductor temperature of 70 deg C and short circuit conductor temperature of 160 deg.C.			
MOUDA STPP-II (2x660MW) / SOLAPUR STPP (2 x 660MW) / NABINAGAR STPP (3x 660MW) / MEJA TPP-I (2 x 660MW) / RAGHUNATHPUR TPP PHASE-II (2 x660MW) STEAM GENERATOR PACKAGE	<b>TECHNICAL SPECIFICATION SECTION-VI</b> <b>BID DOC NO.: CS-9575/ 9571/ 0370/ 0360/ 9586-102-2</b>	<b>PART-B SUB SECTION-III:E3 (LT POWER CABLES)</b>	<b>PAGE 1 OF 6</b>	

CLAUSE NO.	<p style="text-align: center;"><b>TECHNICAL REQUIREMENTS</b></p> 														
2.05.00	<p>The cable cores shall be laid up with fillers between the cores wherever necessary. It shall not stick to insulation and inner sheath. All the cables, other than single core unarmoured cables, shall have distinct extruded PVC inner sheath of black color as per IS : 5831.</p>														
2.06.00	<p>For single core armoured cables, armouring shall be of aluminum wires/formed wires. For multicore armoured cables armouring shall be of galvanised steel as follows : -</p> <table border="0" style="width: 100%;"> <thead> <tr> <th style="text-align: left;">Calculated nominal dia of cable under armour</th> <th style="text-align: left;">Size and Type of armour</th> </tr> </thead> <tbody> <tr> <td>i) Upto 13 mm</td> <td>1.4mm dia GS wire</td> </tr> <tr> <td>ii) Above 13 &amp; upto 25mm</td> <td>0.8 mm thick GS formed wire / 1.6 mm dia GS wire</td> </tr> <tr> <td>iii) Above 25 &amp; upto 40 mm</td> <td>0.8 mm thick GS formed wire / 2.0 mm dia GS wire</td> </tr> <tr> <td>iv) Above 40 &amp; upto 55mm</td> <td>1.4 mm thick GS formed wire / 2.5 mm dia GS wire</td> </tr> <tr> <td>v) Above 55 &amp; upto 70 mm</td> <td>1.4 mm thick GS formed wire / 3.15 mm dia GS wire</td> </tr> <tr> <td>vi) Above 70mm</td> <td>1.4 mm thick GS formed wire / 4.0 mm dia GS wire</td> </tr> </tbody> </table>	Calculated nominal dia of cable under armour	Size and Type of armour	i) Upto 13 mm	1.4mm dia GS wire	ii) Above 13 & upto 25mm	0.8 mm thick GS formed wire / 1.6 mm dia GS wire	iii) Above 25 & upto 40 mm	0.8 mm thick GS formed wire / 2.0 mm dia GS wire	iv) Above 40 & upto 55mm	1.4 mm thick GS formed wire / 2.5 mm dia GS wire	v) Above 55 & upto 70 mm	1.4 mm thick GS formed wire / 3.15 mm dia GS wire	vi) Above 70mm	1.4 mm thick GS formed wire / 4.0 mm dia GS wire
Calculated nominal dia of cable under armour	Size and Type of armour														
i) Upto 13 mm	1.4mm dia GS wire														
ii) Above 13 & upto 25mm	0.8 mm thick GS formed wire / 1.6 mm dia GS wire														
iii) Above 25 & upto 40 mm	0.8 mm thick GS formed wire / 2.0 mm dia GS wire														
iv) Above 40 & upto 55mm	1.4 mm thick GS formed wire / 2.5 mm dia GS wire														
v) Above 55 & upto 70 mm	1.4 mm thick GS formed wire / 3.15 mm dia GS wire														
vi) Above 70mm	1.4 mm thick GS formed wire / 4.0 mm dia GS wire														
2.06.01	<p>The aluminum used for armouring shall be of H4 grade as per IS:8130 with maximum resistivity of .028264 ohms mm<sup>2</sup> per meter at 20 deg C. Aluminum armouring shall be same as indicated above for galvanized steel.</p>														
2.06.02	<p>The gap between armour wires / formed wires shall not exceed one armour wire / formed wire space and there shall be no cross over / over-riding of armour wire / formed wire. The minimum area of coverage of armouring shall be 90%. The breaking load of armour joint shall not be less than 95% of that of armour wire / formed wire. Zinc rich paint shall be applied on armour joint surface, of GS wire/formed wire.</p>														
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CLAUSE NO.	TECHNICAL REQUIREMENTS			
2.09.00	4 core - Red, Yellow, Blue and Black			
	For reduced neutral conductors the core shall be black.			
2.10.00	<p>In addition to manufacturer's identification on cables as per IS, following marking shall also be provided over outer sheath.</p> <p>(a) Cable size and voltage grade - To be embossed</p> <p>(b) Word 'FRLS' at every 5 meter - To be embossed</p> <p>(c) Sequential marking of length of the cable in meters at every one meter-To be embossed / printed.</p> <p>The embossing shall be progressive, automatic, in line and marking shall be legible and indelible.</p>			
2.11.00	All cables shall meet the fire resistance requirement as per Category-B of IEC 332 Part -3.			
2.12.00	Allowable tolerances on the overall diameter of the cables shall be $\pm 2$ mm maximum over the declared value in the technical data sheets.			
2.13.00	In plant repairs to the cables shall not be accepted. Pimples, fish eye, blow holes etc. are not acceptable.			
2.14.00	Cable selection & sizing			
2.14.01	<p>Cables shall be sized based on the following considerations:</p> <p>(a) Rated current of the equipment</p> <p>(b) The voltage drop in the cable, during motor starting condition, shall be limited to 10% and during full load running condition, shall be limited to 3% of the rated voltage</p> <p>(c) Short circuit withstand capability</p> <p>This will depend on the feeder type. For a fuse protected circuit, cable should be sized to withstand the let-out energy of the fuse. For breaker controlled feeder, cable shall be capable of withstanding the system fault current level for total breaker tripping time inclusive of relay pickup time.</p> <p>(d) The minimum conductor size shall be 6 sq.mm for Al conductor cables &amp; 2.5 sq.mm for copper conductor cables. The constructional details of copper conductor cables shall be same as indicated for copper control cables.</p>			
2.14.02	<p><b>Derating Factors</b></p> <p>Derating factors for various conditions of installations including the following shall be considered while selecting the cable sizes:</p> <p>a) Variation in ambient temperature for cables laid in air</p> <p>b) Grouping of cables</p> <p>c) Variation in ground temperature and soil resistivity for buried cables.</p>			
MOUDA STPP-II (2x660MW) / SOLAPUR STPP (2 x 660MW) / NABINAGAR STPP (3x 660MW) / MEJA TPP-I (2 x 660MW) / RAGHUNATHPUR TPP PHASE-II (2 x660MW) STEAM GENERATOR PACKAGE		TECHNICAL SPECIFICATION SECTION-VI BID DOC NO.: CS-9575/ 9571/ 0370/ 0360/ 9586-102-2	PART-B SUB SECTION-III:E3 (LT POWER CABLES)	PAGE 3 OF 6

CLAUSE NO.	<p style="text-align: center;"><b>TECHNICAL REQUIREMENTS</b></p> 		
2.14.03	Cable lengths shall be considered in such a way that straight through cable joints are avoided.		
2.14.04	Cables shall be armoured type if laid in switchyard area, coal handling area or directly buried.		
2.14.05	All LT power cables of sizes more than 120 sq.mm. shall be XLPE insulated and preferable sizes are 1Cx150, 1Cx300, 1Cx630, 3Cx150 & 3Cx240 sq.mm.		
<b>3.00.00</b>	<b>CONSTRUCTIONAL FEATURES</b>		
<b>3.01.00</b>	<b>1.1 KV Grade Power Cables</b>		
	<p>(a) 1.1KV grade XLPE power cables shall have compacted aluminum conductor, XLPE insulated, PVC inner-sheathed (as applicable), armoured/ unarmoured, PVC outer-sheathed conforming to IS:7098. (Part-I).</p> <p>(b) 1.1KV grade PVC power cables shall have aluminum conductor(compact type for sizes above 10 sq.mm), PVC Insulated, PVC inner sheathed (as applicable) armoured/ unarmoured, PVC outer-sheathed conforming to IS:1554 (Part-I).</p> <p>(c) 1.1KV grade Trailing cables shall have tinned copper(class 5)conductor, insulated with heat resistant elastomeric compound based on Ethylene Propylene Rubber (EPR) suitable for withstanding 90 deg.C continuous conductor temperature and 250 deg.C during short circuit, inner-sheathed with heat resistant elastomeric compound, nylon cord reinforced, outer-sheathed with heat resistant, oil resistant and flame retardant heavy duty elastomeric compound conforming to IS 9968</p>		
3.02.00	<p><b>Cable Drums</b></p> <p>(a) Cables shall be supplied in non returnable wooden or steel drums of heavy construction. The surface of the drum and the outer most cable layer shall be covered with water proof cover. Both the ends of the cables shall be properly sealed with heat shrinkable PVC/ rubber caps secured by 'U' nails so as to eliminate ingress of water during transportation, storage and erection. Wood preservative anti-termite treatment shall be applied to the entire drum. Wooden drums shall comply with IS : 10418.</p> <p>(b) Each drum shall carry manufacturer's name, purchaser's name, address and contract number, item number and type, size and length of cable and net gross weight stencilled on both sides of the drum. A tag containing same information shall be attached to the leading end of the cable. An arrow and suitable accompanying wording shall be marked on one end of the reel indicating the direction in which it should be rolled.</p>		
4.00.00	<b>TESTS</b>		
4.01.00	<p><b>GENERAL</b></p> <p>(a) All equipment to be supplied shall be of type tested design. During detailed engineering, the contractor shall submit for Employer's approval the reports of all the type tests as listed in this specification and carried out within last <i>ten</i> 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..</p>		
MOUDA STPP-II (2x660MW) / SOLAPUR STPP (2 x 660MW) / NABINAGAR STPP (3x 660MW) / MEJA TPP-I (2 x 660MW) / RAGHUNATHPUR TPP PHASE-II (2 x660MW) STEAM GENERATOR PACKAGE	<b>TECHNICAL SPECIFICATION SECTION-VI</b> <b>BID DOC NO.: CS-9575/ 9571/ 0370/ 0360/ 9586-102-2</b>	<b>PART-B SUB SECTION-III:E3 (LT POWER CABLES)</b>	<b>PAGE 4 OF 6</b>

CLAUSE NO.	<b>TECHNICAL REQUIREMENTS</b> 																																																		
	<p>(b) 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 Employer either at third party lab or in presence of client/Employers representative and submit the reports for approval.</p> <p>(c) 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> <p>(d) The type test reports once approved for any projects shall be treated as reference. For subsequent projects of NTPC, 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>																																																		
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	<table border="1"> <thead> <tr> <th>S.No.</th> <th>Type Tests</th> <th>Remarks</th> </tr> </thead> <tbody> <tr> <td>a)</td> <td>For Conductor</td> <td></td> </tr> <tr> <td></td> <td>1. Resistance test</td> <td></td> </tr> <tr> <td>b)</td> <td>For Armour Wires/ Formed Wires</td> <td></td> </tr> <tr> <td></td> <td>2. Measurement of Dimensions</td> <td></td> </tr> <tr> <td></td> <td>3. Tensile Test</td> <td></td> </tr> <tr> <td></td> <td>4. Elongation test</td> <td></td> </tr> <tr> <td></td> <td>5. Torsion test</td> <td>For round wires only</td> </tr> <tr> <td></td> <td>6. Winding test</td> <td>For Formed wires only</td> </tr> <tr> <td></td> <td>7. Resistance test</td> <td></td> </tr> <tr> <td></td> <td>8. a) Zinc Coating test</td> <td>For G.S. Formed wires /wires only.</td> </tr> <tr> <td></td> <td>b) Wrapping test</td> <td>For aluminum wires/formed wires only.</td> </tr> <tr> <td>c)</td> <td>For PVC/XLPE insulation &amp; PVC Sheath</td> <td></td> </tr> <tr> <td></td> <td>9. Test for thickness</td> <td></td> </tr> <tr> <td></td> <td>10. Tensile strength &amp; elongation tests before ageing and after ageing</td> <td></td> </tr> <tr> <td></td> <td>11. Ageing in air oven</td> <td></td> </tr> </tbody> </table>			S.No.	Type Tests	Remarks	a)	For Conductor			1. Resistance test		b)	For Armour Wires/ Formed Wires			2. Measurement of Dimensions			3. Tensile Test			4. Elongation test			5. Torsion test	For round wires only		6. Winding test	For Formed wires only		7. Resistance test			8. a) Zinc Coating test	For G.S. Formed wires /wires only.		b) Wrapping test	For aluminum wires/formed wires only.	c)	For PVC/XLPE insulation & PVC Sheath			9. Test for thickness			10. Tensile strength & elongation tests before ageing and after ageing			11. Ageing in air oven	
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CLAUSE NO.	TECHNICAL REQUIREMENTS		
	12. Loss of mass test 13. Hot deformation test 14. Heat shock test 15. Shrinkage test 16. Thermal stability test 17. Hot set test 18. Water absorption test 19. Oxygen index test 20. Smoke density test 21. Acid gas generation test d) For completed cables 22. Insulation resistance test (Volume resistivity method) 23. High voltage test 24. Flammability test as per IEC - 332 Part-3 (Category -B)	For PVC insulation and sheath only For PVC insulation and sheath only For PVC insulation and sheath only For PVC insulation and sheath only For XLPE insulation only For XLPE insulation only For outer sheath only For outer sheath only For outer sheath only	
4.03.00	<b>Acceptance Tests:</b> As per QA table		
4.04.00	<b>Routine Tests :</b> As per QA table		
MOUDA STPP-II (2x660MW) / SOLAPUR STPP (2 x 660MW) / NABINAGAR STPP (3x 660MW) / MEJA TPP-I (2 x 660MW) / RAGHUNATHPUR TPP PHASE-II (2 x660MW) STEAM GENERATOR PACKAGE	TECHNICAL SPECIFICATION SECTION-VI BID DOC NO.: CS-9575/ 9571/ 0370/ 0360/ 9586-102-2	PART-B SUB SECTION-III:E3 (LT POWER CABLES)	PAGE 6 OF 6


# SUB-SECTION-III:E4

## LT CONTROL CABLES


MOUDA STPP-II (2x660MW) / SOLAPUR STPP (2 x 660MW) /  
NABINAGAR STPP (3x 660MW) / MEJA TPP-I (2 x 660MW) /  
RAGHUNATHPUR TPP PHASE-II (2 x660MW)  
STEAM GENERATOR PACKAGE


TECHNICAL SPECIFICATION  
SECTION-VI  
BID DOC NO.: CS-9575/ 9571/ 0370/ 0360/ 9586-102-2


CLAUSE NO.	TECHNICAL REQUIREMENTS			
	<b>LT CONTROL CABLES</b>			
1.00.00	<b>CODES &amp; STANDARDS</b>			
1.01.00	<p>All standards, specifications and codes of practice referred to herein shall be the latest editions including all applicable official amendments and revisions as on date of opening of bid. In case of conflict between this specification and those (IS : codes, standards, etc.) referred to herein, the former shall prevail. All the cables shall conform to the requirements of the following standards and codes :</p> <p>IS :1554 - I      PVC insulated (heavy duty) electric cables for working voltages upto and including 1100V.</p> <p>IS : 3961          Recommended current ratings for cables</p> <p>IS : 3975          Low carbon galvanised steel wires, formed wires and tapes for armouring of cables.</p> <p>IS : 4905          Methods for random sampling.</p> <p>IS : 5831          PVC insulation and sheath of electrical cables.</p> <p>IS : 8130          Conductors for insulated electrical cables and flexible cords.</p> <p>IS : 10418        Specification for drums for electric cables.</p> <p>IS : 10810        Methods of tests for cables.</p> <p>ASTM-D-2843     Standard test method for density of smoke from the burning or decomposition of plastics.</p> <p>IEC-754 (Part-I)          Test on gases evolved during combustion of electric cables.</p> <p>IEC -332          Tests on Electric cables under fire conditions Part-3 : Tests on bunched wires or cables (category -B)</p>			
2.00.00	<b>TECHNICAL REQUIREMENTS</b>			
2.01.00	The cables shall be suitable for laying on racks, in ducts, trenches, conduits and under ground buried installation with chances of flooding by water.			
2.02.00	Cables shall be flame retardant, low smoke (FRLS) type designed to withstand all mechanical, electrical and thermal stresses develop under steady state and transient operating conditions as specified elsewhere in this specification.			
2.03.00	Conductor of control cables shall be made of multi stranded, plain annealed copper.			
2.04.00	PVC insulation shall be suitable for continuous conductor temperature of 70 deg C and short circuit conductor temperature of 160 deg. C.			
2.05.00	The cable cores shall be laid up with fillers between the cores wherever necessary. It shall not stick to insulation and inner sheath. All the cables, other than single core unarmoured cables, shall have distinct extruded PVC inner sheath of black color as per IS : 5831.			
MOUDA STPP-II (2x660MW) / SOLAPUR STPP (2 x 660MW) / NABINAGAR STPP (3x 660MW) / MEJA TPP-I (2 x 660MW) / RAGHUNATHPUR TPP PHASE-II (2 x660MW) STEAM GENERATOR PACKAGE		<b>TECHNICAL SPECIFICATION</b> <b>SECTION-VI</b> <b>BID DOC NO.: CS-9575/ 9571/ 0370/</b> <b>0360/ 9586-102-2</b>	<b>PART-B</b> <b>SUB SECTION-III:E4</b> <b>(LT CONTROL CABLES)</b>	<b>PAGE 1 OF 6</b>

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2.09.00	<p>For cables having more than 5 cores, core identification shall be done by numbering the insulation of cores sequentially, starting by number 1 in the inner layer (e.g. say for 10 core cable, core numbering shall be from 1 to 10). The number shall be printed in Hindu-Arabic numerals on the outer surfaces of the cores. All the numbers shall be of the same colour, which shall contrast with the color of insulation. The color of insulation for all the cores shall</p>																							
<p>MOUDA STPP-II (2x660MW) / SOLAPUR STPP (2 x 660MW) / NABINAGAR STPP (3x 660MW) / MEJA TPP-I (2 x 660MW) / RAGHUNATHPUR TPP PHASE-II (2 x660MW) STEAM GENERATOR PACKAGE</p>		<p>TECHNICAL SPECIFICATION SECTION-VI          BID DOC NO.: CS-9575/ 9571/ 0370/ 0360/ 9586-102-2</p>	<p>PART-B          SUB SECTION-III:E4          (LT CONTROL CABLES) PAGE 2 OF 6</p>																					

CLAUSE NO.	TECHNICAL REQUIREMENTS		
	<div style="text-align: right; border: 1px solid black; padding: 2px; width: fit-content; margin: 0 auto;"> <b>एनटीपीसी</b>  <b>NTPC</b> </div> <p>be grey only. The numerals shall be legible and indelible. The numbers shall be repeated at regular intervals along the core, consecutive numbers being inverted in relation to each other. When the number is a single numeral, a dash shall be placed underneath it. If the number consists of two numerals, these shall be disposed one below the other and a dash placed below the lower numeral. The spacing between consecutive numbers shall not exceed 50 mm.</p> <p>2.10.00 In addition to manufacturer's identification on cables as per IS, following marking shall also be provided over outer sheath :</p> <ul style="list-style-type: none"> <li>(a) Cable size and voltage grade - To be embossed</li> <li>(b) Word 'FRLS' at every 5 meter - To be embossed</li> <li>(c) Sequential marking of length of the cable in meters at every one meter. - To be embossed / printed.</li> </ul> <p>The embossing / printing shall be progressive, automatic, in line and marking shall be legible and indelible.</p> <p>2.11.00 All cables shall meet the fire resistance requirement as per Category-B of IEC 332 Part -3.</p> <p>2.12.00 Allowable tolerances on the overall diameter of the cables shall be <math>\pm 2</math> mm maximum over the declared value in the technical data sheets.</p> <p>2.13.00 In plant repairs to the cables shall not be accepted. Pimples, fish eye, blow holes etc. are not acceptable.</p> <p>2.14.00 <b>Cable selection &amp; sizing</b></p> <ul style="list-style-type: none"> <li>(a) Rated current of the equipment</li> <li>(b) The voltage drop in the cable, during motor starting condition, shall be limited to 10% and during full load running condition, shall be limited to 3% of the rated voltage</li> <li>(c) Short circuit withstand capability</li> </ul> <p>This will depend on the feeder type. For a fuse protected circuit, cable should be sized to withstand the letout energy of the fuse. For breaker controlled feeder, cable shall be capable of withstanding the system fault current level for total breaker tripping time inclusive of relay pickup time.</p> <ul style="list-style-type: none"> <li>(d) The minimum size of conductor shall be 1.5 sq.mm.</li> </ul> <p>2.14.01 <b>Derating Factors</b></p> <p>Derating factors for various conditions of installations including the following shall be considered while selecting the cable sizes:</p> <ul style="list-style-type: none"> <li>a) Variation in ambient temperature for cables laid in air</li> <li>b) Grouping of cables</li> <li>c) Variation in ground temperature and soil resistivity for buried cables.</li> </ul> <p>2.14.02 Cable lengths shall be considered in such a way that straight through cable joints are avoided.</p>		
MOUDA STPP-II (2x660MW) / SOLAPUR STPP (2 x 660MW) / NABINAGAR STPP (3x 660MW) / MEJA TPP-I (2 x 660MW) / RAGHUNATHPUR TPP PHASE-II (2 x 660MW) STEAM GENERATOR PACKAGE	<b>TECHNICAL SPECIFICATION</b> <b>SECTION-VI</b> <b>BID DOC NO.: CS-9575/ 9571/ 0370/</b> <b>0360/ 9586-102-2</b>	<b>PART-B</b> <b>SUB SECTION-III:E4</b> <b>(LT CONTROL CABLES)</b>	<b>PAGE 3 OF 6</b>

CLAUSE NO.	<p style="text-align: center;"><b>TECHNICAL REQUIREMENTS</b></p> 		
2.14.03	Cables shall be armoured type if laid in switchyard area, coal handling area or directly buried.		
3.00.00	<b>CONSTRUCTIONAL FEATURES</b>		
3.01.00	<b>1.1 KV Grade Control Cables</b>		
	Control Cables shall have stranded copper conductor multicore PVC insulated, PVC inner-sheathed ,armoured / unarmoured, PVC outer-sheathed conforming to IS:1554. (Part-I).		
3.02.00	<b>Cable Drums</b>		
	<p>(a) Cables shall be supplied in non returnable wooden or steel drums of heavy construction. The surface of the drum and the outer most cable layer shall be covered with water proof cover. Both the ends of the cables shall be properly sealed with heat shrinkable PVC/ rubber caps secured by 'U' nails so as to eliminate ingress of water during transportation, storage and erection. Wood preservative anti-termite treatment shall be applied to the entire drum. Wooden drums shall comply with IS : 10418.</p> <p>(b) Each drum shall carry manufacturer's name, purchaser's name, address and contract number, item number and type, size and length of cable and net gross weight stencilled on both the sides of the drum. A tag containing same information shall be attached to the leading end of the cable. An arrow and suitable accompanying wording shall be marked on one end of the reel indicating the direction in which it should be rolled.</p>		
4.00.00	<b>TESTS</b>		
4.01.00	<b>GENERAL</b>		
	<p>(a) All equipment to be supplied shall be of type tested design. During detailed engineering, the contractor shall submit for Employer'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. 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> <p>(b) 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 Employer either at third party lab or in presence of client/Employers representative and submit the reports for approval.</p> <p>(c) 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> <p>(d) The type test reports once approved for any projects shall be treated as reference. For subsequent projects of NTPC, 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>		
MOUDA STPP-II (2x660MW) / SOLAPUR STPP (2 x 660MW) / NABINAGAR STPP (3x 660MW) / MEJA TPP-I (2 x 660MW) / RAGHUNATHPUR TPP PHASE-II (2 x660MW) STEAM GENERATOR PACKAGE	<b>TECHNICAL SPECIFICATION</b> <b>SECTION-VI</b> BID DOC NO.: CS-9575/ 9571/ 0370/ 0360/ 9586-102-2	<b>PART-B</b> SUB SECTION-III:E4 (LT CONTROL CABLES)	PAGE 4 OF 6

CLAUSE NO.	TECHNICAL REQUIREMENTS			
4.02.00	<b>Type Tests:</b>			
4.02.01	The Type tests reports for the following shall be submitted for one size each of LT control cable of each make :			
	S. No. Type Test	Remarks		
	a) For Conductor			
	1. Resistance test			
	b) For Armour Wires / Formed Wires			
	2. Measurement of Dimensions			
	3. Tensile Test			
	4. Elongation test			
	5. Torsion test	For round wire only		
	6. Winding test	For Formed wires only		
	7. Resistance test			
	8. Zinc Coating test	For G.S. conductors only.		
	c) For PVC insulation & PVC Sheath			
	9. Test for thickness			
	10. Tensile strength and elongation test before ageing and after ageing			
	11. Ageing in air oven			
	12. Loss of mass test	For PVC insulation and sheath only		
	13. Hot deformation test	For PVC insulation and sheath only		
	14. Heat shock test	For PVC insulation and sheath only		
	15. Shrinkage test			
	16. Thermal stability test	For PVC insulation and sheath only		
	17. Oxygen index test	For outer sheath only		
	18. Smoke density test	For outer sheath only		
	19. Acid gas generation test	For outer sheath only		
MOUDA STPP-II (2x660MW) / SOLAPUR STPP (2 x 660MW) / NABINAGAR STPP (3x 660MW) / MEJA TPP-I (2 x 660MW) / RAGHUNATHPUR TPP PHASE-II (2 x660MW) STEAM GENERATOR PACKAGE	TECHNICAL SPECIFICATION SECTION-VI BID DOC NO.: CS-9575/ 9571/ 0370/ 0360/ 9586-102-2	PART-B SUB SECTION-III:E4 (LT CONTROL CABLES)	PAGE 5 OF 6	


CLAUSE NO.	TECHNICAL REQUIREMENTS		
<p>4.03.00</p> <p>4.04.00</p>	<p>d) For completed cables</p> <p>20. Insulation resistance test (Volume resistivity method)</p> <p>21. High voltage test</p> <p>22. Flammability test as per IEC - 332 Part-3 (Category-B)</p> <p><b>Acceptance Tests:</b> As per QA Table</p> <p><b>Routine Tests :</b>As per QA Table</p>		
<p>MOUDA STPP-II (2x660MW) / SOLAPUR STPP (2 x 660MW) / NABINAGAR STPP (3x 660MW) / MEJA TPP-I (2 x 660MW) / RAGHUNATHPUR TPP PHASE-II (2 x660MW) STEAM GENERATOR PACKAGE</p>	<p>TECHNICAL SPECIFICATION SECTION-VI BID DOC NO.: CS-9575/ 9571/ 0370/ 0360/ 9586-102-2</p>	<p>PART-B SUB SECTION-III:E4 (LT CONTROL CABLES)</p>	<p>PAGE 6 OF 6</p>

# SUB-SECTION-IV: I7

## INSTRUMENTATION AND POWER SUPPLY CABLE

MOUDA STPP-II (2x660MW) / SOLAPUR STPP (2 x 660MW) /  
NABINAGAR STPP (3x 660MW) /MEJA TPP-I (2 x 660MW) /  
RAGHUNATHPUR TPP PHASE-II (2 x660MW)  
STEAM GENERATOR PACKAGE

TECHNICAL SPECIFICATION  
SECTION-VI  
BID DOC NO.: CS-9575/ 9571/ 0370/ 0360/ 9586-102-2

CLAUSE NO.	<div style="text-align: right;"></div> <b>TECHNICAL REQUIREMENTS</b>																	
	<b>INSTRUMENTATION AND POWER SUPPLY CABLE</b>																	
1.00.00	<b>INSTRUMENTATION CABLE, POWER SUPPLY CABLE, INTERNAL WIRING AND ELECTRICAL FIELD CONSTRUCTION MATERIAL</b>																	
1.01.00	<b>General Requirements</b>																	
1.01.01	All cables including special cables, internal wiring and electrical field construction material shall conform to this specification, Employer approved detail engineering drawings & documents and the latest edition of the relevant standards & guidelines. The Bidder shall furnish all material and services required for the completeness of the work identified in his scope as per this specification.																	
1.01.01	The Contractor shall supply, erect, terminate and test all instrumentation cables for control and instrumentation equipment/devices/systems included under Contractor's scope as illustrated in the enclosed Drg. No. 0000-101/102-POI-A-021 and ensuring completeness of the control system.																	
1.01.02	Any other application where it is felt that instrumentation cables are required due to system/operating condition requirements, are also to be provided by Contractor.																	
1.01.03	Other type of cables like fiber optic/co-axial cables for system bus, cables for connection of peripherals etc. (under Contractor's scope) are also to be furnished by the Contractor.																	
1.01.04	Contractor shall supply all cable erection and laying hardware from the main trunk routes like branch cable trays/sub-trays, supports, flexible conduits, cable glands, lugs, pull boxes etc. on as required basis for all the systems covered under this specification.																	
1.01.05	Wherever the quantity has been defined as on as required basis, the same are to be furnished by contractor on as required basis within his quoted lump sump price without any further cost implication to the Employer.																	
2.00.00	<b>Specification of Instrumentation cable</b>																	
2.01.00	<b>Common Requirements</b>																	
	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left;">S. No.</th> <th style="text-align: left;">Property</th> <th style="text-align: left;">Requirement</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>Voltage grade</td> <td>225 V (peak value)</td> </tr> <tr> <td>2.</td> <td>Codes and standard</td> <td>All instrumentation cables shall comply with VDE 0815, VDE 0207, Part 4, Part 5, Part 6, VDE 0816, VDE 0472, SEN 4241475, ANSI MC 96.1, IS-8784, IS-10810 (latest editions) and their amendments read along with this specification.</td> </tr> <tr> <td>3.</td> <td>Continuous operation suitability</td> <td>At 70 deg. C for all types of cables, while 205 Deg C for Type-C cables.</td> </tr> <tr> <td>4.</td> <td>Progressive automatic on-line sequential marking of length in meters</td> <td>To be provided at every one meter on outer sheath.</td> </tr> </tbody> </table>			S. No.	Property	Requirement	1	Voltage grade	225 V (peak value)	2.	Codes and standard	All instrumentation cables shall comply with VDE 0815, VDE 0207, Part 4, Part 5, Part 6, VDE 0816, VDE 0472, SEN 4241475, ANSI MC 96.1, IS-8784, IS-10810 (latest editions) and their amendments read along with this specification.	3.	Continuous operation suitability	At 70 deg. C for all types of cables, while 205 Deg C for Type-C cables.	4.	Progressive automatic on-line sequential marking of length in meters	To be provided at every one meter on outer sheath.
S. No.	Property	Requirement																
1	Voltage grade	225 V (peak value)																
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3.	Continuous operation suitability	At 70 deg. C for all types of cables, while 205 Deg C for Type-C cables.																
4.	Progressive automatic on-line sequential marking of length in meters	To be provided at every one meter on outer sheath.																
MOUDA STPP-II (2x660MW) / SOLAPUR STPP (2 x 660MW) / NABINAGAR STPP (3x 660MW) / MEJA TPP-I (2 x 660MW) / RAGHUNATHPUR TPP PHASE-II (2 x660MW) <b>STEAM GENERATOR PACKAGE</b>	<b>TECHNICAL SPECIFICATION SECTION-VI BID DOC NO.: CS-9575/ 9571/ 0370/ 0360/ 9586-102-2</b>	<b>PART - B SUB-SECTION-IV: I7 (INSTR. AND POWER SUPPLY CABLE)</b>	<b>PAGE 1 OF 14</b>															

CLAUSE NO.

TECHNICAL REQUIREMENTS



- 5. Marking to read 'FRLS' To be provided at every 5 meters on outer sheath except for Type-C cable.
- 6. Allowable Tolerance on overall diameter +/- 2 mm (maximum) over the declared value in data sheet
- 7. Variation in diameter Not more than 1.0 mm throughout the length of cable.
- 8. Ovality at any cross-section Not more than 1.0 mm
- 9. Others
  - a) Durable marking at intervals not exceeding 625 mm shall include manufacturer's name, insulation material, conductor's size, number of pairs, voltage rating, type of cable, year of manufacturer to be provided.
  - b) Cables shall be suitable for laying in conduits, ducts, trenches, racks and underground-buried installation
  - c) Repaired cables shall not be acceptable.

2.02.00


**Specific Requirements**


Specification Requirements	Type-A cable	Type-B cable	Type F & G cable	Type-C cable
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**A. Conductors**

Cross section area	(Same as T/C )		0.5 sq. mm	0.5 sq. mm.
Conductor material	ANSI type KX	ANSI type SX	High conductivity Annealed bare copper	ANSI type KX
Colour code	Yellow-Red	Black-Red	As per VDE-815	Yellow-Red
Conductor Grade	As per ANSI MC 96.1		Electrolytic	As per ANSI MC 96.1
No & dia of strands	7x0.3 mm (nom)			
No. of Pairs	2	2	2,4,8,12,16,24,48	2
Max. conductor resistance per Km (in ohm) at 20 deg. C	As per ANSI MC 96.1		73.4 (loop)	As per ANSI MC 96.1

CLAUSE NO.	TECHNICAL REQUIREMENTS			
	Reference Standard	As per ANSI MC 96.1	VDE 0815	As per ANSI MC 96.1
	<b>B. Insulation</b>			
	Material	PVC type YI 3 Teflon (i.e. extruded FEP)		
	Thickness in mm (Min/Nom/Max)	0.25/0.3/0.35	0.4/0.50	
	Volume Resistivity (Min) in ohm-cm	1 x 10 <sup>14</sup> at 20 deg. C & 1x10 <sup>11</sup> at 70 deg. C.		---
	Voltage Rating	225 V peak operating voltage		
	Reference Standard	VDE 0207 Part 4	VDE 0207 Part 6 & ASTM D 2116.	
	Core diameter above insulation	Suitable for cage clamp connector		
	<b>C. Pairing &amp; Twisting</b>			
	Max. lay of pairs (mm)	50		
	Single layer of polyester numbered tape on each pair provided	Yes		
	Unit formation of four pairs with printing of no. of Unit provided	N.A.	Yes	N.A.
	Conductor /pair identification as per VDE0815	N.A.	To be provided (color coding attached).	N.A.
	<b>D. Shielding</b>			
	Type of shielding	←----- Al-Mylar tape ----->		
	Individual pair shielding	No	To be provided for F-type cable	No
	Minimum thickness of Individual pair shielding	No	28 micron	No
MOUDA STPP-II (2x660MW) / SOLAPUR STPP (2 x 660MW) / NABINAGAR STPP (3x 660MW) / MEJA TPP-I (2 x 660MW) / RAGHUNATHPUR TPP PHASE-II (2 x660MW) STEAM GENERATOR PACKAGE	TECHNICAL SPECIFICATION SECTION-VI BID DOC NO.: CS-9575/ 9571/ 0370/ 0360/ 9586-102-2	PART - B SUB-SECTION-IV: I7 (INSTR. AND POWER SUPPLY CABLE)	PAGE 3 OF 14	

CLAUSE NO.	TECHNICAL REQUIREMENTS			
	Overall cable assembly shielding		To be provided	
	Minimum thickness of Overall cable assembly shielding		55 micron	
	Shielding coverage		100% with at least 20% overlap	
	Drain wire provided for individual shield	N.A.	Yes (for F-type) 7-strand 20 AWG (0.51 mm <sup>2</sup> ) annealed Tin coated copper	N.A.
	Drain wire provided for overall shield	Yes.	7-strand 20 AWG (0.51 mm <sup>2</sup> ) annealed Tin coated copper	
	<b>E. FILLERS</b>			
	Non-hygroscopic, flame retardant		To be provided	
	<b>F. Outer Sheath</b>			
	Material	←--- Extruded PVC compound YM1 with---→	FRLS properties	Teflon (i.e. extruded FRP)
	Minimum Thickness at any point	1.8 mm		0.4 mm
	Nominal Thickness at any point	>1.8 mm		0.5 mm
	Color		Blue	
	Resistant to water, fungus, termite & rodent attack		Required	
	Oxygen index as per ASTM D-2863		not less than 29%	N.A.
	Temperature index as per ASTM D-2863		not less than 250 deg.C	N.A.
	Acid gas generation by weight as per IEC-60754-1		Maximum 20%	N.A.
MOUDA STPP-II (2x660MW) / SOLAPUR STPP (2 x 660MW) / NABINAGAR STPP (3x 660MW) / MEJA TPP-I (2 x 660MW) / RAGHUNATHPUR TPP PHASE-II (2 x660MW) STEAM GENERATOR PACKAGE	<b>TECHNICAL SPECIFICATION SECTION-VI</b> BID DOC NO.: CS-9575/ 9571/ 0370/ 0360/ 9586-102-2	<b>PART - B SUB-SECTION-IV: I7 (INSTR. AND POWER SUPPLY CABLE)</b>	<b>PAGE 4 OF 14</b>	

CLAUSE NO.	TECHNICAL REQUIREMENTS			
	Smoke Density Rating as per ASTM-D2843	Maximum 60% (defined as the average area under the curve when the results of smoke density test plotted on a curve indicating light absorption vs. time as per ASTM-D2843)		N.A.
	Reference standard	VDE207 Part 5		VDE207 Part 6 & ASTM D2116
	<b>G. Electrical Parameters</b>			
	Mutual Capacitance Between Conductors At 0.8 KHz (Max.)	200 nF/km	120 nF/km for F type  100 nF/km for G-type	200 nF/km
	Insulation Resistance (Min.)	100 M Ohm/Km		
	Cross Talk Figure (Min.) At 0.8 KHz	60 dB	60 dB	N.A.
	Characteristic Impedance (Max) At 1 KHz	N.A.	320 OHM FOR F-TYPE 340 OHM FOR G-TYPE	N.A.
	Attenuation Figure at 1 KHz (Max)	N.A.	1.2 db/km	N.A.
	<b>H. Complete Cable</b>			
	Complete Cable assembly	Shall pass Swedish Chimney test as per SEN-SS 4241475 class F3.		N.A.
	Flammability	Shall pass flammability as per IEEE-383 read in conjunction to this specification		N.A.
	<b>I. Accessories</b>			
	Cable accessories of flame retardant quality.	Yes. (Accessories such as harnessing components, markers, bedding, cable jointer, binding tape etc.)		
	<b>J. Tests</b>			
	Routine & Acceptance tests	Refer sub-section IIIE		
MOUDA STPP-II (2x660MW) / SOLAPUR STPP (2 x 660MW) / NABINAGAR STPP (3x 660MW) / MEJA TPP-I (2 x 660MW) / RAGHUNATHPUR TPP PHASE-II (2 x660MW) STEAM GENERATOR PACKAGE	<b>TECHNICAL SPECIFICATION SECTION-VI</b> <b>BID DOC NO.: CS-9575/ 9571/ 0370/ 0360/ 9586-102-2</b>	<b>PART - B</b> <b>SUB-SECTION-IV: I7</b> <b>(INSTR. AND POWER SUPPLY CABLE)</b>	<b>PAGE 5 OF 14</b>	

CLAUSE NO.	<b>TECHNICAL REQUIREMENTS</b> 		
	<p>Type tests</p> <p><b>K Cable Drum</b></p> <p>Type</p> <p>Outermost layer covered with waterproof paper</p> <p>Painting</p> <p>Length</p>	<p>Submission of type test results and certificate shall be acceptable provided the test has been conducted within last 5 years from the date of bid opening. In case the test is not conducted within last 5 years or spec requirements are not met, the same shall be conducted by contractor free of cost to Employer. Also, refer sub-section-IV:19 TYPE TEST REQUIREMENTS FOR C&amp;I.</p> <p>Non-returnable wooden drum (wooden drum to be constructed from seasoned wood free from defects with wood preservative applied to the entire drum) or steel drum.</p> <p>Yes</p> <p>Entire surface to be painted</p> <p>1000 m + 5% for up to &amp; including 12 pairs 500 m + 5% for above 12 pairs</p>	
<p><b>3.00.00</b></p> <p>3.01.00</p> <p>3.02.00</p> <p>3.03.00</p> <p>3.04.00</p> <p>3.05.00</p> <p>3.06.00</p> <p>3.07.00</p>	<p><b>SPECIFICATION OF OPTICAL FIBER CABLES (OFC)</b></p> <p>Optic Fiber cable shall be 4/8/12 core, galvanised corrugated steel taped armoured, fully water blocked with dielectric central member for outdoor/indoor application so as to prevent any physical damage. The cable shall have multiple single-mode or multi mode fibers on as required basis so as to avoid the usage of any repeaters. The core and cladding diameter shall be 9 +/- 1 micrometer and 125 +/- 1 micrometer respectively. The outer sheath shall have Flame Retardant, UV resistant properties and are to be identified with the manufacturer's name, year of manufacturer, progressive automatic sequential on-line marking of length in meters at every meter on outer sheath.</p> <p>The cable core shall have suitable characteristics and strengthening for prevention of damage during pulling viz. Steel central member, Loose buffer tube design, 4 fibers per buffer tube (minimum), Interstices and buffer tubes duly filled with Thixotropic jelly etc. The cable shall be suitable for a maximum tensile force of 2000 N during installation, and once installed, a tensile force of 1000 N minimum. The compressive strength of cable shall be 3000 N minimum &amp; crush resistance 4000 N minimum. The operating temperature shall be - 20 deg. C to 70 deg.C</p> <p>All testing of the fiber optic cable being supplied shall be as per the relevant IEC, EIA and other international standards.</p> <p>Bidder to ensure that minimum 100% cores are kept as spares in all types of optical fibre cables.</p> <p>Cables shall be suitable for laying in conduits, ducts, trenches, racks and under ground buried installation.</p> <p>Spliced / Repaired cables are not acceptable.</p> <p>Penetration of water resistance and impact resistance shall be as per IEC standard.</p>		
<p>MOUDA STPP-II (2x660MW) / SOLAPUR STPP (2 x 660MW) / NABINAGAR STPP (3x 660MW) / MEJA TPP-I (2 x 660MW) / RAGHUNATHPUR TPP PHASE-II (2 x660MW) STEAM GENERATOR PACKAGE</p>	<p><b>TECHNICAL SPECIFICATION SECTION-VI</b>  <b>BID DOC NO.: CS-9575/ 9571/ 0370/ 0360/ 9586-102-2</b></p>	<p><b>PART - B</b>  <b>SUB-SECTION-IV: I7</b>  <b>(INSTR. AND POWER SUPPLY CABLE)</b></p>	<p><b>PAGE 6 OF 14</b></p>

CLAUSE NO.

TECHNICAL REQUIREMENTS



4.00.00

**SPECIFICATION OF POWER SUPPLY CABLES**

For technical specification, testing requirements etc, refer relevant subsections of this specification.


5.00.00


**INSTRUMENTATION CABLE INTERCONNECTION AND TERMINATION PHILOSOPHY**


The cable interconnection philosophy to be adopted shall be such that extensive grouping of signals by large scale use of field mounted Group Junction Boxes (JBs) at strategic locations (where large concentration of signals are available, e.g. valves limit & torque switches, switchgear) is done and consequently cable with higher number of pairs are extensively used. The details of termination to be followed are mentioned in the given Table A.


**TABLE A: CABLE TERMINATION TO BE FOLLOWED**


Application		Type Of Termination		Type Of	Cable
FROM (A)	TO (B)	END A	END B	END B	
Valves/dampers drives (Integral Junction box)	Marshalling cubicle/ Marshalling cum termination Cubicle/local group JB	Plug in connector	Posts mount cage clamp type.		G
Transmitters, Process Actuated switches mounted in LIE/LIR	Integral Junction box of LIE/LIR	Plug in connector	Cage clamp (Rail mount) type.		F,G
RTD heads	Local junction box	Plug in connector	Cage clamp (Rail mount) type.		F
Thermocouple	CJC Box (if applicable)	Plug in connector	Cage clamp (Rail mount) type.		A,B,C*
Other Field Mounted Instrument	Local JB/Group JB	Plug in connector	Screwed, Cage clamp (Rail mount) type		F,G
RTD	Temperature transmitter	Plug in connector	Screwed, Cage clamp type		F
Thermocouple	Temperature transmitter	Plug in connector	Screwed, Cage clamp type		A,B,C*
Local Junction box, Temperature Transmitter, Int. Junction box of LIE/ LIR/Group JB/ MCC/SWGR	Group JB	Cage clamp (Rail mount) type.	Cage clamp (Rail mount) type.		F,G


CLAUSE NO.	<b>TECHNICAL REQUIREMENTS</b> 				
<p>6.00.00</p> <p>6.01.00</p>	<hr/>				
	<p>Application</p> <p>FROM (A)</p>	<p>Type Of Termination</p> <p>TO (B)</p>	<p>END A</p>	<p>Type Of</p> <p>END B</p>	<p>Cable</p>
<p>Local Junction box, Temperature Transmitter, Int. Junction box of LIE/ LIR/Group JB/ MCC/SWGR</p>	<p>Marshalling Cubicle/ Marshalling cum Termination Cabinet</p>	<p>Cage clamp (Rail mount) type.</p>	<p>Posts mount cage clamp type.</p>	<p>F,G</p>	
<p>Marshalling cubicle/ Termination Cabinet</p>	<p>Electronic system cabinet</p>	<p>Cage clamp Post mounted type.</p>	<p>Plug in connector/ Other System as per manufacturer's Standard</p>	<p>Internal wiring</p>	
<p>Marshalling/ Termination System Cabinets</p>	<p>UCD mounted equipments</p>	<p>Post mount cage clamp type.</p>	<p>Plug in connector/ Cage clamp type (rail mounted).</p>	<p>F,G (with plug-in connector at one end)</p>	
<p>DDCMIS/PLC cabinets</p>	<p>PC, Printers etc.</p>	<p>Plug in connector</p>	<p>Plug in connector</p>	<p>Mfr.'s Standard</p>	
<p>Notes</p> <ol style="list-style-type: none"> <li>Normally 10% spare cores shall be provided when the numbers of pairs of cables are more than four pairs except for pre-fabricated cables which shall be as per manufacturer's standard.</li> <li>For analog signals, individual pair shielding &amp; overall shielding &amp; for Binary signals, only overall shielding of instrumentation cables shall be provided.</li> <li>Also refer Drg. 0000-101/102-POI-A-021.</li> <li>*For high temperature applications only.</li> <li>Instrument Cabling for instruments/equipments covered under subsection-IV:13 (MAIN EQP INST SYS) shall be as per manufacturer's standard .</li> </ol>					
<p><b>6.00.00 TERMINAL BLOCKS</b></p>					
<p>6.01.00 All terminal blocks shall be rail mounted/post mounted, cage clamp type with high quality non-flammable insulating material of melamine suitable for working temperature of 105 deg.C. The terminal blocks in field mounted junction boxes, temperature transmitters, instrument enclosures/racks, etc., shall be suitable for cage clamp connections. The terminal blocks in Control Equipment Room logic/termination/marshalling cubicles shall be suitable for post mounted cage clamp connection at the field input end. The terminal blocks for DDCMIS input/output connections from/to SWGR/MCC, Actuators with Integral Starter (for coupling</p>					
<p>MOUDA STPP-II (2x660MW) / SOLAPUR STPP (2 x 660MW) / NABINAGAR STPP (3x 660MW) / MEJA TPP-I (2 x 660MW) / RAGHUNATHPUR TPP PHASE-II (2 x660MW) STEAM GENERATOR PACKAGE</p>	<p>TECHNICAL SPECIFICATION SECTION-VI            BID DOC NO.: CS-9575/ 9571/ 0370/ 0360/ 9586-102-2</p>	<p>PART - B            SUB-SECTION-IV: I7            (INSTR. AND POWER SUPPLY CABLE)</p>	<p>PAGE 8 OF 14</p>		


CLAUSE NO.	<b>TECHNICAL REQUIREMENTS</b> 		
	relays and check back signals of 11 kV and 3.3 kV auxiliaries, LT drives/valves & dampers/solenoids, CT & VT, etc.) shall be provided with built in test and disconnect facilities complete with plug, slide clamp, test socket etc. The exact type of terminal blocks to be provided by the Bidder and the technical details of the same including width etc. shall be subject to Employer's approval.		
6.02.00	All the terminal blocks shall be provided complete with all required accessories including assembly rail, locking pin and section, end brackets, partitions, small partitions, test plug bolts and test plug (as specified above for SWGR connections) transparent covers, support brackets, distance sleeves, warning label, marking, etc.		
6.03.00	The marking on terminal strips shall correspond to the terminal numbering on wiring diagrams. At least 20% spare unused terminals shall be provided everywhere including local junction boxes, instrument racks/enclosures, termination/marshalling cabinets, etc. All terminal blocks shall be numbered for identification and grouped according to the function. Engraved labels shall be provided on the terminal blocks.		
6.04.00	For terminating each process actuated switches, drive actuators, control valves, Thermocouple, RTD, etc. in Local Junction Boxes, etc, refer Drg no. 0000-999-POI-A-065.		
6.05.00	The terminal blocks shall be arranged with at least 100 mm clearance between two sets of terminal blocks and between terminal blocks and junction box walls.		
6.06.00	For ensuring proper connections, Bidder shall provide suitable accessories, along with insulation sleeves. The exact connecting accessory shall be finalized as per application during detail engineering stage subject to Employer's approval without any cost repercussions.		
6.07.00	Internal wiring in factory pre-wired electronic equipment cabinets may be installed according to the Bidder's standard as to wire size and method of termination or internal equipment. Terminal blocks for connection of external circuits into factory prewired electronic equipment cabinets shall meet all the requirements as specified above.		
<b>7.00.00</b>	<b>INTERNAL PANELS/ SYSTEM CABINETS WIRING</b>		
7.01.00	Internal panel/cabinet wiring shall be of multi-stranded copper conductor with FRLS PVC insulation without shield and outer sheath meeting the requirements of VDE 0815.		
7.02.00	Wiring to door mounted devices shall be done by 19 strand copper wire provided with adequate loop lengths of hinge wire so that multiple door opening shall not cause fatigue breaking of the conductor.		
7.03.00	All internal wires shall be provided with tag and identification nos. etched on tightly fitted ferules at both ends in Employer's approved format. All wires directly connected to trip devices shall be distinguished by one additional red color ferrule.		
7.04.00	All external connection shall be made with one wire per termination point. Wires shall not be tapped or spliced between terminal points.		
7.05.00	All floor slots of desk/panels/cabinets used for cable entrance shall be provided with removable gasketed gland plates and sealing material. Split type grommets shall be used for prefabricated cables.		
7.06.00	All the special tools as may be required for solder less connections shall be provided by Bidder.		
MOUDA STPP-II (2x660MW) / SOLAPUR STPP (2 x 660MW) / NABINAGAR STPP (3x 660MW) / MEJA TPP-I (2 x 660MW) / RAGHUNATHPUR TPP PHASE-II (2 x660MW) STEAM GENERATOR PACKAGE	<b>TECHNICAL SPECIFICATION SECTION-VI</b> <b>BID DOC NO.: CS-9575/ 9571/ 0370/ 0360/ 9586-102-2</b>	<b>PART - B</b> <b>SUB-SECTION-IV: I7</b> <b>(INSTR. AND POWER SUPPLY CABLE)</b>	<b>PAGE 9 OF 14</b>

CLAUSE NO.	TECHNICAL REQUIREMENTS											
7.07.00	<p>Wire sizes to be utilized for internal wiring.</p> <p>(i) Current (4-20 mA), low voltage signals (48V); Ammeter/Voltmeter circuit, control switches etc. for electrical system. 0.5 Sq.mm.</p> <p>(ii) Power supply and internal illumination. 2.5Sq.mm. minimum (shall be as per load requirement.)</p>											
<b>8.00.00</b>	<b>INSTRUMENTATION CABLE INSTALLATION AND ROUTING</b>											
8.01.00	All cables assigned to a particular duct/conduit shall be grouped and pulled in simultaneously using cable grips and suitable lubricants. Cables removed from one duct/conduit shall not be reused without approval of Employer.											
8.02.00	<p>Cables shall be segregated as per IEEE Std.-422. In vertically stacked trays, the higher voltage cable shall be in higher position and instrumentation cable shall be in bottom tier of the tray stack. The distance between instrumentation cables and those of other system shall be as follows:</p> <table border="0"> <tr> <td>From 11 kV/6.6 kV/3.3 kV tray system</td> <td>-</td> <td>914 mm</td> </tr> <tr> <td>From 415V tray system</td> <td>-</td> <td>610 mm</td> </tr> <tr> <td>From control cable tray system</td> <td>-</td> <td>305 mm</td> </tr> </table>			From 11 kV/6.6 kV/3.3 kV tray system	-	914 mm	From 415V tray system	-	610 mm	From control cable tray system	-	305 mm
From 11 kV/6.6 kV/3.3 kV tray system	-	914 mm										
From 415V tray system	-	610 mm										
From control cable tray system	-	305 mm										
8.03.00	Cables shall terminate in the enclosure through cable glands. All cable glands shall be properly gasketed. Fire proof sealing (to prevent ingress of dust entry and propagation of fire) shall be provided for all floor slots used for cable entrance. Compression cable glands (double for armoured and single for other cables) shall be provided.											
8.04.00	All cables shall be identified by tag. Nos. provided in Employer's approved format at both the ends as well as at an interval of 5 meters.											
8.05.00	Line voltage drop due to high resistance splices, terminal contacts, insulation resistance at terminal block, very long transmission line etc. shall be reduced as far as practicable.											
8.06.00	The cables emanating from redundant equipment/devices shall be routed through different paths. The above segregation of cables & wiring for redundant equipments/devices shall be in accordance with IEEE-Std-422.											
<b>9.00.00</b>	<b>CABLE LAYING AND ACCESSORIES</b>											
9.01.00	<p><b>CABLE LAYING</b></p> <p>1 Cables shall be laid strictly in line with cable schedule.</p> <p>2 Identification tags for cables.</p> <p>Indelible tags to be provided at all terminations, on both sides of wall or floor crossing, on each conduit/duct/pipe entry/exit, and at every 20 m in cable trench/tray.</p>											
MOUDA STPP-II (2x660MW) / SOLAPUR STPP (2 x 660MW) / NABINAGAR STPP (3x 660MW) / MEJA TPP-I (2 x 660MW) / RAGHUNATHPUR TPP PHASE-II (2 x660MW) STEAM GENERATOR PACKAGE		<b>TECHNICAL SPECIFICATION SECTION-VI</b> <b>BID DOC NO.: CS-9575/ 9571/ 0370/ 0360/ 9586-102-2</b>	<b>PART - B SUB-SECTION-IV: I7 (INSTR. AND POWER SUPPLY CABLE)</b>	<b>PAGE 10 OF 14</b>								

CLAUSE NO.	<b>TECHNICAL REQUIREMENTS</b> 			
9.02.00	<p>3 Cable tray numbering and marking. To be provided at every 10m and at each end of cable way &amp; branch connection.</p> <p>4 Joints for less than 250 Meters run of cable shall not be permitted.</p> <p>5 Buried cable protection With concrete slabs; Route markers at every 20 Meters along the route &amp; at every bend.</p> <p>6 Road Crossings Cables to pass through buried high density PE pipes encased in PCC. At least 300 mm clearance shall be provided between</p> <ul style="list-style-type: none"> <li>- HT power &amp; LT power cables,</li> <li>- LT power &amp; LT control cables</li> <li>- LT control &amp; instrumentation cables,</li> </ul> <p>Spacing between cables of same voltage grade shall be in accordance with the de-rating criteria adopted for cable sizing.</p> <p>7 Segregation (physical isolation to prevent fire jumping)</p> <p>a All cable associated with the unit shall be segregated from cables of other Units.</p> <p>b Interplant cables of station auxiliaries and unit critical drives shall be segregated in such a way that not more than half of the drives are lost in case of single incident of fire.</p> <p>8 Cable clamping All cables laid on trays shall be neatly dressed up &amp; suitably clamped/tied to the tray. For cables in trefoil formation, trefoil clamps shall be provided.</p> <p>9 Optical fiber cables inside conduit shall be laid on cable trays wherever available and feasible. In areas where the same are required to be buried, the same shall be buried in separate trench approx.1.6 meter depth, to be laid in 2" GI/rodent proof HDPE conduits covered with sand, brick and soil along the pipe line route;</p> <p>While crossing roads - to be laid in GI/rodent proof HDPE conduits with sand filling at bottom and sand, soil filling at top with cement concrete;</p> <p>While crossing canals/river- to be laid in GI/rodent proof HDPE conduits within hume pipe.</p> <p>Bidder shall supply and install all cable accessories and fittings like Light Interface Units, Surge suppressors, Opto isolators, Interface Converters, Fibre Optic Card Cage, Fibre Optic Line Driver, Repeater / Modem (for Optical Fibre Cables), cable glands, grommets, lugs, termination kits etc. on as required basis.</p>	<b>TECHNICAL SPECIFICATION</b> <b>SECTION-VI</b> <b>BID DOC NO.: CS-9575/ 9571/ 0370/</b> <b>0360/ 9586-102-2</b>	<b>PART - B</b> <b>SUB-SECTION-IV: I7</b> <b>(INSTR. AND POWER</b> <b>SUPPLY CABLE)</b>	<b>PAGE 11 OF 14</b>

CLAUSE NO.	<p style="text-align: center;"><b>TECHNICAL REQUIREMENTS</b></p> 																								
9.03.00	Bidder shall furnish two completely new sets of cable termination kits like Crimping tools, etc., which are required for maintenance of the system as per the type of termination used.																								
9.04.00	Cables, which terminate in cabinets of draw out sections shall have sufficient cable coiled in the bottom of the cabinet to permit full withdrawal of draw out sections without disconnecting the cables. When prefabricated cables with factory connectors on both ends are longer than required, the excess cable shall be coiled in the bottom of one or both termination cabinets.																								
9.05.00	No splices shall be made in conductors for instrument and control circuits except where required at connections to devices equipped with factory installed pigtails. Such splices shall be made only in approved splicing boxes of fitting with removable cover. The splices shall be made with sufficient slack left in the wires to permit withdrawal of the splice from the splicing box for ease of future disconnection of the splices. All exposed conductor or connector surfaces shall be covered with a minimum of three half-lapped layers of all weather vinyl plastic electrical tape. Taping shall extend a minimum of two cable diameters over the cable jacket and a similar distance over the other insulation or connections requiring insulation.																								
9.06.00	The Bidder shall be responsible for proper grounding of all equipment under C&I package. Further, proper termination of cable shields shall be verified and the grounding of the same shall be coordinated so as to achieve grounding of all instrumentation cable shields at same potential. This shall be completed prior to system tests. All the cables etc. required for grounding of all equipments supplied under this package are to be supplied by the Bidder.																								
9.07.00	The Contractor shall take full care while laying / installing cables as recommended by cable manufacturers regarding pulling tensions and cable bends. Cables damaged in any way during installation shall be replaced at the expense of the Contractor.																								
<b>10.00.00</b>	<p><b>FIELD MOUNTED LOCAL JUNCTION BOXES</b></p> <table border="0" style="width: 100%;"> <tr> <td style="width: 5%;">(i)</td> <td style="width: 40%;">No. of ways</td> <td style="width: 55%;">12/24/36/48/64/72/96/128 with 20% spares terminals.</td> </tr> <tr> <td>(ii)</td> <td>Material and Thickness</td> <td>4mm thick Fiberglass Reinforced Polyester (FRP).</td> </tr> <tr> <td>(iii)</td> <td>Type</td> <td>Door gasket shall be of synthetic rubber.</td> </tr> <tr> <td>(iv)</td> <td>Mounting clamps and accessories</td> <td>Suitable for mounting on walls, columns, structures etc. The brackets, bolts, nuts, screws, glands and lugs required for erection shall be of brass, included in Bidders scope of supply.</td> </tr> <tr> <td>(v)</td> <td>Type of terminal blocks</td> <td>Rail mounted cage-clamp type suitable for conductor size upto 2.5 mm<sup>2</sup>. A M6 earthing stud shall be provided.</td> </tr> <tr> <td>(vi)</td> <td>Protection Class</td> <td>IP: 55 minimum for indoor &amp; IP-65 minimum for outdoor applications.</td> </tr> <tr> <td>(vii)</td> <td>Grounding</td> <td>To be provided.</td> </tr> <tr> <td>(viii)</td> <td>Color</td> <td>To be decided during detailed engineering &amp; subject to Employer's approval.</td> </tr> </table>	(i)	No. of ways	12/24/36/48/64/72/96/128 with 20% spares terminals.	(ii)	Material and Thickness	4mm thick Fiberglass Reinforced Polyester (FRP).	(iii)	Type	Door gasket shall be of synthetic rubber.	(iv)	Mounting clamps and accessories	Suitable for mounting on walls, columns, structures etc. The brackets, bolts, nuts, screws, glands and lugs required for erection shall be of brass, included in Bidders scope of supply.	(v)	Type of terminal blocks	Rail mounted cage-clamp type suitable for conductor size upto 2.5 mm <sup>2</sup> . A M6 earthing stud shall be provided.	(vi)	Protection Class	IP: 55 minimum for indoor & IP-65 minimum for outdoor applications.	(vii)	Grounding	To be provided.	(viii)	Color	To be decided during detailed engineering & subject to Employer's approval.
(i)	No. of ways	12/24/36/48/64/72/96/128 with 20% spares terminals.																							
(ii)	Material and Thickness	4mm thick Fiberglass Reinforced Polyester (FRP).																							
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(vi)	Protection Class	IP: 55 minimum for indoor & IP-65 minimum for outdoor applications.																							
(vii)	Grounding	To be provided.																							
(viii)	Color	To be decided during detailed engineering & subject to Employer's approval.																							
MOUDA STPP-II (2x660MW) / SOLAPUR STPP (2 x 660MW) / NABINAGAR STPP (3x 660MW) / MEJA TPP-I (2 x 660MW) / RAGHUNATHPUR TPP PHASE-II (2 x660MW) STEAM GENERATOR PACKAGE	<b>TECHNICAL SPECIFICATION</b> <b>SECTION-VI</b> <b>BID DOC NO.: CS-9575/ 9571/ 0370/</b> <b>0360/ 9586-102-2</b>	<b>PART - B</b> <b>SUB-SECTION-IV: I7</b> <b>(INSTR. AND POWER</b> <b>SUPPLY CABLE)</b>	<b>PAGE 12 OF 14</b>																						

CLAUSE NO.	<b>TECHNICAL REQUIREMENTS</b> 			
<b>11.00.00</b>  11.01.00           11.02.00  11.03.00  11.04.00  11.05.00  11.06.00  11.07.00  11.08.00	<b>CONDUITS</b>  Conduits shall be generally used for interconnecting cables from field instruments to Local JB's. All rigid conduits, couplings and elbows shall be hot dipped galvanized rigid mild steel in accordance with IS: 9537 Part-I (1980) and Part-II (1981). The conduit interior and exterior surfaces shall have continuous zinc coating with an overcoat of transparent enamel lacker or zinc chromate. Flexible conduit shall be heat resistant lead coated steel, The temperature rating of flexible conduit shall be suitable for the following areas:  (i) Mills (ii) Drum (iii) Main steam, RH steam (iv) Air Heaters (v) Furnace, BFPDTs  For the remaining applications, water leak, fire and rust proof flexible GI conduits shall be provided.  The Bidder shall install conduits according to the general routing as approved by Employer and shall coordinate conduit locations with other works.  All grounding bushings within all enclosures shall be wired together and connected internally to the enclosure grounding lug or grounding bus with 8 AWG bare copper conductor. Conduit runs to individually mounted equipment shall be grounded to the Employer's cable tray grounding conductor with 12 AEG bare copper conductor. All grounding bushings, clamps and connectors shall be subject to approval of the Employer.  All rigid conduit fittings shall conform to the requirements of IS: 2667, 1976. Galvanized steel fitting shall be used with steel conduit. All flexible conduit fittings shall be liquid tight, galvanized steel. The end fittings shall be compatible with the flexible conduit supplied.  All individually mounted equipment and devices shall be connected to the supply conduit, using not more than one meter of flexible conduit adjacent to the equipment or device. Flexible conduit shall be installed in all conduit runs, which are supported by both building steel and structures subject to vibration or thermal expansion. This shall include locations where conduit supported by building steel enters or becomes supported by the turbine generator foundation and where conduit supported by building steel or foundation becomes supported by steam generator framing.  Special areas, such as control rooms in which external noise is to be minimized, shall have flexible conduit in conduit runs where the runs cross from the main building framing to the control room framing.  Conduit supports shall be furnished and installed in accordance with these specifications. Support material shall comply with the following requirements.  i) Hanger rods shall be 12 mm diameter galvanized threaded steel rods.  ii) Single conduit supports shall be one-hole cast metal straps and clamp backs unless other types are acceptable to the Employer. Multiple conduit bank supports shall be constructed of special galvanized support channels with associated conduit clips.  Conduit sealing, explosion proof, dust proof and other types of special fittings shall be provided as required by these specifications and shall be consistent with the area and equipment with which they are installed. Fittings installed outdoors and in damp locations	<b>TECHNICAL SPECIFICATION</b> <b>SECTION-VI</b> <b>BID DOC NO.: CS-9575/ 9571/ 0370/</b> <b>0360/ 9586-102-2</b>	<b>PART - B</b> <b>SUB-SECTION-IV: I7</b> <b>(INSTR. AND POWER</b> <b>SUPPLY CABLE)</b>	<b>PAGE 13 OF 14</b>
<b>MOUDA STPP-II (2x660MW) / SOLAPUR STPP</b> <b>(2 x 660MW) / NABINAGAR STPP (3x 660MW) /</b> <b>MEJA TPP-I (2 x 660MW) / RAGHUNATHPUR TPP</b> <b>PHASE-II (2 x660MW)</b> <b>STEAM GENERATOR PACKAGE</b>				


CLAUSE NO.	<b>TECHNICAL REQUIREMENTS</b> 		
	shall be sealed and gasketed. Hazardous area fittings and conduits sealing shall conform to NEC requirements for the area classification.		
11.09.00	Contractor shall provide double locknuts on all conduit terminations not provided with threaded hubs and couplings. Water tight conduit unions and rain tight conduit hubs shall be utilized for all the application which shall be exposed to weather. Moisture pockets shall be eliminated from conduits.		
11.10.00	Conduits shall be securely fastened to all boxes and cabinets.		
<b>12.00.00</b>	<b>CABLE SUB-TRAY &amp; SUPPORT</b>		
12.01.00	The cable sub-trays and the supporting system, to be generally used between Local/Group JB's and the main cable trays and the same shall be furnished and installed by the Contractor. It is the assembly of sections and associated fittings forming a rigid structural system used to support the cable from the equipment or instrument enclosure upto the main cable trays (trunk route).		
12.02.00	The covers on the cable sub-trays shall be used for protection of cables in areas where damage may occur from falling objects, welding spark, corrosive environment, etc. & shall be electrically continuous and solidly grounded. The cable trays shall not have sharp edges, burrs or projections injurious to the insulation or outer sheath of the cables.		
12.03.00	The supporting arrangement of cable tray system shall be able to withstand the weight of the cable and cable tray system. The supporting interval shall not be more than the recommended span for the above loading for the type of cable tray selected. The tray shall not overhang by more than one meter from the support at the dead end. As far as practicable the cable sub-tray system shall be supported from one side only, in order to facilitate installation and maintenance of cables.		
12.04.00	The Bidder shall furnish and install the estimated quantities and sizes of sub trays/troughs including all required fittings and adaptors on as required basis.		
MOUDA STPP-II (2x660MW) / SOLAPUR STPP (2 x 660MW) / NABINAGAR STPP (3x 660MW) / MEJA TPP-I (2 x 660MW) / RAGHUNATHPUR TPP PHASE-II (2 x660MW) <b>STEAM GENERATOR PACKAGE</b>	<b>TECHNICAL SPECIFICATION SECTION-VI</b> <b>BID DOC NO.: CS-9575/ 9571/ 0370/ 0360/ 9586-102-2</b>	<b>PART - B</b> <b>SUB-SECTION-IV: I7</b> <b>(INSTR. AND POWER SUPPLY CABLE)</b>	<b>PAGE 14 OF 14</b>

# **SUB-SECTION-III:E5**

## **CABLING, EARTHING & LIGHTNING PROTECTION**

MOUDA STPP-II (2x660MW) / SOLAPUR STPP (2 x 660MW) /  
NABINAGAR STPP (3x 660MW) / MEJA TPP-I (2 x 660MW) /  
RAGHUNATHPUR TPP PHASE-II (2 x660MW)  
STEAM GENERATOR PACKAGE

TECHNICAL SPECIFICATION  
SECTION-VI  
BID DOC NO.: CS-9575/ 9571/ 0370/ 0360/ 9586-102-2

CLAUSE NO.	TECHNICAL REQUIREMENTS			
	<b>CABLING, EARTHING &amp; LIGHTNING PROTECTION</b>			
<b>1.00.00</b>	<b>CODES AND STANDARDS</b>			
	IS: 2309, IEEE: 142, IEEE-80, IS: 1255, IS:3043, IS:8309			
<b>2.00.00</b>	<b>REQUIREMENTS</b>			
2.01.00	<p>The complete cable support system shall be supplied and installed for the entire work is in the bidder's scope. The system shall enable proper laying of all power, control, instrumentation and telephone cables, and shall provide necessary mechanical protection, ventilation and segregation for them as per latest engineering practices and cable manufacturers' recommendation .The cable installation shall be carried out as per IS:1255. All hardware and anchoring arrangement shall be included. All steel members shall be hot dip galvanised.</p>			
MOUDA STPP-II (2x660MW) / SOLAPUR STPP (2 x 660MW) / NABINAGAR STPP (3x 660MW) / MEJA TPP-I (2 x 660MW) / RAGHUNATHPUR TPP PHASE-II (2 x660MW) <b>STEAM GENERATOR PACKAGE</b>	<b>TECHNICAL SPECIFICATION SECTION-VI</b> <b>BID DOC NO.: CS-9575/ 9571/ 0370/ 0360/ 9586-102-2</b>	<b>PART-B SUB SECTION-III:E5 (CABLING,EARTHING &amp; LIGHTNING PROTECTION)</b>	<b>PAGE 1 OF 1</b>	

# SUB-SECTION-VII:QE1

## MOTORS

**INDUCTION MOTOR & SYNCHRONOUS MACHINE**

TESTS/CHECKS  TEMS/COMPONENTS	Visual	Dimensional	Make/Type/Rating/TC/General Physical Inspection	Mech./Chem. Properties	NDT /DP/MPI/UT	Metallography	Electrical Characteristics	Welding/Brazing(WPS/PQR)	Heat Treatment
Plates for stator frame, end shield, spider etc.	Y	Y	Y	Y					Y
Shaft	Y	Y	Y	Y	Y	Y			Y
Magnetic Material	Y	Y	Y	Y	Y		Y		
Rotor Copper/Aluminium	Y	Y	Y	Y		Y	Y		Y
Stator copper	Y	Y	Y	Y			Y		Y
SC Ring	Y	Y	Y	Y	Y	Y	Y	Y	Y
Insulating Material	Y		Y	Y			Y		
Tubes for Cooler	Y	Y	Y	Y	Y				Y
Sleeve Bearing	Y	Y	Y	Y	Y				Y
Stator/Rotor, Exciter Coils	Y	Y	Y				Y	Y	
Castings, stator frame, terminal box and bearing housing etc.	Y	Y	Y	Y	Y			Y	
Fabrication & machining of stator, rotor, terminal box	Y	Y			Y				Y
Wound stator	Y	Y					Y	Y	
Wound Exciter	Y	Y					Y	Y	
Rotor complete	Y	Y					Y		
Exciter, Stator, Rotor, Terminal Box assembly	Y	Y					Y		
Accessories, RTD, BTD,CT, Brushes, Diodes, Space heater, antifriction bearing, cable glands, lugs, gaskets etc.	Y	Y	Y						
Motor ( IS 325 / 4722/ 9283)	Y	Y	Y						

INDUCTION MOTOR & SYNCHRONOUS MACHINE

TESTS/CHECKS  ITEMS/COMPONENTS	Magnetic Characteristics	Hydraulic/Leak/Pressure Test	Thermal Characteristics	Run out	Dynamic Balancing	All routine & acceptance tests as per IS-325/IS-4722 /IS- 9283/IS 2148/IEC 60079-1	Vibration	Over speed	Tan delta, shaft voltage & polarization index test
Plates for stator frame, end shield, spider etc.									
Shaft									
Magnetic Material	Y		Y						
Rotor Copper/Aluminium									
Stator copper			Y						
SC Ring									
Insulating Material			Y						
Tubes for Cooler		Y							
Sleeve Bearing		Y							
Stator/Rotor, Exciter Coils									
Castings, stator frame, terminal box and bearing housing etc.									
Fabrication & machining of stator, rotor, terminal box									
Wound stator									
Wound Exciter									
Rotor complete				Y	Y				
Exciter, Stator, Rotor, Terminal Box assembly									
Accessories, RTD, BTD,CT, Brushes, Diodes, Space heater, antifriction bearing, cable glands, lugs, gaskets etc.									
Motor ( IS 325 / 4722 / 9283/2148/IEC 60079-1)						Y	Y	Y	Y1
<p>Note : 1. This is an indicative list of tests/checks. The manufacture is to furnish a detailed Quality Plan indicating the practices &amp; Procedure followed along with relevant supporting documents during QP finalisation. However, No QP for LT motor upto 50KW.</p> <p>2. Makes of all major bought out items will be subject to NTPC approval.</p> <p>Y1 = for HT Motor / Machines only.</p>									

# **SUB-SECTION-VII:QE3**

## **LT POWER CABLES**

CLAUSE NO.

QUALITY ASSURANCE



QUALITY ASSURANCE & INSPECTION MODULE NO. SQE 13

L.T POWER CABLES  
(1.1 KV PVC & XLPE CABLES)

Attributes / Characteristics	Make, Rating, Type & TC	Dimension/surface finish	Mechanical Properties	Chemical Composition	Electrical Properties	Spark Test	Hot set test (XLPE)	Lay length / Sequence	Armour coverage, Cross over, looseness, Gap between two armour wire/strip	Sequential marking/surface finish /cable length	Tensile strength, elongation before & after ageing of insulation & outer sheath	Thermal Stability of insulation and outer sheath *	Anti termite treatment on wooden drums	Constructional / requirement as per NTPC Spec.	Routine and acceptance test as per Relevant Standard and NTPC specification	FRLS Test
Aluminum (IS-8130)	Y	Y	Y	Y	Y											
PVC Compound (IS-5831)	Y		Y		Y						Y					
XLPE Compound (IS-7098 Part-I)	Y		Y		Y		Y				Y					
FRLS PVC Compound (IS-5831 ) ASTM-D-2843/ IS 10810 (Part-58) IEC-60754 Part-I	Y		Y								Y					
Armour wire/strip (IS-3975)	Y	Y	Y													
Insulated Core		Y				Y	Y					Y				
Laid up core		Y						Y								
PVC Inner sheath		Y														
Armouring		Y							Y							
Outer sheath		Y								Y	Y	Y				Y
Finish cable (IS-1554 & 7098 – Part-1) ASTM-D-2843/ IS 10810 ( Part - 58 ) IEC-60754 Part-I Swedish Chimney SS 4241475 for (F3 category) Flammability test IEC-60332 Part –3 Cat-B	Y	Y							Y	Y	Y	Y		Y	Y	Y
Wooden drum (IS-10418) / Steel drum		Y											Y			

Note: This is an indicative list of test/checks. The manufacturer is to furnish a detailed quality plan indicating the practice and procedure along with relevant supporting documents.

2. Not applicable for XLPE insulation

MOUDA STPP-II (2x660MW) / SOLAPUR STPP (2 x 660MW) / NABINAGAR STPP (3x 660MW) / MEJA TPP-I (2 x 660MW) / RAGHUNATHPUR TPP PHASE-II (2 x660MW)  
STEAM GENERATOR PACKAGE

TECHNICAL SPECIFICATION SECTION-VI  
BID DOC NO.: CS-9575/ 9571/ 0370/ 0360/ 9586-102-2

PART-B  
SUB-SECTION-VII:QE3  
LT POWER CABLES

PAGE 1 OF 3

**ROUTINE TESTS**

Routine tests shall be carried out on each drum of finished cables for all types & sizes.

Following shall constitute routine tests:

- 1) Conductor Resistance test
- 2) High voltage test at room temperature

**ACCEPTANCE TESTS**

Following Acceptance tests shall be carried out for each type and size of the cables on the cable drums selected at random as per sampling plan mentioned in IS: 1554 Part 1 & IS 7098 Part-I

**A) For Conductor**

- 1) Annealing test For copper conductor only
- 2) Tensile test For aluminium conductor only
- 3) Wrapping test For aluminium conductor only
- 4) Resistance test

**B) For Armour Wires / Formed Wires ( If applicable )**


- 1) Measurement of Dimensions
- 2) Tensile Tests
- 3) Elongation Test
- 4) Torsion Test For Round wires only
- 5) Wrapping Test
- 6) Resistance Test
- 7) Mass of Zinc coating test For G S wires / Formed wires only
- 8) Uniformity of Zinc coating For G S wires / Formed wires only
- 9) Adhesion test For G S wires / Formed wires only
- 10) Freedom from defects

**C) For PVC / XLPE insulation & PVC Sheath**

- 1) Test for thickness
- 2) Hot set test For XLPE insulation only
- 3) Tensile strength & Elongation before ageing

**D) For completed cables**

- 1) Insulation resistance test ( Volume resistivity method )
- 2) High voltage test at room temperature

CLAUSE NO.	QUALITY ASSURANCE			
	<p><b>E) Following tests shall be carried out and only one sample shall be taken from each offered lot of all sizes for these tests:-</b></p> <ol style="list-style-type: none"> <li>1) Tensile strength &amp; elongation after ageing on PVC / XLPE insulation and PVC outer sheath</li> <li>2) Thermal stability test on PVC insulation and outer sheath</li> <li>3) Oxygen index test on outer sheath</li> <li>4) Smoke density rating test on outer sheath as per ASTM –D 2843</li> <li>5) Acid gas generation test on outer sheath as per IEC – 60754 (Part 1)</li> <li>6) Flammability test as per IEC-60332 - Part- 3 ( Category- B ) on completed cable</li> <li>7) Fire resistance test as per SS 4241475 (F3 Category ) on completed cable</li> </ol> <p><b>F) Following tests shall be carried on one length of each size of offered lot:</b></p> <ol style="list-style-type: none"> <li>1) Surface finish, length measurement, sequence of cores, armour coverage, Gap between two consecutive armour wires / formed wires</li> </ol>			
MOUDA STPP-II (2x660MW) / SOLAPUR STPP (2 x 660MW) / NABINAGAR STPP (3x 660MW) / MEJA TPP-I (2 x 660MW) / RAGHUNATHPUR TPP PHASE-II (2 x660MW) STEAM GENERATOR PACKAGE	TECHNICAL SPECIFICATION SECTION-VI BID DOC NO.: CS-9575/ 9571/ 0370/ 0360/ 9586-102-2	PART-B SUB-SECTION-VII:QE3 LT POWER CABLES	PAGE 3 OF 3	

# **SUB-SECTION-VII:QE4**

## **LT CONTROL CABLES**

CLAUSE NO.

QUALITY ASSURANCE



QUALITY ASSURANCE & INSPECTION MODULE NO. SQE 14

L.T CONTROL CABLES  
(1.1 KV PVC CABLES)

Attributes / Characteristics	Item / Components / Sub System Assembly	Make, Type, Rating, T.C	Dimension/surface finish	Mechanical Properties	Chemical Composition	Electrical Properties	Spark Test	Lay length/Sequence	Armour coverage, cross over, looseness, gap between two armour wire	Sequential marking/surface finish/cable length	Tensile strength, elongation before & after ageing of insulation & outer sheath	Thermal stability of insulation and outer sheath	Anti termite treatment on wooden drums	Constructional feature as per NTPC Spec.	Routine & Acceptance test as per relevant standard & page 2 & 3 of this table	FRLS Test
	Copper Conductor (IS-8130)	Y	Y	Y	Y	Y										
	PVC Compound (IS-5831)	Y		Y		Y					Y					
	FRLS PVC Compound IS-5831 ASTM-D-2843/ IS 10810 (Part-58 ) IEC 60754 Part-1	Y		Y							Y					Y
	Armour wire/strip (IS-3975)	Y	Y	Y												
	Insulated Core		Y				Y	Y				Y				
	Laid up core		Y					Y								
	PVC Inner sheath		Y													
	Armouring		Y						Y							
	Outer sheath		Y							Y	Y	Y				Y
	Finish cable (IS-1554- 1 ) ASTM-D-2843/ IS 10810 (Part-58 ) IEC-60754 Part-1 Swedish Chimney: SEN SS 424-1475( F3 category) Flammability test IEC-60332 Part-3 Cat-B	Y	Y						Y	Y	Y	Y		Y	Y	Y
	Wooden drum( IS : 10418) / Steel drum		Y									Y				

- 1.Note : This is an indicative list of test/checks. The manufacturer is to furnish a detailed quality plan indicating the Practice and procedure along with relevant supporting documents.



**CONTROL CABLE**

**ROUTINE TESTS**

Routine tests shall be carried out on each drum of finished cables for all types & sizes.

Following shall constitute routine tests:

- 1) Conductor Resistance test
- 2) High voltage test at room temperature

**ACCEPTANCE TESTS**

Following Acceptance tests shall be carried out for each type and size of the cables on the cable drums selected at random as per sampling plan mentioned in IS: 1554 Part 1

**A) For Conductor**

- 1) Annealing test For copper conductor only
- 2) Resistance test

**B) For Armour Wires / Formed Wires ( If applicable )**


- 1) Measurement of Dimensions
- 2) Tensile Tests
- 3) Elongation Test
- 4) Torsion Test For Round wires only
- 5) Wrapping Test
- 6) Resistance Test
- 7) Mass of Zinc coating test For G S wires / Formed wires only
- 8) Uniformity of Zinc coating For G S wires / Formed wires only
- 9) Adhesion test For G S wires / Formed wires only
- 10) Freedom from defects

**C) For PVC insulation & PVC Sheath**

- 1) Test for thickness
- 2) Tensile strength & Elongation before ageing

**D) For completed cables**

- 1) Insulation resistance test ( Volume resistivity method )  
High voltage test **at room temperature**

CLAUSE NO.	QUALITY ASSURANCE			
	<p><b>E) Following tests shall be carried out and only one sample shall be taken from each offered lot of all sizes for these tests:-</b></p> <ol style="list-style-type: none"> <li>1) Tensile strength &amp; elongation after ageing on PVC insulation and PVC outer sheath</li> <li>2) Thermal stability test on PVC insulation and outer sheath</li> <li>3) Oxygen index test on outer sheath</li> <li>4) Smoke density rating test on outer sheath as per ASTM –D 2843</li> <li>5) Acid gas generation test on outer sheath as per IEC –60 754 (Part 1)</li> <li>6) Flammability test as per IEC 60332 - Part- 3 ( Category- B ) on completed cable</li> <li>7) Fire resistance test as per SS 4241475 (F3 Category ) on completed cable</li> </ol> <p><b>F) Following tests shall be carried on one length of each size of offered lot:</b></p> <ol style="list-style-type: none"> <li>1) Surface finish, length measurement, sequence of cores, armour coverage, Gap between two consecutive armour wires / formed wires</li> </ol>			
MOUDA STPP-II (2x660MW) / SOLAPUR STPP (2 x 660MW) / NABINAGAR STPP (3x 660MW) / MEJA TPP-I (2 x 660MW) / RAGHUNATHPUR TPP PHASE-II (2 x660MW) STEAM GENERATOR PACKAGE	TECHNICAL SPECIFICATION SECTION-VI BID DOC NO.: CS-9575/ 9571/ 0370/ 0360/ 9586-102-2	PART-B SUB-SECTION-VII:QE4 LT CONTROL CABLES	PAGE 3 OF 3	

# **SUB-SECTION-VII:QE5**

## **CABLING, EARTHING & LIGHTNING PROTECTION**



**CABLING, EARTHING, LIGHTNING PROTECTION**

ATTRIBUTES / CHARACTERISTICS  ITEMS/COMPONENTS / SUB SYSTEMS	Dimension	Paint shade, paint thickness, adhesion	Pre-treatment of sheet	IP protection	Proof load*	Surface finish	Deflection test*	HV & IR	Galvanise Test (If Applicable)	Functional	Bought out items/Bill of material	Routine tests as per relevant standard & specification	Acceptance tests as per relevant standard & specification	Constructional feature as per NTPC
Wall Mounted-Lighting Panel (IS-513, IS:5, IS:2629, 2633, 6745)	Y	Y	Y	Y		Y		Y	Y	Y	Y	Y	Y	Y
Switch box/junction box/ Receptacles Panel (IS-513, IS:5, IS:2629, 2633, 6745)	Y	Y	Y	Y		Y		Y	Y	Y	Y	Y	Y	Y
Cable glands(BS-6121)	Y											Y		
Cable lug(IS-8309)	Y											Y		
Lighting wire(IS-694)	Y											Y		
Flexible conduits	Y											Y		Y
Conduits(Galvanise & Epoxy) IS-9537 & IS-2629,2633 ,6745	Y		Y								Y	Y		Y
RCC Hume Pipe (IS-458)												Y		
Cable termination & straight through joint (VDE-0278)	Y											Y		Y
Cable Trays, Flexible supports system & accessories IS-513, 2629,2633,6745	Y		Y		Y	Y	Y	Y	Y	Y		Y	Y	Y
Trefoil clamp	Y													Y
GI flats for earthing & lighting protection (IS 2062, 2629, 6745,2633)	Y		Y						Y			Y		Y
GI wire (IS-280)	Y											Y		
Fire Sealing System ( BS -476)												Y	Y	Y

.Note:1.This is an indicative list of tests /checks. The manufacturer is to furnish a detailed Quality Plan indicating the practice and procedure along with relevant supporting documents.  
 2.\* Deflection Test on cable trays and Proof Load test on cable trays support system will be as per details given in the NTPC technical specification & approved MQP. The above acceptance tests shall be done only on one sample from each size of offered lot.  
 3. Make of all items will be subject to NTPC approval.

**SUB-SECTION DE3**

**POWER AND CONTROL CABLES**

MOUDA STPP-II (2x660MW) / SOLAPUR STPP (2 x 660MW) /  
NABINAGAR STPP (3x 660MW) / MEJA TPP-I (2 x 660MW) /  
RAGHUNATHPUR TPP PHASE-II (2 x660MW)  
STEAM GENERATOR PACKAGE

TECHNICAL DATA SHEETS  
SECTION-VI  
PART-F  
BID DOC NO.: CS-9575/ 9571/ 0370/ 0360/ 9586-102-2

Clause No.	POWER AND CONTROL CABLES		
	<p style="text-align: right;">..... (Bidder's Name)</p> <p><b>POWER AND CONTROL CABLES</b> (Use separate sheet for each type and size of cables)</p> <p>1.00.00 Make (Shall be as per approved QA make) .....</p> <p>1.02.00 Country of Manufacturer .....</p> <p>1.03.00 Type &amp; designation .....</p> <p>1.04.00 Applicable standard .....</p> <p>1.05.00 Cable size &amp; no. of cores .....</p> <p>1.06.00 Rated voltage .....</p> <p>1.07.00 Catalogue attached as Annexure No. ....</p> <p>1.08.00 Continuous current rating for max. conductor temperature .....</p> <p>    a) When laid in air at an ambient     temperature of 50 deg. C .....</p> <p>    b) When buried in soil having     thermal resistivity of 150 deg.C     cm/w at a depth of 1000 mm     at ground ambient temperature     of 40 deg. C .....</p> <p>1.09.00 Short circuit withstand capacity and duration for .....</p> <p>    a) Conductor .....</p> <p>    b) Screen .....</p> <p>    c) Armour .....</p> <p>1.10.00 Conductor .....</p> <p>    a) Material .....</p> <p>    b) Nominal cross section     area in sq. mm .....</p>		
NAME OF THE PROJECT.....  STEAMGENERATOR PACKAGE	TECHNICAL DATA SHEET SECTION-VI BID DOC NO.: CS-9575/ 9571/ 0370/ 0360/ 9586-102-2	PART-F CHAPTER-I SUB-SECTION:DE3 (ELECTRICAL)	PAGE 1 OF 2

Clause No.	POWER AND CONTROL CABLES		
		<p style="text-align: right;">..... (Bidder's Name)</p>	
1.11.00	c) Shape of conductor d) DC resistance at 20°C (Maxm.) Insulation	..... ..... .....	..... ..... .....
1.12.00	a) Material b) Nominal thickness (in mm) c) Type of curing (for XLPE) Metallic screen (wherever applicable) a) Material b) Type c) Short Ckt. (KA) & Period (Sec.)	..... ..... ..... ..... ..... ..... .....	..... ..... ..... ..... ..... ..... .....
1.13.00	Material & Type of Inner sheath	.....	.....
1.14.00	Armour material & shape	.....	.....
1.15.00	Outer sheath material & type	.....	.....
1.16.00	Over all dia of cable (in mm)	.....	.....
1.17.00	Guaranteed value of minimum oxygen index of outer sheath	.....	.....
1.18.00	Maximum acid-gas generation by weight (%) of outer sheath	.....	.....
1.19.00	Smoke Density rating of outer sheath	.....	.....
<b>NAME OF THE PROJECT.....</b>  <b>STEAMGENERATOR PACKAGE</b>	<b>TECHNICAL DATA SHEET</b> <b>SECTION-VI</b> <b>BID DOC NO.: CS-9575/ 9571/</b> <b>0370/ 0360/ 9586-102-2</b>	<b>PART-F</b> <b>CHAPTER-I</b> <b>SUB-SECTION:DE3</b> <b>(ELECTRICAL)</b>	<b>PAGE</b> <b>2 OF 2</b>

## **SUB-SECTION-VII:Q16**

# **INSTRUMENTATION AND POWER SUPPLY CABLE AND CABLE TRAY**

MOUDA STPP-II (2x660MW) / SOLAPUR STPP(2 x 660MW) /  
NABINAGAR STPP (3x 660MW) / MEJA TPP-I (2 x 660MW) /  
RAGHUNATHPUR TPP PHASE-II (2 x660MW)  
STEAM GENERATOR PACKAGE

TECHNICAL SPECIFICATION  
SECTION-VI  
BID DOC NO.: CS-9575/ 9571/ 0370/ 0360/ 9586-102-2

**INSTRUMENTATION CABLE**

TESTS  ITEMS															
	Conductor Resistance ® & (A)	High Voltage ® & (A)	Insulation Resistance ® & (A)	Constructional detail, dimensions (A)	Outer-Sheath/core marking, end sealing (A)	Thermal Stability (A) +	Visual, Surface finish (A) +	Electrical Parameters ** (A) +	Persulphate Test (A) +	Overall/Coverage/Continuity (A)	Swedish chimney Test (SS-4241475) (A) ++	FRLS Test * (A) ++	Tensile & Elongation before & after aging (A) ++	Vol. Resistivity. at room & Elevated Temp. (A) ++	Spark test report review ®
<b>1. Instrument cable twisted and shielded</b>															
Conductor(IS-8130)	Y			Y			Y								
Insulation(VDE-207)				Y	Y	Y	Y						Y		Y
Pairing/Twisting				Y	Y		Y								
Shielding				Y			Y			Y					
Drain wire	Y			Y			Y		Y	Y					
Inner Sheath				Y	Y	Y	Y					Y	Y		
Outer Sheath				Y	Y	Y	Y					Y	Y		
Over all cable	Y	Y	Y	Y	Y		Y	Y			Y			Y	
Cable Drums(IS-10418)				Y			Y								

**Note :** High Temp. cables shall be subjected to tests as per VDE-207(Part-6) Compensating cables shall be checked for Thermal EMF/Endurance test as per IS 8784.

**Note :** This is an indicative list of tests/checks. The manufacture is to furnish a detailed Quality Plan indicating his practice & Procedure along with relevant supporting documents during QP finalization for all item.

**Note :** ® - Routine Test    A - Acceptance Test    Y - Test Applicable

**Note :** Sampling Plan for Acceptance test shall be as per IS 8784 (As applicable)

- \* FRLS Tests: Oxygen / Temp Index ( ASTM D-2863), Smoke Density Rating (ASTM – D 2843), HCL Emission ( IEC-754-1)
- \*\* Characteristic Impedance, Attenuation, Mutual Capacitance, Cross Talk (As applicable)
- + Sample size will be One No. of each size/type per lot.
- ++ Sample size will be One No. sample for complete lot offered irrespective of size/type.





TITLE:  
**TECHNICAL SPECIFICATION FOR  
MILL REJECT HANDLING SYSTEM**  
**2X600MW MAUDA STPP STAGE-II & 1X500 MW**

BHEL DOCUMENTS NO.: PE-TS-385-160-A001

VOLUME **II-B**

SECTION -C

REV. NO. 00

DATE:

Page

**VOLUME – II B**

**SECTION – C3**

**SPECIFIC TECHNICAL REQUIREMENTS**

**CONTROL AND INSTRUMENTATION SPECIFICATION FOR 2X600MW MAUDA STPP STAGE-II**

**2X660MW MOUDA II**  
**SECTION-C**  
**Scope of C&I for MRHS**

- 1 The controls for MRHS shall be realized in plant DDCMIS (in BHEL scope) based control system.
- 2 The requirements given below are to be read in conjunction with detailed Technical specification enclosed in the specification. Further in case of any discrepancy in the requirement within the same section noted by the bidder in the specification, the same will be brought to the notice of BHEL in the form of pre- bid clarification. In absence of any pre-bid clarification, the more stringent requirement as per interpretation of customer shall prevail without any commercial implication.
3. Plant schematic for monitoring & operation shall be available on OWS (BHEL scope), bidder to submit list of important signal along with applicable schematic for monitoring in DCS.
4. All the Instrumentation as shown in P&ID shall be in bidder's scope. All Primary and Secondary Instruments for the package shall be supplied, along with accessories like impulse pipe, fittings & valve manifolds etc as per Installation diagram attached in detailed specification. Necessary racks required for mounting of these instruments shall be supplied by bidder.
5. All bidirectional drives are with integral starter. Detailed datasheet, wiring diagram of actuator is attached in detailed technical specification.
6. All instruments/Drives shall be terminated on JB/Panel in field. All instrument/Drives & JB/Panel & connecting Instrument are in Bidder Scope.
8. For scope of cables refer Electrical scope of specifications.
10. The solenoid operated valves/ damper/gates shall have limit switches for open/ close feedback. Solenoid valve shall be rated for 24 V DC only.
11. The make/model of various instruments/items/systems shall be subject to approval of owner/purchaser during detailed engineering stage. No commercial implication in this regard shall be acceptable. In case of any conflict and repetition of clauses in the specification, the more stringent requirements among them are to be complied with.
12. All field instrument enclosures shall be IP-65 & local panel / cabinet enclosures shall be IP-55 (if applicable).
13. Bidder presence is required (3 man days) at BHEL-EDN, Bangalore for the implementation of control schemes in DCS during FAT of DDCMIS.
14. Bidder presence is required (around 7 man days) at site during DDCMIS Commissioning.
15. Instrumentation specification & QAP shall be followed as per detailed technical specification.
16. Diaphragm seal to be used for instrumentation having corrosive media contact.

17. Local panels for each transporter vessel, complete with all hardware, relays, fuses, wiring, tubing, space heaters etc. shall be provided by bidder.

18. Bidder to include VMS for HT drives, if any.

19. 24V DC power supply for all instruments including level switches, timer cards and solenoid valve shall be provided from DCS (SG C&I) by BHEL. Separate 230VAC UPS supply shall not be provided for any purpose. Hence, bidders to select coil/measuring instruments voltage accordingly. Also cable required to power the instruments shall be in bidder's scope.

20. If controller is integral to compressor then microprocessor/PLC based system along with suitable operator interface is required for compressor control system. Two way Ethernet connectivity to DCS for information & overall control of compressors should be provided.

21. If controller for individual compressors is not integral to compressors then control shall be through SG DCS (BHEL scope)..

22. In both the cases mentioned in point no-23 & 24, overall control shall be through SG DCS (BHEL scope).

23. Bidder to provide one no local panel for mill reject system of each mills and each pyrite hoppers. This local panel will act as interface between the DCS and field devices for commands & feedbacks.

24. Bidder to supply any other system/equipment not listed above to meet the functionality of the system

**2X660MW MOUDA II**  
**SECTION-C**  
**Scope of C&I for MRHS**

- 1 The controls for MRHS shall be realized in plant DDCMIS (in BHEL scope) based control system.
- 2 The requirements given below are to be read in conjunction with detailed Technical specification enclosed in the specification. Further in case of any discrepancy in the requirement within the same section noted by the bidder in the specification, the same will be brought to the notice of BHEL in the form of pre- bid clarification. In absence of any pre-bid clarification, the more stringent requirement as per interpretation of customer shall prevail without any commercial implication.
3. Plant schematic for monitoring & operation shall be available on OWS (BHEL scope), bidder to submit list of important signal along with applicable schematic for monitoring in DCS.
4. All the Instrumentation as shown in P&ID shall be in bidder's scope. All Primary and Secondary Instruments for the package shall be supplied, along with accessories like impulse pipe, fittings & valve manifolds etc as per Installation diagram attached in detailed specification. Necessary racks required for mounting of these instruments shall be supplied by bidder.
5. All bidirectional drives are with integral starter. Detailed datasheet, wiring diagram of actuator is attached in detailed technical specification.
6. All instruments/Drives shall be terminated on JB/Panel in field. All instrument/Drives & JB/Panel & connecting Instrument are in Bidder Scope.
8. For scope of cables refer Electrical scope of specifications.
10. The solenoid operated valves/ damper/gates shall have limit switches for open/ close feedback. Solenoid valve shall be rated for 24 V DC only.
11. The make/model of various instruments/items/systems shall be subject to approval of owner/purchaser during detailed engineering stage. No commercial implication in this regard shall be acceptable. In case of any conflict and repetition of clauses in the specification, the more stringent requirements among them are to be complied with.
12. All field instrument enclosures shall be IP-65 & local panel / cabinet enclosures shall be IP-55 (if applicable).
13. Bidder presence is required (3 man days) at BHEL-EDN, Bangalore for the implementation of control schemes in DCS during FAT of DDCMIS.
14. Bidder presence is required (around 7 man days) at site during DDCMIS Commissioning.
15. Instrumentation specification & QAP shall be followed as per detailed technical specification.
16. Diaphragm seal to be used for instrumentation having corrosive media contact.

17. Local panels for each transporter vessel, complete with all hardware, relays, fuses, wiring, tubing, space heaters etc. shall be provided by bidder.

18. Bidder to include VMS for HT drives, if any.

19. 24V DC power supply for all instruments including level switches, timer cards and solenoid valve shall be provided from DCS (SG C&I) by BHEL. Separate 230VAC UPS supply shall not be provided for any purpose. Hence, bidders to select coil/measuring instruments voltage accordingly. Also cable required to power the instruments shall be in bidder's scope.

20. If controller is integral to compressor then microprocessor/PLC based system along with suitable operator interface is required for compressor control system. Two way Ethernet connectivity to DCS for information & overall control of compressors should be provided.

21. If controller for individual compressors is not integral to compressors then control shall be through SG DCS (BHEL scope)..

22. In both the cases mentioned in point no-23 & 24, overall control shall be through SG DCS (BHEL scope).

23. Bidder to provide one no local panel for mill reject system of each mills and each pyrite hoppers. This local panel will act as interface between the DCS and field devices for commands & feedbacks.

24. Bidder to supply any other system/equipment not listed above to meet the functionality of the system

	<b>2X660 MW MOUDA II</b>	SECTION: C
	<b>SPECIFIC TECHNICAL REQUIREMENTS (C&amp;I) MILL REJECT HANDLING SYSTEM</b>	
<p><b>Specific Technical Requirements (C&amp;I):</b></p> <p>1.0 Mill Reject Handling System shall be operated from plant DCS through operator work stations located in central control room. In addition, provision of local operation from local control panel shall also be provided.</p> <p>2.0 Bidder to provide one no local control panel for mill reject system of each Mills and each pyrite hoppers. This local panel will act as interface between the DCS and the field devices for commands &amp; feedbacks.</p> <p>3.0 Local Control Panel for Compressors of Mill Reject Handling System shall be provided with command &amp; feedback interface with plant DCS. In addition provision of local operation (START/STOP) from local control panel shall also be provided.</p> <p>4.0 Bidder to include VMS for HT drives, if any.</p> <p>5.0 Bidder to include all the instruments (PG, PS, LS, TS, FS etc.) required for the package along with fittings, accessories and valve manifold.</p> <p>6.0 The solenoid operated valves/ damper/gates shall have limit switches for open/ close feedback. Solenoid valve shall be rated either for 220V DC or 24 V DC only.</p> <p>7.0 The junction boxes for termination of instruments /actuator limit switches/ solenoid valve limit switches etc are in bidder's scope.</p> <p>8.0 230 VAC UPS supply shall be provided at a single point. Further distribution to various instruments shall be in Bidder's scope. Bidder to include necessary power distribution board in his scope. Any power supply other than the above, if required by any instrument/device, has to be derived by the Bidder from the above supply and all necessary hardware for the same shall be in bidder's scope. Bidder to furnish UPS power requirement along with the bid.</p> <p>9.0 The make/model of various instruments/items/systems shall be subject to approval of owner/purchaser during detailed engineering stage. No commercial implication in this regard shall be acceptable. In case of any conflict and repetition of clauses in the specification, the more stringent requirements among them are to be complied with.</p> <p>10.0 In case of any contradiction most stringent clause/condition shall prevail.</p> <p>11.0 Drawings/Documents and data to be furnished after award of the contract:</p>		

	<b>2X660 MW MOUDA II</b>	SECTION: C
	<b>SPECIFIC TECHNICAL REQUIREMENTS (C&amp;I) MILL REJECT HANDLING SYSTEM</b>	
<ul style="list-style-type: none"><li>• Control &amp; operational write-up for the system</li><li>• Recommended control scheme/ logic diagram</li><li>• Process manuscript for implementation in DCS</li><li>• List of Drives ( Solenoid valves etc)</li><li>• I/O list</li><li>• GA drawings of local panel.</li><li>• Power requirement.</li><li>• Local control panel and field instruments quality plan.</li><li>• Local control panel &amp; instruments data sheet.</li><li>• JB grouping document.</li><li>• Cable schedule and cable interconnection drawing.</li><li>• Instrument schedule</li><li>• Any other document decided during detailed engineering.</li></ul>		


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**SUB-SECTION-IV: I4**


**MEASURING INSTRUMENTS  
(PRIMARY & SECONDARY)**


MOUDA STPP-II (2x660MW) / SOLAPUR STPP (2 x 660MW) /  
NABINAGAR STPP (3x 660MW) /MEJA TPP-I (2 x 660MW) /  
RAGHUNATHPUR TPP PHASE-II (2 x660MW)  
STEAM GENERATOR PACKAGE

TECHNICAL SPECIFICATION  
SECTION-VI  
BID DOC NO.: CS-9575/ 9571/ 0370/ 0360/ 9586-102-2

CLAUSE NO.	TECHNICAL REQUIREMENTS															
<b>MEASURING INSTRUMENTS</b>																
<b>1.00.00</b>  1.01.00  1.02.00  1.03.00  1.04.00  1.05.00  1.06.00	<b>MEASURING INSTRUMENTS</b>  Measuring instruments/equipment and subsystems offered by the Bidder shall be from reputed experienced manufacturers of specified type and range of equipment, whose guaranteed and trouble free operation has been proven. Refer Sub-section-IV:11(Basic Design Criteria). Further, all instruments shall be of proven reliability, accuracy, and repeatability requiring a minimum of maintenance. They shall comply with the acceptable international standards and shall be subject to Employer's approval. All instrumentation equipment and accessories under this specification shall be furnished as per technical specifications, ranges, makes/numbers as approved by the Employer during detailed engineering.  Every panel-mounted instrument requiring power supply shall be provided with a pair of easily replaceable glass cartridge fuses of suitable rating. Every instrument shall be provided with a grounding terminal and shall be suitably connected to the panel grounding bus.  All local gauges as well as transmitters, sensors, and switches for parameters like pressure, temperature, level, flow etc. as required for the safe and efficient operation and maintenance as well as for operator and management information (including all computation) of equipment under the scope of specification shall be provided on as required basis within the quoted lump sum price. For bidding purpose, tentative minimum instruments have been indicated on the P&IDs. However, contractor shall supply any additional local gauges/switches/transmitters/sensors for reasons mentioned above without any additional cost to the Employer.  The necessary root valves, impulse piping, drain cocks, gauge-zeroing cocks, valve manifolds and all the other accessories required for mounting/erection of these local instruments shall be furnished, even if not specifically asked for, on as required basis. The contacts of equipment mounted instruments, sensors; switches etc. for external connection including spare contacts shall be wired out in flexible/rigid conduits, independently to suitably located common junction boxes. The proposal shall include the necessary cables, flexible conduits, junction boxes and accessories for the above purpose. Double root valves shall be provided for all pressure tapping where the pressure exceeds 40 Kg./sq.cm.  For all instruments envisaged for sea water applications, they shall be provided with wetted parts made of monel/Hastelloy C or any other material (if provenness experience of the proposed material for such applications is established by Contractor).  All instruments shall be provided with durable epoxy coating for housings and all exposed surfaces of the instruments.															
<b>2.00.01</b>	<b>SPECIFICATION FOR ELECTRONIC TRANSMITTER FOR PRESSURE, D.P., FLOW AND LEVEL</b>  <table border="1"> <thead> <tr> <th colspan="3"><b>ELECTRONIC TRANSMITTERS</b></th> </tr> <tr> <th>Sl.No.</th> <th>Features</th> <th>Essential/Minimum Requirements</th> </tr> </thead> <tbody> <tr> <td>1.</td> <td>Type of Transmitter</td> <td>Microprocessor based 2 wire type, Hart protocol compatible.</td> </tr> <tr> <td>2.</td> <td>Accuracy</td> <td>± 0.1% of calibrated span (minimum)</td> </tr> </tbody> </table>				<b>ELECTRONIC TRANSMITTERS</b>			Sl.No.	Features	Essential/Minimum Requirements	1.	Type of Transmitter	Microprocessor based 2 wire type, Hart protocol compatible.	2.	Accuracy	± 0.1% of calibrated span (minimum)
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CLAUSE NO.	TECHNICAL REQUIREMENTS		
	3.	Output signal range	4-20 mA DC (Analog) along with superimposed digital signal (based on HART protocol)
	4.	Turn down ratio	10:1 for vacuum/very low pressure applications. 30:1 for other applications.
	5.	Stability	± 0.1% of calibrated span for six months for Ranges up to and including 70 Kg/cm <sup>2</sup> . ± 0.25% of calibrated span for six months for Ranges more than 70 Kg/cm <sup>2</sup> (g).
	6.	Zero and span drift	+/- 0.015% per deg. C at maximum span. +/-0.11% per deg. C at minimum span.
	7.	Load impedance	500 ohm (min.)
	8.	Housing	Weather proof as per IP-55 with durable corrosion resistant epoxy coating.
	9.	Over Pressure	150% of maximum operating pressure
	10.	Connection (Electrical)	Plug and socket type
	11.	Process connection	1/2 inch NPT (F)
	12.	Span and Zero	Continuous, tamper proof, Remote as well as adjustability manual from instrument with zero suppression and elevation facility.
	13.	Accessories	-Diaphragm seal, pulsation dampeners, syphon etc. as required by service and operating condition.  -2 valve manifold for absolute pressure transmitters (3-valve manifold for gauge/ vacuum pressure transmitters) and 5 valve manifold for DP/level/flow transmitters.  -For hazardous area, explosions proof enclosure as described in NEC article 500.
	14.	Diagnostics	Self Indicating feature
	15.	Power supply	24V DC ± 10%.
	16.	Adjustment/calibration/maintenance	Centralised PC based system (In Employer's Scope). In addition total two (2) no. of hand- held type universal calibrators per unit, compatible with HART protocol, shall be provided.
MOUDA STPP-II (2x660MW) / SOLAPUR STPP (2 x 660MW) / NABINAGAR STPP (3x 660MW) / MEJA TPP-I (2 x 660MW) / RAGHUNATHPUR TPP PHASE-II (2 x660MW) STEAM GENERATOR PACKAGE	TECHNICAL SPECIFICATION SECTION-VI BID DOC NO.: CS-9575/ 9571/ 0370/ 0360/ 9586-102-2	PART - B SUB-SECTION-IV I-4 (MEASURING INSTRUMENTATION)	PAGE 2 OF 14

CLAUSE NO.	TECHNICAL REQUIREMENTS																																						
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	<p>In case it becomes necessary to use a DP transmitter for pressure measurement, then a 3-valve manifold should be used in place of 2-valve manifold.</p>																																						
	<p>LVDT type is not acceptable.</p>																																						
	<p>Where the process fluids are corrosive, viscous, solid bearing or slurry type, diaphragm seals shall be provided. Parts below the diaphragm shall be removable for cleaning. The entire volume above the diaphragm shall be completely filled with an inert liquid suitable for the application.</p>																																						
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CLAUSE NO.	TECHNICAL REQUIREMENTS																							
	12.	False signal tolerance	Transmitter shall be capable of ignoring false echoes from internal tank/sumps obstructions such as pipes, heating coils or agitator blades. Also transmitter shall have adjustable damping circuitry																					
	13.	Range	Range of transmitter shall be capable of covering the complete level span of tank taking care of blocking distance, frequency attenuation due to surface, obstructions, vapors etc																					
	14.	Display	Minimum 4 character display with integral keypad, access protected by user code.																					
	15.	Diagnostics	Loss of echo alarm etc																					
	16.	Load Impedance	500 ohms minimum																					
	17.	Electrical Connection	Plug and socket																					
	18.	Accessories	<ul style="list-style-type: none"> <li>• All weather canopy for protection from direct sunlight and direct rain.</li> <li>• All mounting hardware and accessories required for erection and commissioning mounting fittings material shall be SS 316.</li> <li>• For hazardous areas, explosion proof enclosure as described in NEC article 500.</li> </ul>																					
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