

**THE WEST BENGAL POWER DEVELOPMENT CORPORATION LTD  
(WBPDCL)**


**SAGARDIGHI THERMAL POWER PROJECT,  
1 X 660 MW UNIT NO 5, STAGE III**


**TECHNICAL SPECIFICATION  
FOR  
MILL REJECT SYSTEM (PNEUMATIC TYPE)  
&  
COAL BUNKER DEBLOCKING DEVICES**

**SPECIFICATION NO.: PE-TS-445-160-A001**



**BHARAT HEAVY ELECTRICALS LTD  
POWER SECTOR- PROJECT ENGINEERING MANAGEMENT  
NOIDA  
INDIA**

	SAGARDIGHI THERMAL POWER PROJECT, 1 X 660 MW UNIT NO 5, STAGE III.  MILL REJECT SYSTEM (PNEUMATIC TYPE) & COAL BUNKER DEBLOCKING DEVICES	SPECIFICATION No: PE-TS-445-160-A001	
		VOLUME: II B & III	
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## SECTION-I

### SPECIFIC TECHNICAL REQUIREMENT

SUB-SECTION IA  
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SPECIFIC TECHNICAL REQUIREMENT (MECHANICAL)  
SPECIFIC TECHNICAL REQUIREMENT (ELECTRICAL)  
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### SUB SECTION-IA

### SPECIFIC TECHNICAL REQUIREMENT (MECHANICAL)




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#### SCOPE OF ENQUIRY / INTENT OF SPECIFICATION

- 1.1.1 This specification includes, but not limited to, design, engineering, manufacturing, inspection and testing, painting, supply/delivery duly packed at project site including freight, unloading, storage and handling at site, erection and commissioning, trial run at site, performance guarantee test and handing over to the customer in line with drawings/ documents/ test procedures approved by BHEL/Customer for **Mill Reject System** including mandatory spares, erection and commissioning spares and maintenance tools and tackles.
- 1.2 The contractor shall be responsible for providing all material, equipment & services, which are required to fulfil the intent of ensuring operability, maintainability, reliability and complete safety of the complete work covered under this specification, irrespective of whether it has been specifically listed herein or not. Omission of specific reference to any component / accessory necessary for proper performance of the equipment shall not relieve the responsibility of providing such facilities to complete the supply, erection and commissioning.
- 1.3 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 judgement is not in full accordance herewith.
- 1.4 The extent of supply under the contract includes all items shown in the drawings, notwithstanding the fact that such items may have been omitted from the specification or schedules. Similarly, the extent of supply also includes all items mentioned in the specification and /or schedules, notwithstanding the fact that such items may have been omitted in the drawing.
- 1.5 The general terms and conditions, instructions to tenderer 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.
- 1.6 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 / conflicting 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. 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


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commercial implication on account of the same. Further in case of any missing information in the specification not brought out by the prospective bidders as part of pre-bid clarification, the same shall be furnished by Purchaser/ Customer as and when brought to their notice either by the bidder or by purchaser/ customer themselves. However, such requirements shall be binding on the successful bidder without any commercial & delivery implication.

- 1.7 The bidder's offer shall not carry any sections like clarification, interpretations and /or assumptions.
- 1.8 Deviations, if any, should be very clearly brought out clause by clause in the deviation schedule along with cost of withdrawal; otherwise, it will be presumed that the vendor's offer is strictly in line with NIT specification.
- 1.9 In case all above requirements are not complied with, the offer may be considered as incomplete and would become liable for rejection.
- 1.10 In the event of any conflict between the requirements of two clauses of this specification documents or requirements of different codes and standards specified, more stringent requirement as per the interpretation of the Owner shall apply.
- 1.11 In case all above requirements are not complied with, the offer may be considered as incomplete and would become liable for rejection.
- 1.12 Unless specified otherwise, all through the specification, the word contractor shall have same meaning as successful bidder /vendor and Owner/Customer/ Purchaser/Employer will mean BHEL and /or Customer including their consultant as interpreted by BHEL in the relevant context. For details refer the relevant clause in GCC.
- 1.12 Manufacturing Quality Plan for reference is included in this specification to enable the bidder to understand the extent of inspection and testing requirements to execute this project package. The successful bidder has to follow the quality plan's minimum requirement during manufacturing and testing. Further all checks and tests indicated in Quality Assurance Requirement as detailed in Customer's specification etc have to be followed.

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## 1.0 SCOPE OF WORK

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, structural work, minor civil works as required, trial run, Performance Guarantee test and handing over of Mill Reject Handling System including supply of mandatory spares, erection and commissioning spares and tools & tackles 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) Stack up assembly of pyrite hopper and conveying vessel below each mill shall comprise of following items.
  - 1 no. pneumatic cylinder operated knife gate valve with solenoid valve along with deflection cone, open and close limit switches at mill outlet/pyrite hopper inlet.
  - 1 no. 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.
  - RF type level switches with probes per pyrite hopper for High level and High-high levels.
  - Temperature switch per pyrite hopper as per flow diagram.
  - 1 no. of pneumatically operated knife gate valve at pyrite hopper outlet for pyrite hopper isolation with solenoid valve, open and close limit switches for interlock.
  - 1 no. of pneumatically operated knife gate valve at oversize discharge chute of pyrite hopper provided with solenoid valve, open & close limit switches for interlock with pyrite hopper inlet knife gate valve.
  - 1 no. of pneumatically operated knife gate valve at by pass chute of pyrite hopper provided with solenoid valve, open & close limit switches for interlock with pyrite hopper inlet knife gate valve.
  - 1 no. of transporter vessel complete with pneumatically operated inlet valve, Alloy CI outlet bend, local control panel etc.
  - 1 set of MS ERW pipe for mill reject conveying from transporter vessel to Mill Reject Storage bunker.
  - 1 lot of Alloy CI bends
- b) Terminal boxes (qty. as per layout) with up stand on bunker top for terminating the reject conveying pipes.

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- c) 2 nos. mill reject bunkers, i.e., one no. mill reject bunkers per mill bay along with structure, liner and pneumatic operated bunker discharge gate with canvas chute at bunker outlet, staircase up to mill reject bunker roof top, operating & maintenance platform, hand railing, bag filter with differential pressure switch, RF type level switch, pressure relieve valve, chain pulley block with traveling trolley and monorail arrangement etc.
- d) 2 nos. (1 working & 1 standby) oil free screw type air compressors with drive motors, local control panels, instruments, portable vibration analyser, tachometer and all other accessories.
- e) 1 no. air receiver per mill bay complete with auto drain traps, safety relief valve, instruments and all accessories.
- f) 1 no. non clogged fixed, submersible type sump pump along with local control panel per mill bay complete with suction & discharge piping for pumping out water from drain sump to nearest plant drain, instruments and all other accessories.
- g) 1 lot of piping, fittings, valves & instruments for conveying air, instrument air, cooling water for transporter vessel inlet valve top plate (if applicable), cooling water quenching in the pyrite hopper, cooling water for air compressor etc.
- h) 1 lot of Local Control Panel/pneumatic panels and JB's (1 no. for each pyrite hopper) properly mounted on rack along with required Stainless steel impulse/pneumatic tubing.
- i) 1 lot of insulation & cladding, if required, to maintain surface temperature of pyrite hopper within 60°C .
- j) 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.
- k) All insert plates, embedment plates, anti-vibration pads below conveying vessel if applicable foundation bolts/ anchor bolts etc. required for bidder's equipment.
- l) Charge of all lubricants and fluids as per GTR
- m) Electrical and C&I scope as per enclosure elsewhere in the specification.
- n) One (1) set of Mandatory Spares as per the list attached in specification.
- o) One (1) set of Erection & Commissioning spares as required for the complete system.
- p) One (1) set of Maintenance tools and tackles as per the list attached in specification.
- q) All counter- flanges with nuts, bolts and gaskets at all the terminal points.
- r) Relevant scope of supply as per GTR, GCC & SCC.
- s) 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.

## 1.2 SCOPE OF SERVICES

Scope of services shall include but not necessarily limited to

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- a) Unloading, Storage, handling and transportation at site
- b) Minor civil work like penning, chipping of foundation, grouting etc.
- c) Pre-Commissioning work such as flushing, hydraulic testing etc. Necessary instrumentation for pre-commissioning, trial run, and performance guarantee test shall be arranged by the successful bidder at their own cost.
- d) Erection & Commissioning of Mill Reject Handling System.
- e) Inspection & testing, trial run, performance guarantee & handing over to end client
- 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, compressors, air receivers, pipe rack and pit / trench details for 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) Relevant scope of services as per GTR, GCC, ECC & SCC.
- k) 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.
  - ii) Transporter vessel foundation
  - iii) Drain Sump & Trench/Hume pipe as required in mill bay.
  - iv) Foundation of Compressor and Air receivers.
  - v) Mill Reject bunker foundation.
  - vi) Various cable trenches, pipe pedestals & pipe rack foundation.
  - vii) Trucks for unloading mill reject from storage bunkers and further disposal of mill rejects.
  - viii) Trolley for manual disposal of Rejects.
  - ix) MRS compressor house and single girder crane.

However, location, sizing and loads and any other input related to above as applicable shall be given by the successful bidder within 8 weeks of placement of LOA.
- b) Fire Protection system for MRS compressor house.
- c) Lighting of Mill bay, MRS compressor house & Bunker area.
- d) Electrical exclusion as per Electrical scope sheet enclosed in the specification.
- e) Relevant exclusion as per GTR, GCC, SCC & ECC.

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### 3.0 SERVICES TO BE PROVIDED BY THE CUSTOMER

As per Utility Requirement – Section III D.

### 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.
Mill Reject outlet towards road tanker	Mill reject bunker outlet with canvas chute.
Equipment cooling Water, Instrument Air and Service Water tapings	As mentioned in Utility Requirement – Section III D.

### 5.0 PERFORMANCE / DEMONSTRATION GUARANTEES

The following minimum and details mentioned elsewhere in specification shall be performed.

#### a) PERFORMANCE GUARANTEE TESTS AT SITE.

- Maximum noise level shall not exceed 85 dB (A) when measured at 1.0 m away from the noise emission source as per Clause no 16.02.00, Volume: II-A, Section: V General Technical Requirements.
- Continuous effective discharge and guaranteed conveying at 0.7 TPH per mill without spillage as per clause no. 4.02.00 Volume: II-H2, Section: II Mill Reject System.
- SMP Level <30mg/Nm<sup>3</sup> of vent air from bag filter.

#### b) TESTS AT SHOP


- Following shall be demonstrated for each air compressor:  
Power consumption, capacity, discharge pressure.
- Following shall be performed for each air compressor:  
Rotating components shall be statically and dynamically balanced. Dynamic balancing tests shall be carried out. Test procedure and acceptance limit shall be guided by the relevant testing standard and shall be enclosed in the QAP.

### 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.

### 7.0 PAINTING/CORROSION PROTECTION REQUIREMENT shall be as per clause no. 14.00.00 Volume: II-A, Section: V General Technical Requirements of Customer's specification.

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Successful bidder shall furnish detailed Painting Schedule for Mill Reject System (based on painting specification attached with specification) for Customer's 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).

## 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 specific and standard technical specifications for Mill Reject Handling System.

In case of *any contradictory requirement* in specification of particular equipment, the requirement given in Section I shall prevail over those indicated in Section-II. Further, in case of any contradictory requirement within the same section and clarifications not having been sought by the bidders w.r.t. 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** 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.

## 10.0 QUALITY PLANS, INSPECTION & TESTING PROCEDURE (Reference Annexures)

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 (Refer Section-III)


The drawings and documents to be submitted with the bid shall strictly be the list. Any document other than those indicated therein will not be reviewed and will not form part of contract.

## 12.0 DRAWINGS/DOCUMENTS REQUIRED DURING DETAIL ENGINEERING (Refer Annexures)

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



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### 13.0 DRAWING/DOCUMENT DISTRIBUTION SCHEDULE (Refer Annexures)

Drawing/document distribution schedule shall be as per Annexures enclosed elsewhere in the specification.

### 14.0 DOCUMENT MANAGEMENT SYSTEM (DMS)

Bidder to note that the successful bidder, during detail engineering, will submit the drg/doc through web based Document Management System (DMS). Bidder would be provided access to 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:

BHEL reserves the right for drawing/document submission through web based Document Management System. Bidder would be provided access to the DMS for drawing/document 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 (<https://www.bhelpem.com/wrenchweb>).

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](http://www.bhelpem.com)) under the Vendor section. For quick access bidder may refer the link <http://bhelpem.com/DMSManuals/DMSManuals.html>

### 15.0 DRAWINGS ENCLOSED WITH THE SPECIFICATION (Refer Annexures)

Bidder to note that the flow diagram of Mill Reject System shows the minimum requirement including instruments for the system. 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.

### 16.0 OTHER REQUIREMENTS


#### i) Site Visit before submission of offer

Bidders shall make Site visit in order to familiarize themselves with the existing facility and condition of site before submitting the bid in order to make their offer complete. BHEL shall not entertain any cost implication for making the system complete for any lack of input data during detail engineering.

#### ii) Technical Requirements




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- Operation philosophy and control philosophy shall be submitted by the vendor during detail engineering stage for BHEL / CUSTOMER /CONSULTANT approval and approved document shall be adhered and the system shall be provided accordingly for which no commercial implication shall be entertained by BHEL.
- All possible efforts shall be made by the bidder to get the approval of drawings and documents from BHEL / customer / consultant at the earliest and the documents prepared / generated by them or their sub-vendors shall be checked by their competent authority before submission to BHEL.
- Mill Reject System design shall also consider the presence of occasional burning coal particles along with the rejects, which would increase the reject temperature.
- Revision made by the bidder in any drawings and documents shall be highlighted by indicating the no. of revisions in a triangle without fail so that the minimum time is required by BHEL to review the drawings and documents.
- Civil works will be provided by BHEL / Customer. Hence, bidder has to furnish the civil inputs in time. Bidder has to carry out the rectification in the civil works in the event of any changes in the civil input data furnished by them or delay in submission of input data by them. Bidder to furnish the civil foundation drawing along with the loading data for approval during detailed engineering stage showing / indicating the followings :-
  - a) Scope of work by BHEL / Customer and bidder shall be indicated with different legend or in the form of note.
  - b) Civil loads shall be furnished showing detailed calculation.
  - c) Details of pockets as required for anchor bolts.
- Bidder to depute competent designer (s) at BHEL's/ CUSTOMER /CONSULTANT office during detailed engineering stage to discuss drawings and other technical documents as and when required by BHEL. However, minimum 7 days notice shall be served for the same.
- All the drawings which are required to be furnished to BHEL during detailed engineering stage shall include technical parameters, details of paints, BOQ / BOM etc in tabular form indicating all components including bought out items and their quantity, material of construction indicating its applicable code / standard, weight, make etc.
- All drawings and documents including general arrangement drawing, data sheet, calculation etc. shall be furnished to BHEL during detailed engineering stage and shall include / indicate the following details for clarity w.r.t. inspection, construction, erection and maintenance etc.:-
  - a) All drawings and documents shall bear BHEL's title block and drawing / document number.

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- b) All drawings and documents shall indicate the list of all reference drawings including general arrangement.
- c) All drawings shall include / show plan, elevation, side view, cross - section, skin section, blow - up view, all major self-manufactured and bought out items shall be labeled and included in BOQ / BOM in tabular form.
- Bar chart, list of drawings and documents including data sheet, manual calculation, quality plan, field quality plan, performance guarantee test procedure, list of sub – vendors (mechanical, C & I and erection and commissioning), technical specification and material of construction, painting specification / schedule, dispatch schedule etc. of various items as required by BHEL / customer / consultant shall be submitted to BHEL / customer / consultant during detail engineering stage for approval and the approved drawings / documents shall be adhered by the bidder without any commercial implication.

**ANNEXURE IA : EQUIPMENT DESIGN/SELECTION CRITERIA FOR MILL REJECT SYSTEM: To be read in conjunction with “Technical Data sheet” of Customer’s specification , Vol: II-H2.**


Mill Data		
a	No. of mills (working & standby) at Coal consumption with Worst Coal firing at 100% TMCR.	7 working + 1 standby
b	Type of Mills	Vertical spindle bowl mill /HP 1103 ( DC )
c	Elevation of Mill Reject Spout (Tramp iron spout)	3.5m from (FFL)
d	Mill Arrangement	Side mill arrangement with 8 mills(each mill bay shall house 4 mills)
Reject Data		
e	Reject Temperature (Normal/Design) (deg. C)	Around 180 °C / 200 °C
f	Max/Normal Size of mill rejects to be handled	50 mm (5% of total reject) max size, 25 mm (normal size).
g	Bulk Density for a) Volumetric calculation b) Load calculation	1600 Kg/m <sup>3</sup> 2400 Kg/m <sup>3</sup>
System Data		
a	Type of mill reject system	Pneumatic conveying system , Continuous duty
b	Mill Reject System Design capacity with 5% margin over the maximum consumption	773 kg/hour
c	Guaranteed conveying rate at 100% BMCR with Worst coal (overall continuous basis) per mill	700 kg/hour

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Equipment Data		
<b>1.</b>	<b>Pyrite Hopper</b>	
a	No of Pyrite Hopper	One (1) no. per mill
b	Number of outlet	Three (3) nos.
c	Capacity	2-3 times Transporter Vessel capacity
d	Pyrite Hopper Accessories	
e	Temperature switch	As per flow diagram. Material suitable for minimum 500 °C.
f	RF type level switch	As per flow diagram. Material suitable for minimum 500 °C.
g	Water Spray quenching system with solenoid operated spray nozzle	One (1) no. per hopper
h	Rupture disc	One (1) no. per hopper. Suitable for 350 °C to 400 °C.
i	Flexible joint	One (1) no. per hopper
j	Oversize reject chute	One (1) no. per hopper
k	Bypass Chute	One (1) no. per hopper
l	Material of construction	
m	Pyrite hopper body	MS as per IS 2062, Grade A, 8 mm thick
n	Grid	Flat and bars minimum 10mm of MS:2062 Grade A. Sizing grid shall be provided in mill reject pyrite hopper to remove mill reject of size >50mm. The mill reject systems shall be designed for input size of 50mm.
o	Supports, Platform	MS as per IS 2062 Gr A
p	Provision of inspection/poking doors in pyrite hopper	Yes
q	Pressure Gauge at each service water and instrument air line to pyrite hopper	One (1) no.
<b>2.</b>	<b>Knife Gate Valve (Metal to metal seated)</b>	
	Type & Quantity	
a	Knife gate valve at Mill outlet – (KGV-1)	One (1) no. 200 NB Pneumatic cylinder operated per hopper
b	Knife gate valve at Over size discharge chute of Pyrite Hopper (KGV-2)	One (1) no. 200 NB Pneumatic cylinder operated per hopper
c	Knife gate valve at By Pass Chute of Pyrite Hopper (KGV-3)	One (1) no. 200 NB Pneumatic cylinder operated per hopper
d	Knife gate valve at Pyrite Hopper outlet (KGV-4)	One (1) no. 200 NB Pneumatic cylinder operated per hopper
e	Deflection cone	Provided before the pyrite hopper inlet knife gate valve
f	Method of operation	Solenoid valve with manual override facility.
g	Each knife gate valve (KGV-1 to KGV-4) shall be provided with open and close limit switch for interlock and control purpose with indication in OWS of DDCMIS based control system and local control panel/pneumatic panel.	
<b>3.</b>	<b>Transporter Vessel</b>	

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a	No. of transporter vessel envisaged	One (1) no. per hopper
b	Capacity of transporter vessel	Transporter vessel of adequate capacity to convey reject at design rate shall be provided. Pyrite Hopper is provided with an effective volume of 2 cycles (minimum) to act as buffer holding capacity. Vessel shall operate on level probe mode with timer back-up.
c	Dedicated pneumatic panel with minimum features as mentioned. One (1) no. per stack up assembly	<ul style="list-style-type: none"> <li>One "Power On" indication</li> <li>Push button for Probe override operation</li> <li>Push button for Purge operation (Purge or equivalent system as per vendor's proven practice shall be decided during detail engineering)</li> <li>Local indication of limit switches of pneumatically operated KGV's and vessel inlet valve.</li> </ul>
d	Conveying velocity	As per bidder's practice.
e	Number of cycle per hour	Not more than 6 per hour
4.	<b>Reject conveying pipe</b>	
a	Reject conveying pipe size	As per system requirement (to be decided by system supplier)
b	Quantity	As per layout requirement
c	Type of joint in pipe line	Flanged
d	Distance over which material is to be conveyed and the lift	As per layout requirement
5.	<b>Bunker &amp; Its Accessories</b>	
a	Number required	One (1) no. for each mill bay.
b	Effective Capacity	75 MT considering 24 hours' storage volume for the mill reject based on worst coal firing at 100% BMCR.
c	Number of outlet	One (1) no. per bunker
d	Material of Construction and Thickness	
f	Bunker Plates	Refer Technical Data sheet" of Customer's specification , Vol: II-H2
g	Liners	Refer Technical Data sheet" of Customer's specification , Vol: II-H2
h	Discharge gate	Refer Technical Data sheet" of Customer's specification , Vol: II-H2
i	Pressure Relief Valve	One (1) no. per bunker
j	Level Transmitter	One (1) nos. per bunker
k	Terminal Boxes with Up stand on bunker top for terminating the reject conveying pipes	Refer "Technical Data sheet" of Customer's specification, Vol: II-H2. Impacting surface shall be provided with SAIL HARD/TISCRAIL liner.
l	Clear access/headroom underneath MRS bunker for a road tanker/truck	4.5 m, suitable chute work under the silo for the Road Tanker/Trucks receive the rejects shall also be provided.
6.	<b>Bag Filter on Bunker top with associated</b>	

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	<b>instruments</b>	
	Type & Number	Reverse pulse jet type / One per bunker
	Material of filter cloth	Polyester needle felt of antistatic type
	Air to cloth ratio (at maximum air flow)	Refer "Technical Data sheet" of Customer's specification , Vol: II-H2
	Bag cage and filter body	Bag filter body - MS IS 2062 Gr A, 3 mm thick with stiffeners. Bag Cage - 18SWG, IS 7089, galvanized.
	Outlet air quality (SMP level) at bag filter discharge;	Less than 30 mg/NM3 or as per Environmental norms (whichever is more stringent.)
	Differential Pressure Gauge and Differential Pressure Switch	One (1) no. per bag filter
	Hand operated Chain Pulley Block with geared trolley over bag filter	<ul style="list-style-type: none"> <li>No. of CPB – 1 no per bunker top.</li> <li>Service condition – Class II outdoor as per IS 3832.</li> <li>Capacity of Chain Pulley Block shall be selected considering a minimum margin of 25% over the maximum weight of the heaviest equipment/component to be handled but in no case the capacity shall less than 1T.</li> <li>Performance test shall be duly certified by govt. approved agency.</li> <li>For details refer "Miscellaneous Hoists" of Customer's specification , Vol: IIK.</li> </ul>
<b>7.</b>	<b>Compressors with drive motor and all other accessories</b>	
	No. and type of compressors	2x100% capacity (1 working + 1 Standby) continuous duty Oil free rotary screw type air compressors.
	Location	Housed in MRS Compressor House
	Pressure	As per supplier's proven practice
	Service	Conveying air
	Type of Drive	Electric Motor
	Compressor selection criteria	<ul style="list-style-type: none"> <li>Minimum temperature : 5°C</li> <li>Maximum temperature : 50 °C</li> <li>Design condition (temperature &amp; Relative humidity) : 50°C &amp; 100% RH at atmospheric pressure.</li> <li>Height above MSL (m) : 34m</li> <li>Cater to the compressed air requirements of mill reject handling system working simultaneously for the worst coal condition.</li> <li>Noise level- As per functional guarantees.</li> <li>The maximum velocity to be considered in compressed air and cooling water piping shall be as mentioned elsewhere in this Technical</li> </ul>

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		Specification.
	Materials of construction	Refer "Technical Data sheet" of Customer's specification, Vol: II-H2.
	Instrumentation	As per manufacturer's standard practice & redundancy requirement as per attached C & I specification.
	Conveying air compressor system shall be designed to supply the air to operate each dense phase pneumatic conveying system of both bays simultaneously.	
<b>8.</b>	<b>Air receiver with isolation valves, instruments &amp; accessories</b>	
	Quantity	One (1) no. per bay
	Design Code	ASME Section-VIII or IS: 2825 Class II vessel A corrosion allowance of 1.5 mm (minimum) shall be provided. It shall be designed for 1.5 times the compressor discharge pressure.
	Capacity	Each air receiver capacity shall be selected to convey one complete cycle with a minimum margin of 25% provided over and above the calculated air capacity. Minimum capacity of each receiver shall be 15 m <sup>3</sup> .
	Shell/ Body	Refer "Technical Data sheet" of Customer's specification , Vol: II-H2
	Safety relief valve, fusible plugs, pressure gauges, pressure switch, temperature gauge, flanged pipe connections, inspection manholes with automatic drain traps	One (1) no. per air receiver Pressure gauges shall be provided at each air inlet line to air receiver in addition to pressure gauge on air receiver
	Auto drain & Y type Strainer	One (1) no. per air receiver
	Structural platform for maintenance of safety relief valves and instruments	To be provided by supplier. The air receivers will be vertical self-supporting cylindrical vessels with supporting legs for resting. Operation & maintenance platform along with access ladder shall be provided. Fixing of air receivers should be done with anchor fasteners.
<b>9.</b>	<b>Pipe work for Conveying Air, Instrument Air, Cooling Water for Inlet Valve top plate of Transporter Vessel (if applicable), Cooling water for Quenching in Pyrite Hopper, Cooling water for air compressor</b>	
	Quantity	One (1) lot
	Material of construction	Refer "Technical Data sheet" of Customer's specification , Vol: II-H2 & "Low Pressure Piping, Valves" , Vol II- J1
	Instruments	As per flow diagram.
<b>10.</b>	<b>Type and no. of sump pumps with local control panel</b>	
	Material of construction	
	Casing, suction bell and impeller	Refer "SUMP PUMPS, DRIVES AND ACCESSORIES" of Customer's specification , Vol: IIK.
	Shaft/Sleeves	
	Capacity	

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	Head discharge	
11.	Impulse tubing	Shall be of SS 304 type
12.	Control System	DDCMIS based control system (BHEL scope)
13.	Lines for various services Valves for Air & Water Lines Fittings, Flanges, Fasteners & Gaskets Velocities	Refer "Low Pressure Piping, Valves, Volume II-J1" of Customer's specification.

Notes

- 1) The instruments quantity and redundancy refer Flow diagram and C & I specification.


**ANNEXURE IB: EQUIPMENT DESIGN/SELECTION CRITERIA FOR COAL BUNKER DEBLOCKING DEVICES: To be read in conjunction with "Technical Data sheet" of Customer's specification, Vol: II-H2 for items as applicable.**

applicable.

	Function	The air cannons shall aid and assist the free flow of raw coal in coal bunkers to address the material build-up problems like arching, bridging, rat-holing & funneling which occur due to moisture, compaction, storage for long duration etc. They are operated to provide optimal flow pattern.
	No. of units in plant	One (1) with two (2) bunker bays of four (4) bunkers each
Raw Coal Bunker Data		
	Refer attached "BUNKER SIZING CALCULATION for RAW COAL-CYLINDRICAL WITH CONICAL HOPPER"	
Coal Data		
	Refer "ANALYSIS OF COAL" of Customer's specification , Vol: II-A	
Equipment Data		
1	Pneumatic Air Cannon with all accessories like solenoid valves, mounting bracket, safety chain etc.	
	No. of Air cannons per bunker	As per vendor's design based on hopper profile, bulk density of material etc. (Minimum 7 nos per bunker)
	Capacity	As per vendor's proven practice
	Material of Construction	As per codes and standards in contract
	Pneumatic / local panel	One (1) no. per bunker with DOP of IP 65 along with interface with DCS
	Location of Pneumatic Air cannons	Shall be strategically located/ mapped on coal bunker as per vendor's proven practice
2	Compressors with drive motor and all other accessories	
	Location	Housed in MRS Compressor House




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	<b>SAGARDIGHI THERMAL POWER PROJECT, 1 X 660 MW UNIT NO 5, STAGE III.</b>  <b>MILL REJECT SYSTEM (PNEUMATIC TYPE) &amp; COAL BUNKER DEBLOCKING DEVICES</b>  <b>SPECIFIC TECHNICAL REQUIREMENT</b>	<b>SPECIFICATION No: PE-TS-424-160-A001</b>	
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	Type of compressors	Oil free screw type air compressors - Water cooled. Each compressor shall have own microprocessor based control system which shall be further interfaced (hardwired and redundant soft wired) with DCS for start/stop, load/unload and monitoring of compressors.
	No. of compressors	2x100% capacity (1 Working + 1 Standby), each compressor shall be sized to cater air requirement of eight (8) bunkers.
	Pressure	As per supplier's proven practice
	Type of Drive	Electric Motor
	Compressor selection criteria	<ul style="list-style-type: none"> <li>• Minimum temperature : 5°C</li> <li>• Maximum temperature : 50 °C</li> <li>• Design condition (temperature &amp; Relative humidity) : 50°C &amp; 100% RH at atmospheric pressure.</li> <li>• Height above MSL (m) : 34m</li> </ul>
	Margin on compressor capacity	At least 10% margin shall be provided on compressor capacity over and above the maximum flow requirement.
	Noise & vibration level	As per functional guarantees mentioned elsewhere for compressors.
	Materials of construction	Refer "Technical Data sheet" of Customer's specification, Vol: II-H2
	Instrumentation	As per manufacturer's standard practice & redundancy requirement as per attached C & I specification.
<b>3</b>	<b>Air receiver with isolation valves, instruments &amp; accessories</b>	
	Quantity	One (1) no. per bay
	Design Code	ASME Section-VIII or IS: 2825 Class II vessel A corrosion allowance of 1.5 mm (minimum) shall be provided. It shall be designed for 1.5 times the compressor discharge pressure.
	Capacity	Air receiver capacity shall be selected for effective deblocking with a minimum margin of 25% provided over and above the arrived air receiver capacity (Minimum 5 m <sup>3</sup> )
	Material of construction for shell, end plates and flanges	Refer "Technical Data sheet" of Customer's specification , Vol: II-H2
	Safety relief valve	One (1) no. per air receiver. Pressure gauges shall be provided at each air inlet line to air receiver in addition to pressure gauge on air receiver
	Auto drain & Y type Strainer	One (1) no. per air receiver



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	Structural platform for maintenance of safety relief valves and instruments	To be provided by vendor.
	The air receivers will be vertical self-supporting cylindrical vessels with supporting legs for resting. Operation & maintenance platform along with access ladder shall be provided. Fixing of air receivers should be done with anchor fasteners.	
<b>4</b>	<b>Pipe work for Service Air, Instrument Air, Cooling water for compressor along with valves, filter regulator etc.</b>	
	Material of construction	Refer "Technical Data sheet" of Customer's specification , Vol: II-H2 & "Low Pressure Piping, Valves" , Vol II- J1
<b>5</b>	Control System	The "No COAL" flow detector of ultrasonic type provided (in BHEL's scope) in the raw coal discharge line from bunker to the coal feeder shall start the air cannons in the bunker. Microprocessor based compressor control with auto-changeover to standby compressor in case of trip condition. Compressor start/stop and load/unload control shall also be from DCS in addition to microprocessor control. Control of deblocking devices shall be through DCS. In addition to control from DCS, control from local panel shall also be provided.
<b>6</b>	Impulse tubing	SS 304 type

## Notes

- 1) The instruments quantity and redundancy refer Flow diagram and C & I specification.



## **VOLUME: II**

### **TECHNICAL SPECIFICATIONS**



**VOLUME : II-A**  
**LEAD SPECIFICATION**



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### VOLUME : II-A

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## SECTION-I

### INTENT OF SPECIFICATION





## SECTION-I

### INTENT OF SPECIFICATION

1.00.00 This specification is intended to cover design, engineering, manufacture, inspection and testing at manufacturer's works, packing and shipment and delivery at site, unloading, storage and handling at site of all equipment and materials, all necessary civil/structural/ architectural works, erection of all mechanical / electrical / control& instrumentation equipment and materials, site testing, commissioning, trial run, performance and guarantee tests and other services including supply co-ordination, engineering and project management related to the equipment/systems comprising 1 x 660 MW Unit, as specified hereinafter and in accordance with the requirements, conditions, annexures, drawings etc. stated in Volume-I and Volumes II-B to II-L which shall be considered as a part of this volume as completely as if bound herewith.

The specification consists of Volumes-I, II, III detailed index of which has been furnished elsewhere. This specification shall be read and construed in conjunction with the drawings and annexures to determine the scope of work. The quantities shown on drawings and annexures are indicative. Any variation arising during detailed engineering stage will be taken into account by the Contractor without any extra cost and time to the owner.

The Bidder shall be responsible for providing all material, equipment and services, specified or otherwise which are required to meet the intent of this specification, ensuring high degree of reliability and ease of operation and maintenance. The equipment and system/sub-systems shall conform to all aspects of high standards of engineering, design and workmanship and shall be capable of performing in continuous commercial operation, in a manner acceptable to the Owner and shall also be in line with the current practice for reliable and efficient functioning of the plant.

Owner shall interpret the meaning of the specification, drawings, requirement of operation, maintenance, redundancy etc., and shall have a right to reject or accept any work or material which in his assessments is not technically complete to meet the requirements of this specification and/or applicable National and International standards mentioned elsewhere in this specification.

Bidder is required to carefully examine and understand the specifications and seek clarifications, if required, to ensure that he has understood the specifications as intended by the Owner. In the absence of any specific clarifications made by the Owner during bidding stage, the interpretation of Owner shall be final. The Bidder's offer should not carry any sections like clarifications, interpretations and/or assumptions. All such points are required to be clarified during bidding stage.

In the event of conflict between requirements of any two clauses of this specification/documents or requirements of different codes/standards, specified, the more stringent requirement as per the interpretation of the Owner shall apply.

**WBPDC**

In case all the above requirements are not complied with, the offer may be considered as incomplete and liable to be treated as non-responsive.

2.00.00

Whenever a material or article is specified or described by the name of a particular brand, manufacturer or vendor, the specific items mentioned shall be understood as establishing type, function and quality desired.

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WBPDC

EPC Bid Document  
Sagardighi Thermal Power Project  
1x660 MW Unit No. 5, Phase – III

**SECTION-II**

**NOT USED**



Development Consultants Pvt. Ltd.

Volume : II-A  
Section : II





## SECTION-III

### PROJECT SYNOPSIS AND GENERAL INFORMATION





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## SECTION-III

### PROJECT SYNOPSIS AND GENERAL INFORMATION

#### 1.00.00 INTRODUCTION

The West Bengal Power Development Corporation Limited (WBPDC) proposes to extend their on-going Phase-II extension project of 2x500 MW at Sagardighi by adding one super critical unit of 660 MW as Phase-III extension unit. Sagardighi TPS is located in the village Manigram in Murshidabad district of West Bengal, India. The West Bengal Power Development Corporation Limited, a Company fully owned by the Government of West Bengal formed in the year 1985, have commissioned 2x300 MW Thermal Power Plant together with all other infrastructure at Sagardighi Thermal Power Project. Presently WBPDC is also working on their under-construction Phase- II extension project of 2x500 MW at Sagardighi.

The Bidder shall acquaint himself, by visiting the site, with the conditions prevailing at site. The information given here in under is for general guidance only.

#### 2.00.00 APPROACH TO SITE

Sagardighi Super Thermal Power Station site is located at Manigram village, 13 KM north of Sagardighi town by the side of the SMGR (Sagardighi-Manigram-Gankar-Raghunathganj) Road at a distance 20 KM from National Highway 34 in Murshidabad District, West Bengal and around 240 KM from Kolkata, India. The nearest rail station is Manigram adjacent to the site on Bandel - Barhawara branch line and 6.5 KM from Sagardighi Railway Station on Sainthia - Azimgunj line of Eastern Railway. From Sagardighi railway station a railway line will branch off to the site for material unloading and coal marshalling. The equipment will be normally transported by rail only and under exceptional cases by road. The material consignments shall be as per the restrictions of rail and road transportation prevailing in the country.

Nearest Airport – Kolkata.

Nearest Seaport –Haldia.

#### 3.00.00 LAND

The total land available for the Power Station and Plant auxiliaries will be generally as per the Site Location Plan (12A05-DWG-M-002) enclosed and flexibility will remain to make the final equipment layout based on equipment sizes.

All construction material, heavy equipment, over dimensioned consignments (ODC) for the station during construction may be transported through road/rail access. During operation stage, coal would be transported through rail access.





The total land, approximately 706 hectares, has already been acquired for the present and proposed extension. The locations of various facilities and plant auxiliaries for Unit 1 & 2 under Phase-I and Units 3 & 4 in Phase-II and the space provision for extension unit no. 5 (660 MW) will be as per the General Layout enclosed. About 456 acre of land has been kept for disposal of ash. The Bidder shall accommodate equipment offered under this specification generally within the spaces allocated for such equipment in the General Layout. Specific approval from Owner/Consultant shall be taken by the contractor prior to any revision or relocation.

Except where stated otherwise, the plinth levels of all buildings shall be 300 mm above the corresponding developed grade level and the road level shall be 150 mm above the developed grade.

#### 4.00.00 SOURCE OF COAL

The Power plant shall receive coal from ECL mines. Coal is planned to be transported in rake loads through the existing Pakur- Tildanga-Dhulian-Monigram broad gauge line or through Pakur- Nalhati (proposed)–Takipara-Gosaingram-Poradanga-Monigram broad gauge line. The coal would be carried in rake loads of BOBR/BOX-N wagons.

It is considered that coal would be received from the same source as the plant under Phase-I and Phase-II station with similar characteristics and a new mine at Pachwara (north) in Jharkhand being developed by WBPDCCL. These sources being connected by B.G. rail track, coal would be transported by rail only. For coal unloading, crushing and storage facility it is proposed that a new Wagon tippler along with crusher houses, conveyors will be installed in addition to existing coal handling plant of Phase-II station with suitable extension from the end of Transfer Point (TP-19).

#### 5.00.00 SOURCE OF WATER

The source of water for this project is the River Bhagirathi (5 km) through the proposed intake pump house under implementation for Phase-II station. The water from the River Bhagirathi will be transferred and stored in the five (5) nos. Plant Raw Water Reservoirs by augmentation of the Intake water transportation system for phase - II for meeting the requirement of Phase-III Sagardighi TPS.

The Power station will operate on semi open recirculating condenser cooling system using cooling towers. In addition all water conservation and recycling measures will be adopted to minimize requirement of make up water. The proposed project will adopt zero effluent discharge philosophy.

#### 6.00.00 ASH DISPOSAL AREA

Bottom Ash (BA) shall be extraction in wet form and conveyed to the disposal area in lean slurry form. Whereas Fly Ash (FA) shall be extracted in dry form and stored in dry form for onward usage. However, arrangement shall be also





### CIVIL, STRUCTURAL AND ARCHITECTURAL WORK (BUILDINGS CONSTRUCTED WITH SPACE FOR PHASE III)

Necessary Walkway connection between operating floors of Power House of Phase – II (Existing) and Phase – III shall be considered by Bidder.

Few civil foundations have already been constructed for future equipment. Such existing foundation details including bolts, inserts etc. to be studied in detail before procurement of specific equipment for respective purposes so that the same can safely be placed over the existing foundations complying all technical compatibility. In case this is not at all possible, new foundations need to be constructed after complete demolition of existing foundations.

For further details regarding the existing facilities of Phase – II, please refer Volume – II G1, G2 and G2: Technical Specifications for Civil, Structural and Architectural..

#### 8.00.00 SALIENT DESIGN DATA

8.01.00 For implementation of the project, the Bidder shall consider the following Site and Meteorological data:-

- |    |                         |   |  |
|----|-------------------------|---|--|
| a) | Location                | : | Manigram village, Sagardighi, Raghunathganj sub-division, Murshidabad District, West Bengal.               |
| b) | Latitude and Longitude  | : | 24° 22' 13.7" N, 88° 6' 15.8" E<br>(Topo sheet No.78/D/3)  |
| c) | Nearest Towns           | : | Ajimganj, Jangipur, Raghunathganj.   |
| d) | District Head Quarters  | : | Berhampore - 40 km.  |
| e) | Approach Road           | : | 20 km from National Highway (NH-34)  |
| f) | Nearest Railhead        | : | Manigram railway station on Bandel-Barhawara branch line 1 km from site.                                   |
| g) | Source of Water         | : | Bhagirathi River - 5 km  |
| h) | Source of Coal          | : | Pachwara (North) mine block in Jharkhand.  |
| i) | Fuel Transportation     | : | By rail in rake loads of BOBR/BOX-N wagons.  |
| j) | Surrounding Habitations | : | Villages - Manigram, Chhamugram, Karaia, Thakurpara on the south; Bhumhar, Khasittor, Ekrakhi on the west; |





WBPDC

Dhalo, Bagpara, Santoshpur on the north and Harirampur, Chandparam, Dogachhi on the east.

- k) Level : Within 34.5 m contour. Land is above HFL (highest flood level) of the area.
- l) Soil : Less fertile alluvial soil.
- m) Land Use : Within existing plant boundary of WBPDC.

Meteorological data of site is given below:

- a) Design ambient dry bulb temperature : 50 °C maximum  
5 °C minimum
- b) Highest wet bulb temp : 26.9 °C
- c) Maximum relative humidity : 84%
- d) Average relative humidity : 73%
- e) Average annual Rainfall : 1389 mm
- f) Wind load : In accordance with IS-875 for a basic wind speed of 47 m/sec, up to a height of 10 metres above mean ground level.
- g) Seismic Zone : Zone III as per IS: 1893 latest edition.
- h) Altitude : 34M above MSL



**WBPDCL**

**EPC Bid Document  
Sagardighi Thermal Power Project  
1x660 MW Unit No. 5, Phase - III**

## **SECTION-V**

### **GENERAL TECHNICAL REQUIREMENTS**

**Development Consultants Pvt. Ltd.**

**Volume : II-A  
Section : V  
General Technical Requirements**

**WBPDC**

**EPC Bid Document**  
**Sagardighi Thermal Power Project**  
**1x660 MW Unit No. 5, Phase - III**

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## SECTION-V

### GENERAL TECHNICAL REQUIREMENTS

#### 1.00.00 **CODES AND STANDARDS**

1.01.00 Except where otherwise specified, the Plant shall comply with the appropriate Indian Standard or an agreed internationally accepted Standard Specification as listed in the annexure to this Section and mentioned in detailed specifications, each incorporating the latest revisions at the time of tendering. Where no internationally accepted standard is applicable, the Bidder shall give all particulars and details as necessary; to enable the Owner to identify all of the Plant in the same detail as would be possible had there been a Standard Specification.

1.02.00 Where the Bidder proposes alternative codes or standards he shall include in his tender one copy (in English) of each Standard Specification to which materials offered shall comply. In such case, the adopted alternative standard shall be equivalent or superior to the standards mentioned in the specification.

1.03.00 Wherever specified or required the Plant shall conform to various statutory regulations such as Indian Boiler Regulations, Indian Electricity Rules, Indian Explosives Act, Factories Act etc. Wherever required, approval for the plant supplied under the specification from statutory authorities shall be the responsibility of the Successful Bidder.

1.04.00 In the event of any conflict between the codes and standards referred above, and the requirements of this specification, the requirements, which are more stringent, shall govern.

1.05.00 In case of any change of code, standards and regulations between the date of purchase order and the date the Successful Bidder proceeds with manufacturing the Owner shall have the option to incorporate the changed requirements. It shall be the responsibility of the Successful Bidder to advise Owner of the resulting effect.

#### 2.00.00 **RESPONSIBILITY FOR DESIGN**

2.01.00 The Bidder shall assume full responsibility for the design of the whole and every portion of the Plant, whether or not the design work was undertaken specifically in relation to the Contract and whether or not the Successful Bidder was directly involved in the design work.

2.02.00 Notwithstanding the Owner's wish to receive the benefits of new, advanced and improved technologies, a prime requirement is that all the systems and components proposed shall have been already adequately developed and shall have demonstrated good reliability under similar, or more arduous conditions elsewhere, at least for continuous 2 years in two different power station.

2.03.00 The Bidder shall carry out optimization studies for selection of pipe size and equipment wherever required. The result of such studies shall be included as part of bid proposal.





The successful Bidder shall have to carry out surge analysis and other transient condition studies as may be necessary and as required by the Owner as per proven engineering practice.

- 2.04.00 The Bid shall include a detailed discussion on the development status of and the reasons for any changes made in proposed systems or components for the Plant, as compared with similar items previously supplied in other installations cited by the bidder as reference plants.
- 2.05.00 The Bidder may also make alternate offers, provided such offers are superior in his opinion in which case adequate technical information, operating feedback, etc. are to be enclosed with the offer, to enable the Owner to assess the superiority and reliability of the alternatives offered. In case of each alternative offer, its implications on the performance, guaranteed efficiency, auxiliary power consumptions, etc. shall be clearly brought out to the Owner to make an overall assessment. In any case, the base offer shall necessarily be in line with the specifications i.e. Base offer shall be as per the technical specifications and the same will be considered for techno-commercial evaluation.
- 3.00.00 **NAME PLATES (RATING PLATES)**
- 3.01.00 Instruction plates, nameplates or labels shall be permanently attached to each main and auxiliary item of plant in a conspicuous position. These plates shall be engraved with the identifying name, type and manufacturers serial number, together with the loading conditions under which the item of plant has been designed to operate.
- 3.02.00 Items such as valves, etc. which are subject to hand operation, shall be provided with nameplates so constructed as to remain clearly legible throughout the life of the plant giving due consideration to the difficult climatic conditions to be encountered. Nameplates shall be securely mounted where they will not be obscured in service by insulation, cladding, actuators or other equipment. Direction of flow is also to be engraved.
- 3.03.00 All trade nameplates and labels shall be in English language. All measurements shall be in M.K.S. Units.
- 3.04.00 The size and location of nameplates shall be subject to Approval of the Owner/Owner's Engineer.
- 4.00.00 **SAFETY AND SECURITY**
- 4.01.00 The design shall incorporate every reasonable precaution and provision for the safety of all personnel and for the safety and security of all persons and property. The design shall comply with all appropriate statutory regulations relating to safety. All structures and equipment shall be designed and constructed to withstand every foreseeable static and dynamic loading condition, including loading under earthquake conditions, with an adequate margin of safety.
- 4.02.00 Ready and safe access with clear headroom shall be provided to all parts of the plant for operation, inspection, cleaning and maintenance.



4.03.00 Escape routes and clear ways shall be provided to allow speedy evacuation of the plant in the event of fire or explosion, and the plant layout shall allow for ease of access to all parts of the Works by rescue and fire fighting teams. The Plant layout shall be designed to localize and minimise the effects of any fire or explosion. The recommendations of NFPA, OSHA, and TAC etc. as necessary shall be followed in all respects.

4.04.00 The use of corrosive, explosive, toxic or otherwise hazardous materials shall be kept to a minimum during construction and the design of the plant shall minimise the requirement for such materials during operation and maintenance. Where such materials must be used, all necessary precautions shall be taken in the design, manufacture and layout of equipment to minimise the resulting hazard, and all equipment necessary for the protection and first-aid treatment of personnel in the event of accidents shall be provided. Particular attention is drawn to avoid the use of materials containing asbestos in any form.

#### 5.00.00 **GUARDS**

5.01.00 Effective guards and fences must be provided to prevent injury to operators through accident or malpractice.

5.02.00 Mesh guards which allow visual inspection of equipment with the guard in place are generally preferable. The guards shall be constructed of mesh attached to a rigid framework of mild steel rod, tube, or angle and the whole galvanised to prevent loss of strength by rusting or corrosion. The guards shall be designed to facilitate removal and replacement during maintenance.

5.03.00 All drive belts, couplings, gears, sharp metallic edges and chains must be safely guarded. Any lubricating nipple requiring attention during normal running must be positioned where they can be reached without moving the guards.

5.04.00 Guards for couplings and rotating shafts shall be in accordance with BS 5304-1975 or similar approved standard. All rotating shafts and parts of shafts must be covered.

5.05.00 Suitable fencing shall be provided to enclose all openings or doorways used for the hoisting and lowering of machinery etc. This fencing must be securely fixed but quickly detachable when required. A secure handhold must be provided on each side of the opening or doorway.

#### 6.00.00 **LOCATION AND LAYOUT REQUIREMENTS**

The majority of plant and equipment shall all be of indoor installation. A broad list of buildings housing such equipment is given In Vol-II-G2 Section I. Layout shall facilitate access for operation-maintenance and inspection of any one or more equipment/components at a time without disturbing the operation or installation of rest of the plant. Further, Bidder should comply with the criteria given under the various equipment and system specifications as well as those stipulated in Annexure-II attached to this section.

Enclosed General Layout and other tender layout drawings enclosed in Vol-II-L show the location of major installations and auxiliary buildings. The Bidder



shall try to retain these locations as far as practicable. The layout of equipment within the power house as shown in the tender drawings is indicative. The Bidder may, subject to Owner's acceptance alter the same to suit the space requirement of the equipment offered.

While developing the layout of buildings the following criteria shall be given effect:

- a) The minimum width of clear access corridors around equipment shall be 1.2 meters.
- b) Each building shall have an identified vacant space for equipment unloading and maintenance and preferably a separate bay altogether in buildings housing heavy equipment. Provision for handling equipment by monorail hoist and/or overhead crane shall be made as required.
- c) The plinth level with respect to the existing grade level shall be as indicated elsewhere in Vol-II-A Section-V/Annexure-II.
- d) The minimum clear height available between two consecutive floor slabs shall not be less than five (5) meters. A clear head room of 2.2 meters shall be maintained between the floor and any overhead piping/cables or other obstruction. Adequate provision for natural ventilation and illumination shall be made as per good engineering practices.
- e) There shall be at least two (2) nos. main access doors, one on either side of each building, of which one shall be minimum 3 meters wide with rolling shutters for equipment entry. For multistoried buildings, at least two (2) nos. regular staircases diagonally opposite to each other shall be provided connecting all the floors and roof. These minimum requirements shall be augmented as required depending on the floor area, statutory requirements and TAC recommendations.
- f) All buildings shall have provision for toilet and associated effluent discharge system together with facility for drinking water. The criteria for ventilation, fire protection and illumination of building spaces shall be as specified in Vol-II-A Section-V/Annexure-II.
- g) All rail/road crossings for pipe/cable racks shall be constructed with minimum 8 meters headroom from top of rail/road to bottom of rack. Similarly top cover over underground pipes/cables shall be minimum one (1) meter. For other detail refer to Annexure-II of this section.
- h) Cubicle for operating personnel shall be located at safe place near the equipment.
- i) Pipe rack, cable rack and Pipe cum Cable rack shall have hand railings (not less than 1200 mm high) in walkways (min. 800 mm wide) on both sides at appropriate heights.



## 7.00.00 OPERATION AND MAINTENANCE CONSIDERATIONS

7.01.00 Space for ease of operation and maintenance including equipment removal, tube bundle/cartridge/rotor pulling etc. shall be provided. All valves, gates, dampers and other devices shall be located and oriented in such a way that they are accessible from operating floor levels. Where this cannot be adhered to, platforms and walkways with access ladders shall be provided to facilitate operation and maintenance.

7.02.00 Lifting devices i.e. hoists, chain pulleys, jacks, etc. shall be provided for handling of any equipment and/or part having weight in excess of 100 Kg during erection and maintenance activities. Suitable beams, hooks etc. for this purpose shall be provided in the buildings and clear space provided below to a platform or floor which will allow normal risk free transport means to be used.

Lifting tackles, slings, etc. to be connected to hook of the hoist/crane shall also be provided by the Bidder for lifting the various equipments and accessories covered under this specification.

7.03.00 All similar parts of the equipment shall be made to gauge and shall be interchangeable with and shall be made of same material and workmanship as the corresponding parts of the equipment. Where feasible common components shall be employed in different pieces of equipment in order to optimize the spares inventory and utilization.

## 8.00.00 MATERIALS

8.01.00 In selecting materials of construction of equipment, the Bidder shall pay particular attention to the atmospheric conditions existing at the Site and the nature of material/fluid handled.

All materials shall be new and shall be of the quality most suited to the proposed application.

8.02.00 Materials used for various components shall be those which have already proven operating experience in similar type of applications.

8.03.00 All parts which could deteriorate or corrode under the influence of the atmospheric, meteorological or soil conditions at the Site, or under the influence of the working conditions shall be suitably and effectively protected so that such deterioration or corrosion is a minimum over the life of the plant.

## 8.04.00 Prohibited Materials

The use of the following materials is prohibited:

- a) High alumina cement in structural elements
- b) Wood wool slabs in permanent framework to concrete
- c) Calcium chloride in mixtures for use in concrete works



- d) Naturally occurring aggregate for use in reinforced concrete that does not comply with the applicable codes and standards.
- e) Cast iron for any oil service
- f) Carcinogenic material and suspected carcinogenic materials by World Health Organization.
- g) Asbestos or any other fibrous form of hydrated magnesium silicate
- h) Any other material generally known to be deleterious if used or incorporated in such project like the facility.

#### 9.00.00 **LUBRICATION**

- 9.01.00 Provision shall be made for suitable efficient lubrication where necessary to ensure smooth operation free from undue wear.
- 9.02.00 Non ferrous capillary tubing shall be used throughout.
- 9.03.00 Gear boxes and oil baths shall be provided with filling and drain plugs, both of adequate size. An approved means of oil indication including level switches and temperature indication shall be provided.
- 9.04.00 All high speed gears shall be oil bath lubricated. Low speed gears shall be lubricated by means of soft grease. Removable and accessible drip pans shall be provided to collect lubricant, which may drop, from operating parts.
- 9.05.00 All lubrication points shall be conveniently situated for maintenance purposes. It must be possible to carry out lubrication from a gangway or landing and without the removal of guarding or having to insert the hand into it. Where accessibility to a bearing for oiling purposes would be difficult a method of remote lubrication shall be fitted.
- 9.06.00 The Bidder shall supply grease gun equipment suitable to service each type of nipple fitted.

#### 10.00.00 **LUBRICANTS, SERVO FLUIDS AND CHEMICALS**

- 10.01.00 The Bidder shall provide a detailed and comprehensive specification for all lubricating oils, greases and control fluids required for the entire plant. A sufficient supply of these shall be provided by the Successful Bidder for initial commissioning, first fill and till completion of facilities and handing over of respective units.
- 10.02.00 The Bidder shall supply a detailed schedule giving the lubricant testing, cleaning and replacement procedures. All equipment and facilities necessary for the testing, cleaning and changing of lubricants and control fluids shall be provided. The Successful Bidder shall endeavor to reduce the varieties and grades of required lubricants and control fluids to a minimum, matching them where possible to those already in use in the generating station in order to simplify procurement and minimise storage requirements. All lubricants and control fluids shall be of internationally recognized standards and shall be easily







obtainable from a large number of Indian suppliers. Bidder shall also indicate the equivalent Indian Standard for the above for easy procurement in future.

10.03.00 No lubricant or control fluid shall have toxic or other harmful effects on personnel or on the environment.

#### 11.00.00 **PLANT LIFE AND MODE OF OPERATION**

The complete plant including all the equipment and systems individually and collectively shall be designed for continuous operation for an economic service life of thirty (30) years under the prevailing site conditions and for the type of duty as specified in relevant sections of the specification.

The critical components of the Steam Generator, Turbine-Generator and Auxiliary equipment, the life of which is limited by time and temperature dependent mechanisms such as thermal stress, creep and low cycle fatigue, are to be designed considering expected (hot, warm and cold) start-up, shut-down and cyclic load variations. (Details are specified in the Volume IIB – Specification of Steam Generator and Auxiliaries and Volume IIC – Specification of Steam Turbine and Auxiliaries and)

The units would be operated on base load with cyclic load variation. The load variation is expected to be as per schedule depending on power demand.

#### 12.00.00 **PACKAGING & MARKING**

All the equipment shall be suitably protected, coated, covered or boxed and crated to prevent damage or deterioration during transit, handling and storage at site till the time of erection. While packing the materials, the limitations from the point of view of availability of railway wagon sizes in India should be taken account of. The details of various wagons normally available with Indian Railways for transportation of heavy equipment shall be considered by the Bidder. The Bidder shall be responsible for all loss or damage during transportation, handling and storage due to improper packing.

Bidder shall conduct his own route survey and transportation logistics for transportation of the equipments to project site by road/rail/sea and indicate the same in his proposal.

Each package shall have identification marking indicating the name and address of the consignee shall be clearly marked in indelible ink on two opposite sides and top of each of the packages. In addition the Bidder shall include in the marking gross and net weight, outer dimension and cubic measurement. Each package shall be accompanied by a packing note (in weather proof paper) quoting specifically the name of the Bidder, the number and date of contract and names of the office placing the contract, nomenclature of contents and Bill of Material.

#### 13.00.00 **PROTECTION**

Equipment having antifriction or sleeve bearings shall be protected by weather-tight enclosures. Coated surfaces shall be protected against impact, abrasion, discoloration and other damages. Surfaces that are damaged shall be repainted.



Electrical equipment, controls and insulations shall be protected against moisture and water damages. All external gasket surfaces and flange faces, couplings, rotating equipment shafts, bearings and like items shall be thoroughly cleaned and coated with rust preventive compound as specified above and protected with suitable wood, metal or other suitable covering to ensure their full protection. All exposed threaded parts shall be greased and protected with metallic or other suitable protectors.

All piping, tubing and conduit connections on equipment and other equipment openings shall be closed with rough usage covers or plugs shall be sealed and taped. Male threaded openings shall be closed with rough usage covers or plugs shall be sealed and taped. Female threaded openings shall be closed with forged steel plugs.

Returnable containers and special shipping devices shall be returned by the Bidder.

#### 14.00.00 **PAINTING**

##### 14.01.00 **General**

All exposed metallic and wooden surfaces subject to corrosion shall be protected by shop application of suitable coatings. Surfaces not easily accessible after shop assembly shall be treated before-hand and protected for life of the equipment. Surfaces to be finish painted after installation shall be shop painted with at least two (2) coats of primer. Steel surfaces, which are not to be painted, shall be coated with suitable rust preventive compound subject to the acceptance of the Owner.

All paints shall be used in accordance with the manufacturer's instructions. No thinners or other substance shall be added to the coating material without the prior notification and specific acceptance of the Owner. The quality and vendor of the paints shall require acceptance of the Owner.

Procedure for painting of any item, if not indicated in the relevant specification, shall be developed by the Bidder. This procedure and quality of paint shall be subject to Owner's acceptance

All paints shall be applied in a normal full coat, shall be free from runs, sags, wrinkles, patchiness, brush marks or other defects.

All primers shall be properly applied on to the surface and the first priming coat shall be applied as soon as possible after cleaning, within four hours maximum. The paint shall be applied by brush, roller or airless spray, according to the manufacturer's instructions. Spray painting shall be carried out by operators trained and thoroughly experienced in the use of the spray painting equipment.

If the drying interval between successive coats of paint or primer exceeds the manufacturer's recommendations, the paint already applied shall be completely and uniformly abraded with fine abrasive paper before putting on the next coat.





Paint spraying on large surfaces shall not be done indoors, without the prior notification and specific acceptance of the Owner. Spray guns shall not be used outdoors in windy weather nor near unprotected surfaces of a contrasting colour and under no circumstances shall spray guns be used where spray may be carried into or onto exposed electrical equipment or unprotected humans.

The Bidder shall provide suitable protection for adjacent plants from air borne materials during cleaning and spraying to the satisfaction of Owner

Paint containers shall not be opened until required and the paint shall be mechanically mixed thoroughly before use, and agitated occasionally during use.

Electrical equipment shall be shop finished with one or more coats of primer and two coats of high-grade oil resistant enamel. The interior of all panels' cabinets and enclosures shall be finished with gloss white enamel. For detail please refer relevant electrical sub-section Volume II F1 & F2.

The Bidder shall furnish sufficient touch-up paint for one complete finish coat on all exterior factory surfaces of each item of equipment. The touch-up paint shall be of the same type and colour as the factory applied paint and shall be carefully packed to avoid damage during shipment. Complete painting instructions shall be furnished.

Shop primer for steel and iron surfaces which will have a continuous operating temperature below 35°C shall be selected by the Bidder, in accordance to the relevant standard. Special high temperature primer shall be used on surface exposed to operating temperature above 35°C.

The colour scheme shall be submitted during execution of contract for acceptance by the Owner.

14.02.00

### Surface Preparation

The grade of surface preparation shall be classified as indicated in Annexure-I of this section.

Sl. No.	Type of Preparation	Reference Standards		
		SSPC	SIS	BS 4232
1.	Solvent cleaning	SP1	-	-
2.	Hand Tool Cleaning	SP2	St-2	-
3.	Power Tool Cleaning	SP3	St-3	-
4.	Flame cleaning of new steel	SP4	-	-
5.	White metal blast cleaning	SP5	Sa-3	First Quality
6.	Commercial blast cleaning	SP6	Sa-2	Third Quality
7.	Brush-off blast cleaning	SP7	Sa-1	-
8.	Pickling	SP8	-	-



9.	Weathering followed by blast cleaning	SP9	-	-
10.	Near white blast cleaning	SP10	Sa-2.5	Second Quality

Oil and grease shall be removed from the surface by washing with a suitable detergent, rinsing with clean water, and drying.

The abrasive to be used shall be metal grit.

The surface preparation of all steel surfaces to be coated shall be free from all mill scales, rust corrosion products, oxides, paints, oil or other foreign matter.

All welded areas and appurtenances shall be given special attention for removal of welding flux in crevices. Welding splatter, slivers, laminations and underlying mill scale exposed during shot blasting shall be removed or repaired.

No acid/solvents/other cleaning solutions shall be used on surfaces after they have been blasted.

#### 14.03.00

#### **Application of Primer and Paint**

Primer shall be applied immediately after surface preparation has been completed.

Brushing, spraying, roller coating or other suitable method shall be adopted for application of primer and paint and the work shall be carried out strictly as per the recommendation given by the paint manufacturer.

Primerized surfaces shall be faultless and shall not have mudcracking, dripping over thickness and dry sprays.

Before application of paint/primer, the following shall be particularly checked for conformance to this specification and recommendation of the paint manufacturer:

- a) Surface preparation profile.
- b) Catalysis ratio for two component paints.
- c) Pot life.
- d) Minimum and maximum top coating times.
- e) Type and quantity of thinners (if required)
- f) Viscosity
- g) Soundness of previous coating.
- h) Ambient conditions (temperature, humidity, etc)



Depending on the degree of contamination by foreign matters, the surfaces primed at shop shall be washed as follows to the satisfaction of the Owner:

- a) With clean water under a pressure of a least 7 Kg/cm<sup>2</sup> (g) using suitable nozzles. During washing broom or corn brushes shall be used.
- b) With suitable solvents, (such as Carbon Tetrachloride, Trichloroethylene etc.) if necessary, to remove traces of grease, oil etc.

Coated parts shall be carefully handled using hemp ropes, cloth belts, pendulum conveyors or suitable means as instructed by the Owner.

Surfaces which cannot be painted after fabrication shall be primed and provided with suitable rust preventive oil before boxing up.

Paints shall be stored in well-ventilated rooms, far away from heat sources, open flames, sparks and protected from sun. Outdoor storage is not permitted. Storage life shall be clearly indicated on the container. Paints, which have thickened or gelled or contained in non-original containers or in unsealed containers shall not be used. Owner's decision in this regard shall be final and binding.

The requirements for the dry film thickness (DFT) of paint and the materials to be used shall be as per Table I & II of this section.

For detail painting on building & structural steel elements refer Section-IIG/1 & IIG/2 of this specification.

#### 14.04.00 **Damaged Paintwork**

Any damaged paintwork shall be made good as follows:

- a) The damaged area, together with an area extending 25mm around its boundary, shall be cleaned down to bare metal.
- b) A priming coat shall be immediately applied, followed by a full paint finish equal to that originally applied and extending 50mm around the perimeter of the original damage.
- c) The repainted surface shall present a smooth surface. This shall be obtained by carefully chamfering the paint edges before and after priming.

#### 14.05.00 Surface preparation and painting work shall not be carried out under the following weather conditions:

- a) When the surface is wet or expected to become wet before the paint/primer has dried up due to impending rain, fog or mist.
- b) High winds.
- c) Ambient temperature below 5deg.C or surface temperature less than 3 deg.C above dew point.



- d) Relative Humidity is more than 85%.

14.06.00

### **Inspection and Testing of Painting**

The following inspection and testing shall be performed during and on completion of paint systems.

- Shot blasting profile shall be checked using a suitable profile-meter. Acceptable profile shall be 25-30 microns.
- Check of time of top coating and drying, in accordance with the recommendation of paint manufacturer.
- Check of Dry Film thickness by suitable Non Destructive Equipment. The painting shall be rejected if any of the spot measurement shows thickness to be less than 80% of the specified thickness.
- Check of adhesion of Paint Material by "Chequering" or another suitable method.
- Check of porosity of coating for internals, by the use of a suitable instrument.
- Visual inspection of appearance and uniformity of the surfaces painted.

If during above inspection, painting defects are observed, the Bidder shall carry out rectification to bring the faulty surface to the acceptable degree.

The areas where defective or damaged coatings have been repaired or replaced shall be re-inspected to the original requirements.

Surface temperature and humidity readings shall be taken prior to application of each coat. The work shall not proceed if the ambient temperature parameters are outside the requirements of this specification. If more stringent, the coating manufacturer's requirement shall dictate.

The dry film thickness shall be tested with a micro test film gauge or an accepted equivalent. The testing method shall be in accordance with SSPC – PA 2.

15.00.00

### **COLOUR CO-ORDINATION & FINISH**

15.01.00

Exterior surfaces throughout the plant shall be finished in colours and textures which will blend harmoniously together and with the surrounding landscape.

15.02.00

Interior surfaces throughout the plant shall be finished in colours and textures which will blend harmoniously together and which will be conducive to; the comfort, well-being and high productivity of the operators. Operating plant and services provided shall be colour coded for ease of identification.

15.03.00

All finishes shall be durable and as far as possible maintenance free. Finishes shall be easily cleaned.





15.04.00 Final colours and finishes shall be to the acceptance of the Owner.

## 16.00.00 ENVIRONMENT PROTECTION AND NOISE LEVEL REQUIREMENT

### 16.01.00 Environment Protection

The plant shall be designed for installation and operation in harmony with the surrounding environment and all measures of pollution control shall be ensured by the Bidder to restrict pollution from the liquid effluent and stack emission within the limits as given below with due consideration of Environment (Protection) Rules 1986 as amended till date.

The Plant shall be designed meeting the latest environmental requirement issued by MoEF, GOI. In the event of Ministry of Environment & Forest stipulate any other conditions not specified hereunder, the Bidder shall comply with those requirements.

#### 16.01.01 Liquid Effluent Discharge

- a) Provision laid down in schedule-I for Thermal Power Plants and also in Schedule-VI. General Standards for discharge of Environmental pollutants Part-A: Effects of Environmental (protection) Rules 1986, as amended till date.
- b) Any specific requirement of State Pollution Authorities over and above the above stipulation.

#### 16.01.02 Air Quality Emissions

- a) Suspended Particulate Matter at chimney outlet - Maximum  $30 \text{ mg/Nm}^3$
- b) Oxides of Nitrogen ( $\text{NO}_x$ ) -  $100 \text{ mg/Nm}^3$ .
- c) Sulphur di-Oxide ( $\text{SO}_2$ ) -  $100 \text{ mg/Nm}^3$
- d) Mercury (Hg) -  $0.03 \text{ mg/Nm}^3$
- e) The Efflux velocity from boiler stack(s) shall not be less than 25 m/sec.
- g) Outlet dust emission level of bag filter installed in AHP and CHP shall be restricted to  $30 \text{ mg/NM}^3$ .
- h) For The Coal Handling Plant, areas covered under Dry Fog Dust Suppression (DFDS) shall be designed to control the dust emission level in the working area measured at distance of 2m from the dust generation sources, over and above the atmosphere background dust level to shall be within  $5 \text{ mg/NM}^3$

The Bidder shall include in his scope all necessary equipment and measuring instruments to comply with above requirements. Location and accessibility of the instruments shall be properly coordinated.



16.02.00

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### Noise Level Requirement

The plant shall be designed, constructed and provided with suitable acoustic measures to ensure the noise level criteria as per the following stipulations.

- a) Maximum noise level shall not exceed 85 dB (A) when measured at 1.0M away from the noise emission source.
- b) Maximum noise level from its source within the premises shall not exceed 70 dB (A) as per Environment (Protection) Rules 1986, Schedule-III, 'Ambient Air Quality Standards' in respect of noise.
- c) Any statutory changes in stipulations regarding noise limitation that may occur in future according to State Pollution Control Board or Central pollution Control Board or Ministry of Environment & Forest regulation during tenure of the contract, the Successful Bidder shall comply with the requirement.

### 17.00.00 INSPECTION AND TESTING

#### 17.01.00 Inspection and Tests during Manufacture

17.01.01 The method and techniques to be used by the Successful Bidder for the control of quality during manufacture of all plant and equipment shall be agreed with the Owner prior to the Award of Contract.

17.01.02 The Owner's general requirements with respect to quality control and the required shop tests are set out elsewhere in this specification.

17.01.03 Before any item of plant or equipment leaves its place of manufacture the Owner shall be given the option of witnessing inspections and tests for compliance with the specification and related standards.

17.01.04 Advance notice shall be given to the Owner as agreed in the Contract, prior to the stage of manufacture being reached, and the piece of plant must be held at this stage until the Owner has inspected the piece, or has advised in writing that inspection is waived. If having consulted the Owner and given reasonable notice in writing of the date on which the piece of plant will be available for inspection, the Owner does not attend the Successful Bidder may proceed with manufacture having forwarded to the Owner duly certified copies of his own inspection and test results.

The Successful Bidder shall forthwith forward to the Owner's Engineer duly certified copies of the Test Certificates in Three (3) copies for approval.

17.01.05 Under no circumstances any repair or welding of castings be carried out without the consent of the Engineer. Proof of the effectiveness of each repair by radiographic and/or other non-destructive testing technique, shall be provided to the Engineer.

17.01.06 All the individual and assembled rotating parts shall be statically and dynamically balanced in the works.





Where accurate alignment is necessary for component parts of machinery normally assembled on site, the Successful Bidder shall allow for trial assembly prior to dispatch from place of manufacture.

- 17.01.07 All materials used for the manufacture of equipment covered under this specification shall be of tested quality. Relevant test certificates shall be made available to the Purchaser. The certificates shall include tests for mechanical properties and chemical analysis of representative material.
- 17.01.08 All pressure parts connected to pumping main shall be subjected to hydraulic testing at a pressure of 150% of shut-off head for a period not less than one hour. Other parts shall be tested for one and half times the maximum operating pressure, for a period not less than one hour.
- 17.01.09 All necessary non-destructive examinations shall be performed to meet the applicable code requirements.
- 17.01.10 All welding procedures adopted for performing welding work shall be qualified in accordance with the requirements of Section-IX of ASME code or IBR as applicable. All welded joints for pressure parts shall be tested by liquid penetrant examination according to the method outlined in ASME Boiler and Pressure Vessel code. Radiography, magnetic particle examination magnuflux and ultrasonic testing shall be employed wherever necessary/ recommended by the applicable code. At least 10% of all major butt welding joints shall be radiographed. Statutory payments in respect of IBR approvals including inspection shall be made by the Successful Bidder. Successful Bidder's scope and responsibility shall also include preparation of all necessary documents in the specific formats stipulated by the statutory bodies, coordination and follow up for above approvals.
- 17.02.00 **Performance Tests at Site**
- 17.02.01 The full requirements for testing the system shall be agreed between the Owner and the Bidder prior to Award of Contract. The completely erected System shall be tested by the Successful Bidder on site under normal operating conditions. The Successful Bidder shall also ensure the correct performance of the System under abnormal conditions, i.e. the correct working of the various emergency and safety devices, interlocks, etc.
- 17.02.02 The Bidder shall provide complete details of his normal procedures for testing, for the quality of erection and for the performance of the erected plant. These tests shall include site pressure test on all erected pipe work to demonstrate the quality of the piping and the adequacy of joints made at site.
- 17.02.03 The Successful Bidder shall furnish the quality procedures to be adopted for assuring quality from the receipt of material at site, during storage, erection, pre-commissioning to tests on completion and commissioning of the complete system/equipment.
- 17.03.00 For details of specific tests required on individual equipment refers to respective section of this specification.





18.00.00

**TRAINING OF OWNER'S PERSONNEL**

The Successful Bidder shall extend all possible assistance and co-operation to the Purchaser regarding the transfer of technology and developing expertise in the area of engineering operation and maintenance of the Plant.

Number of man-days of training as mentioned below shall be included in his Tender.

18.01.00

**Training at Successful Bidder's Premises**

The Successful Bidder shall conduct training of Sixty Five (65) engineers of the Purchaser on engineering, operation and maintenance of the Plant at the Successful Bidder's or Associates or Sub Vendor's premises where adequate training facilities are available during the design and manufacturing stage of the successful Bidder.

The total man-months for training of engineers shall be maximum sixty (60), having following indicative break-up:





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Discipline	No. of Engineers	No. of Man-month
Operation	25 heads	25
Maintenance Boiler, Turbine,	25 heads	25
Electrical Maintenance	5 heads	5
Control & Instrumentation	10 heads	5
	----- 65 heads -----	----- 60 -----

However, the details of the training programme will be discussed and finalised with the successful Bidder.

The training may also be arranged by the Successful Bidder in any Plant where the equipment manufactured by the Successful Bidder or his Associates is under installation, operation or testing to enable the trainees to become familiar with the equipment being furnished by the Successful Bidder. All expenses inherently related to the training shall be borne by the Successful Bidder and shall include but not limited to travel expenses in case of off-shore training (international and inland fares), lodging and per diem charges as well as medical insurance, instructors fee, programme and miscellaneous cost to be incurred during the training.

The training programme shall be adequate for the trainees to acquire the necessary expertise and competence in the area of engineering, operation and maintenance and as trainers for in-house technology transfer programme of the Purchaser.

The Successful Bidder shall be responsible for the development of the Training Module and Programme Schedule, which shall be submitted to the Purchaser for approval.

The components of the training modules shall include but not be limited to the training procedures/methodology, instructional materials such as audio visual materials, CDs and slides and manuals for each trainee.

Three (3) sets of the materials included in the training modules shall be handed over to the Purchaser upon completion of the training. An evaluation shall be jointly undertaken by the Successful Bidder and the Purchaser's representative on the adequacy, appropriateness and relevance of the training and the programme effectiveness after the training. The training material shall be in English language only.

The content of the training programme shall include but not be limited to :

1. Coal fired thermal plant principles in management and practice for operators, technicians and maintenance personnel.





2. Plant operation and systems training for operators including simulator training as applicable.
3. Maintenance training programme covering electrical, mechanical and instrumentation and control.

Said training programme shall be submitted to the Purchaser for approval.

The timing of the training should be such that the participants will be conversant with sufficient know-how to participate in the pre-commissioning and commissioning tests of the Plant.

The Successful Bidder shall provide qualified English speaking instructors and training coordinator(s) during the tenure of the training programme.

#### 18.02.00 **Operation and Maintenance Training at Site**

The Successful Bidder shall provide a comprehensive training programme related to design application, plant management, operation and maintenance, including trouble shooting, of the Successful Bidder's supplied system and equipment at the Site starting from Start of Commissioning and thereafter up to the Final hand over of the Unit..

The following instructors shall be at the Site continuously during the training :

- a) One (1) for Steam Generator and Auxiliaries
- b) One (1) for Turbine Generator and Auxiliaries
- c) One (1) for Electrical Works
- d) One (1) for Instrumentation and Control (Boiler and Auxiliaries)
- e) One (1) for Instrumentation and Control (Turbine and Auxiliaries)

#### 18.03.00 **On-the-Job Training**

During the period of pre-commissioning, commissioning and trial operation, the Purchaser shall provide operation and maintenance personnel to assist the Successful Bidder in the operation and maintenance of his supply and work under the direction of the Successful Bidder for the purpose of on-the-job training.

The Purchaser shall have the right to send to the Site his employees later intended to operate and maintain the equipment supplied under this Contract. The successful Bidder shall, without additional cost, use his site staff to instruct these employees on the operation and maintenance of the equipment. All instructions shall be in the English language.



## ANNEXURE-I

## LIST OF STANDARDS FOR REFERENCE

- a) International Standards Organisation (ISO).
- b) International Electro-technical Commission (IEC).
- c) American Society of Mechanical Engineers (ASME).
- d) American National Standards Institute (ANSI).
- e) American Society for Testing and Materials (ASTM).
- f) American Institute of Steel Construction (AISC).
- g) American Welding Society (AWS).
- h) Architecture Institute of Japan (AIJ).
- i) National Fire Protection Association (NFPA).
- j) National Electrical Manufacturer's Association (NEMA).
- k) Japanese Electro-technical Committee (JEC).
- l) Institute of Electrical and Electronics Engineers (IEEE).
- m) Federal Occupational Safety and Health Regulations (OSHA).
- n) Instrument Society of America (ISA).
- o) National Electric Code (NEC).
- p) Heat Exchanger Institute (HEI).
- q) Tubular Exchanger Manufacturer's Association (TEMA).
- r) Hydraulic Institute (HIS).
- s) International Electro-Technical Commission Publications.
- t) Performance Test Code (PTC).
- u) Applicable German Standards (DIN).
- v) Applicable British Standards (BS).
- w) Applicable Japanese Standards (JIS).
- x) Electric Power Research Institute (EPRI).



- y) Standards of Manufacturer's Standardization Society (MSS).
- z) Bureau of Indian Standards Institution (BIS).
- aa) Indian Electricity Rules.
- bb) Indian Boiler Regulations (IBR).
- cc) Indian Explosives Act.
- dd) Indian Factories Act.
- ee) Tariff Advisory Committee (TAC) rules.
- ff) Emission regulation of Central Pollution Control Board (CPCB).
- gg) Pollution Control regulations of Ministry of Environment & Forests, Govt. of India.
- hh) Central Board of Irrigation and Power (CBIP) Publications.
- ii) National Building Code (NBC).
- jj) Indian Road Congress (IRC).
- kk) Latest guidelines of Railway Authority.



## ANNEXURE-II

## CRITERIA FOR LAYOUT

## PLOT PLAN LAYOUT REQUIREMENTS

The guidelines shall be applied in general, unless otherwise stated in other technical Volumes. In addition to these guidelines, Bidder shall refer the attached Plot Plan, drawing no. **12A05-DWG-M-003A**, for tentative arrangement of the various facilities under this package.

ITEM	SPECIFICATION REQUIREMENT
<b>A. Site conditions to be considered</b>	
1. Prevalent wind direction during summer (for deciding Cooling Tower orientation)	Refer wind-rose in plot plan.
2. Prevalent wind direction(s) during dry seasons (for deciding the location of coal stock pile and ash dump/ unloading areas, minimising the pollution effect due to dust)	Refer wind-rose in plot plan
<b>3. Location of:</b>	
a) Water intake point.	Towards South.
b) Water discharge point.	-.
c) Plant drainage outfall point(s).	Towards East.
d) Railway entries & exits.	Towards South.
e) Road entries & exits.	Towards North & North-East.
f) Electrical power transmission grid system.	Towards East.
g) selected ash dump area.	Towards North.
h) Nearest residential area.	Towards South.





ITEM	SPECIFICATION REQUIREMENT
<b>B. Layout Requirements</b>	
<b>1. Maximum permissible slope in</b>	
a) Rail track	1 in 400
b) Road	1 in 30
c) Sides of unpaved embankment	1 in 2
<b>2. Required road width</b>	
a) Main roads	8.0 Metres with 2.5m wide shoulders on either side.
b) Auxiliary interconnections	4.0 Metres with 1.0m wide shoulders on either side.
c) Road to the power house unloading bay :	
• Only for entry to the unloading bay	Yes.
• To pass through the unloading bay	No.
<b>3. Required minimum horizontal distance between the nearest points of</b>	
a) Plant boundary and the boundary of residential area	(Local municipality/factory rule)
b) Electrical transformer and any other	As per the Tariff Advisory building/facility Committee Rules.
c) Fire water supply installation and any building/facility subject to fire risk.	As per the Tariff Advisory Committee Rules.
d) Inflammable liquid (fuel oil, etc.) storage & handling installation and their fencing and other buildings/facilities.	Rules of the Indian Explosive (Indian Explosives Act) and Indian Petroleum Code.
<b>4. Required minimum vertical clearance</b>	
a) Under pipes/cable racks at road crossings	8.0 Metres.
b) Soil coverage over underground pipes	1.0 Metre (minimum).
c) Pipe/Cable trench	No Trench. Pipe/Cable Racks shall be used exclusively.



ITEM	SPECIFICATION REQUIREMENT
5. Railway Wagon clearance	As per the rules of the Indian Railways.
6. Minimum Clearance between any road edge and building/structure/ any fixed installation.	3 Metres.
7. <b>Required level, above the local developed grade level, of</b>	
a) top of all roads	150 mm.
b) all outdoor paved areas	150 mm.
c) Temporary storage areas, workshops, offices, residence etc. required at the time of erection work.	Yes.



## BUILDING/ EQUIPMENT LAYOUT REQUIREMENTS

ITEM	SPECIFICATION REQUIREMENT
<b>A. Minimum clear space required at all working and walking areas for operating &amp; maintenance personnel</b>	
<b>1. Horizontal, in all directions</b>	
a) Adjacent to any electrical equipment, electrical cables, running (rotating/reciprocating) equipment, safety valve or vent/drain pipe outlet, pipe/ equipment of surface temperature exceeding 60°C.	1200 mm.
b) Adjacent to any other plant facilities (including walls/structures)	1000 mm.
<b>2. Vertical (head-room clearance)</b>	
a) Under any pipe/equipment surface of temperature exceeding 60°C and any electrical cables or other electrical items.	2.2 Meters.
b) Under any other plant facilities (including structures, pipes etc.)	2.2 Meters.
<b>3. For all areas</b> where any equipment (including trucks, trolleys and other material handling equipment) will move or maneuver.	Minimum 500 mm clear in all direction from the outer edges of the equipment.
<b>4. Minimum clear hand space required for</b>	
a) The application of thermal insulation	100 mm
b) Welding work	150 mm
c) Bolt tightening	150 mm





**B. Floors, platforms, staircase, ladders, walls, doors & windows**

**1. Statutory Requirement**

As per the regulations of OSHA, Tariff Advisory Committee, Indian National Building Code, Indian Factories Act, Local Municipal Rules, etc.

**2. Operation & Maintenance Requirement**

- a) Adequate floor space shall be kept to permit dismantling, temporary storing and in-situ maintenance of plant & equipment parts, satisfying the clear space requirements stated above. A separate unloading bay for such purpose is required.

Yes

- b) Floors or fixed/portable platforms with stairs/ladders shall be provided for easy approach to any plant item, including valves, instruments, etc. to be operated, observed and/or to be frequently (more than once a month) maintained.

Yes

3. **Plinth level** of all buildings, above the Finished Ground Level (FGL)

300 mm. However, 500 mm for power house building.

4. **Minimum access** opening required (with rolling shutter)

3.5 m wide x 4 m high or, more wherever entry of loaded truck is envisaged, depending upon the equipment size to be handled.

**C. Other Maintenance Requirement**

**C. Other Maintenance Requirement**

**1. Generator stator handling**

In case the Generator stator cannot be handled by the turbine house crane, all provisions for its overhauling, including the arrangement to slide the stator on the turbine house floor, the foundation work for stator jacking /lowering assembly, dismantling of building end walls/structures etc. shall be kept.

Yes





2. Maintenance of the internals/impellers of all important equipment, like boiler feed pumps, feed water heaters, Surface Condenser, fans of the boiler draft plant, Intake and circulating water pumps, cooling water pumps, coal mills, air compressors, blowers, heat exchangers, fuel oil pumps, filters etc. Shall be possible without disconnecting or dismantling any piping/ducting.
3. Overhauling and handling of the casings for the above items Shall be possible without disturbing/dismantling any piping/ducting not directly connected to them.
4. Crane Approach  
  
Wherever required the unobstructed approach of the crane hook/other hoisting equipment hook to various plant & equipment shall be possible. Yes
- D. Central Control Room  
  
All electronic equipment other than those directly associated with control, operation or presentation of displays shall be mounted external to the control room in air conditioned control equipment room. Yes  
  
The bidder shall describe in his bid the proposed layout philosophy of the Central Control Room and Control Equipment Room and the arrangement of equipment best suited for the system offered by him and as per good ergonomically consideration.  
  
However, as a guide line, following features are given :
  - a) False ceiling and false flooring shall be provided.
  - b) Uniform height, colouring schemes for cabinets etc. shall be available.
  - c) The total area of floor space covered by Control Consoles/Panels in the Control Room shall not exceed 15% of floor area.
  - d) No opening shall be provided from Boiler side.
  - e) Two double leaf doors, suitably located for entering the Control room shall be provided with opening towards the turbine floor.





- f) Cable entry for the panels/consols shall be from bottom and suitable openings shall be provided.
- g) The Control Room lighting shall be designed to provide a glare free uniform illumination. The level of illumination shall be minimum 400 LUX.
- h) Necessary Air Conditioning shall be provided for Central Control room, Control Equipment Room and SWAS room etc.
- i) Basic amenities like toilet, Tiffin rooms, wash basins, rest rooms etc. shall be provided near the Control Room.

**D. Toilet and drinking water facility**

Required in all buildings and on all floors wherever operating personnel are to be deployed.

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## **SECTION-VI**

### **PROJECT MANAGEMENT AND SITE SERVICES**



**Development Consultants Pvt. Ltd.**

**Volume : II-A**  
**Section : VI**  
**Project Management and Site Services**



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## SECTION-VI

### PROJECT MANAGEMENT AND SITE SERVICES

#### 1.00.00 PROJECT MANAGEMENT SERVICES

##### 1.01.00 Responsibility

The Bidder shall identify a separate and independent project management team headed by a Project Manager for the execution of this project. Responsibilities of this project Management team shall cover the areas listed below :

- a) Planning and Monitoring
- b) Owner's Engineering Management
- c) Contracts Management
- d) Quality Assurance, Inspection & Expediting
- e) Construction Management
- f) Spares Management
- g) Commissioning Management

Detailed responsibilities in the above areas are discussed below :

##### 1.02.00 Organisation

##### 1.02.01 Headquarters

The project management team shall be stationed at the organizational headquarter and headed by a senior level executive designated as the Project Manager who shall be responsible to Owner for the execution of the project. . He should have adequate financial power and authority to give decision.

Separately, designated leaders shall be identified for each of the areas mentioned under 1.01.00, who, in turn, will report to the Project Manager for all matters related to this contract.

##### 1.02.02 Central Co-ordination Cell

The central coordination/ cell shall be based in Kolkata and shall have sufficient technical personnel to coordinate technical matters and to quickly resolve day to day queries or references made by Owner and his Consultants without having the need to refer to his headquarters each time.





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### 1.02.03 Site Organisation

The site should have a competent construction manager for all site operations with adequate financial power and sufficient level of authority to take site decisions. The organisation chart for site should indicate the various levels of experts to be posted for supervision in the various fields in civil construction, erection, commissioning etc.

### 1.02.04 Organisation Chart

The Bidder shall furnish a detailed organisation chart for the project management team, clearly identifying the key personnel in each of the areas mentioned at 1.01.00 above. The expected number of executives at different levels shall also be indicated, separately for headquarters, central coordination cell and site organisation.

### 1.03.00 Implementation Schedule

The following milestones shall be followed by the Contractor against each activity as detailed below:

1.	Letter of Award (LOA)	Zero Date
2.	Supply Completion	36 months from LOA
3.	Synchronization	38 months from LOA
4.	Completion of Trial Operation	42 months from LOA
5.	System & Completion of all facilities as per contract and handing over	45 months from LOA After rectifying all jobs as identified in the Punch List to the satisfaction of the Owner.
6.	P. G. Test	To be completed within three (3) months after Completion of all facilities and handling over.
7.	Guarantee/Warranty Period	For a period of 18 months from the date of completion of the facilities or twelve (12) months from the date of operation acceptance (or any part thereof), whichever occurs first and any suitable extension of time for completion of rectified job granted by Employer
8.	Final Acceptance	After the expiry of defect liability period



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#### 1.03.01 Owner's Engineering Schedules

These schedules shall cover various design submissions indicating different Owner's Engineering activities to be performed. Such schedules shall be furnished by the Bidder for each and every plant/systems/ equipment/ item covered in the scope of this specification.

#### 1.03.02 Manufacturing Schedule

The Contractor shall submit to the Owner's Engineer his manufacturing and delivery schedules for all equipment within thirty (30) days from the date of issue of the Letter of Award (LOA). Such schedules shall be in line with the detailed network for all phases of the work of the Contractor. Such schedules shall be reviewed, updated and submitted to the Owner's Engineer, once in every two months thereafter, by the Contractor. Schedules shall also include the materials and equipment purchased from outside suppliers.

#### 1.03.03 Erection Schedules

In order to achieve the overall completion schedule, the Contractor shall provide the Owner all the information covering erection sequence, testing and commissioning activities. These schedules may be based on the recommended erection procedures and will be subject to discussions/agreements with the Owner subsequent to the award of contract.

1.03.04 The successful Bidder shall have to provide all the above schedules (i.e. 1.03.01, 1.03.02 & 1.03.03) in a tabular form in addition to that in the form of L2 & L3 networks and these shall necessarily include information not limited to the earliest and latest dates for various activities/submissions and also any related constraints. However, the Bidder shall include in his proposal a Level-1 (L-1) network showing the major activities and various milestones to achieve the above mentioned completion schedule.

1.03.05 The Contractor shall provide the Owner the original disc/software for all such schedules along with requisite no. of copies (as required by the Owner) within an agreed time schedule. This time schedule will be agreed between Owner/Bidder at the time of award of Contract. The Contractor's project management software shall be compatible with that of the Owner and the input data shall be furnished to the Owner in a manner compatible with Owner's project management software, Primavera.

#### 1.04.00 Detailed Responsibilities

##### 1.04.01 Planning & Monitoring

###### a) Planning

The Bidder shall prepare a Master Network Schedule in the form of PERT network consisting of at least 500 activities.







The network shall be prepared on a Work Breakdown Structure for the project which sub-divides the project into a set of manageable systems/sub-systems. The master network will identify milestones of key events for each system/package in the areas of Owner's Engineering, procurement, manufacture and despatch and erection and commissioning. The master network shall represent the Level-I plan and will form the basis for development of detailed second and third tier execution plans. The master network shall conform to the overall schedule prescribed by Owner.

The master network should be submitted along with the bid, which would be mutually discussed and finalised before the Award of Contract. This master network would clearly indicate the responsibility of the Bidder and project management team. This master network would form a part of the contract. The master network shall also identify a complete list of inputs to be furnished by the Owner which may be required for proper interfacing and tie-up. Scheduled dates for providing such inputs shall also be indicated, which will be mutually discussed and finalised.

**b) Monitoring & Progress Reporting**

The progress reports would be emanated every month, one from the head office of the Contractor and another from the site office. The progress report emanating from the head office should necessarily include the following sections:

- i) Report on key milestones.
- ii) Management summary indicating critical areas with details of actions initiated and effect of any on the project.
- iii) Action needing attention of the Owner/Consultant.
- iv) Detailed package wise status of Owner's Engineering submissions, quality plan submissions and approval, procurement manufacture and despatch.

The monthly report generated from the site office should necessarily include:

- i) Report on key milestones.
- ii) Management summary indicating critical areas with details of actions initiated and effect if any on the project.
- iii) Action needing attention of the Owner/Consultant.



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- iv) This report would also cover the areas pertaining to the receipt of the equipment at the port, port clearance, transport, receipt at site, erection and commissioning.

In addition to the above, as the project execution progresses, the Contractor shall also be responsible for generating more frequent reports in the form of fax/e-mail information on progress in critical areas so that actions can be expedited. The exact format of the progress report shall be finalised after award of Contract.

#### 1.04.02

#### **Owner's Engineering Management**

Based on the master network for the project (L-1) the Contractor will prepare an exhaustive list of Owner's Engineering activities for the equipment/systems covered in his scope and a detailed programme of accomplishing the same within the time frame specified in the master network. This schedule will form the Level-2 (L-2) network for Owner's Engineering activities.

Based on (L-2) network, the Bidder shall further develop the Level-3 (L-3) network for Owner's Engineering activities which will indicate schedule for data availability, drawing release date and document submission dates.

Detailed (L-2) and (L-3) networks would be submitted sequentially by the Contractor within two months from the date of issue of Letter of Award and finalised within one (1) month thereafter.

All such networks shall be provided in MS PROJECT software.

The Owner's Engineering management team should also co-ordinate all interface Owner's Engineering activity between the Contractor and the equipment sub-vendors so as to ensure the correctness and completeness of related Owner's Engineering documentation before the same is submitted to the Owner.

#### 1.04.03

#### **Contracts Management**

Based on the master network, the Contractor shall submit L-2 programmes of manufacture and despatch. In addition, the master network shall also include periods considered for site activities viz. erection, commissioning etc. These L-2 programmes would be submitted in 2 months time from the date of award of contract and finalised within one (1) month thereafter. The Contractor will also submit site mobilisation plan. This programme would be submitted at the time of finalisation of award of contract and agreed immediately thereafter so that immediate development of the various activities at site could take place.

The Contractor should also submit L-3 programmes for the manufacturing, despatch of the various items. These networks shall also show the customer hold points (CHP) which have to be cleared by Owner or their authorised representative(s) before further manufacturing can take place. These L-3 programmes for the manufacture and despatch would clearly identify responsibilities of the Contractor, sub-Contractor and Owner. These networks





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shall be submitted within one (1) month of the date of finalisation of the various sub-contracts by the Contractor.

In case all the manufacture is being done by the Contractor then the L-2 programmes would be themselves amplified to cover details of the manufacture, inspection, clearance by Owner and despatch.

The Contractor shall also submit the programme for procurement of bought out items, detailed shipping schedule and cash flow statement for Owner's approval.

1.04.04

#### **Quality Assurance, Inspection and Expediting**

The Contractor shall submit the list of manufacturers/sub-vendors from whom the equipment are expected to be procured and the quality assurance plans thereof for the manufacture shall be approved by the QA group of Owner before the manufacturing is commenced. The list of major suppliers would be submitted along with the bid and this shall be mutually discussed and approval will be given by the Owner during contract negotiation meeting prior to placement of Letter of Award. This approved list will be binding to the bidder. In the said list, Owner reserves the right to include reputed/reliable vendors of his own choice. Regarding the various other sub-vendors, the list would be submitted within six (6) months of the award of the contract that shall be scrutinized by the Owner to accord approval. In such list Owner reserves the right to include vendors of his own choice. No further vendor approval will be given after six (6) months. On the quality plans, the customer hold points will also be identified based on which Owner would give clearance for the manufacture to proceed further.

Quality assurance/Inspection group of Owner or its representative would issue a material despatch clearance certificate (MDCC) after the inspection clearance which will enable the Contractor to despatch the equipment and claim the payment. In the despatch programme, the Contractor shall indicate a schedule of estimated programme, tonnages specifically identifying various oversize dimensioned consignments (ODC). Further the Contractor will also be required to ensure at all stages of shipment that packing of all shipments despatched are suitable for ocean freight to India, handling at the port of entry, inland transportation and preservation at site up to erection. All despatch details & item lists shall be made available to both Owner & site immediately after shipping.

The Contractor shall also expedite all despatches from their own works/works of their sub-vendors, so as to match with the various activities mentioned at 1.04.03 above.

1.04.05

#### **Construction Management**

Based on the L-1 Master Network Programme, within two (2) months of the issue of Letter of Award, the Contractor shall submit a programme of construction/erection/commissioning, either in continuation with the manufacture and despatch or separately for the implementation. These





programmes would be amplified showing when the civil drawings shall be released by him and construction of civil works shall be completed by him to facilitate start of erection and subsequent activities and shall form the basis for site execution and detailed monitoring. The three monthly rolling programme with the first month's programme being tentative based on the site conditions would be prepared based on these L-3 programmes. The Contractor shall also be involved along with the Owner to tie up detailed resource mobilisation plan over the period of time of the contract matching with the performance targets.

The L-3 programme would be jointly finalised by the site in-charge of the Contractor with the Owner's project coordinator as well as the site planning representative. The erection programme will also identify the sequential erectable tonnages that are required for various equipment which should be taken care of in the despatch programmes.

Erection and commissioning of the equipment shall also be done under the supervision of experts from the respective equipment/ system supplier.

#### 1.04.06 **Spares Management**

Along with the proposal for the plant and equipment, the Contractor shall also submit proposals/schedule for the following:

- a) Mandatory spares
- b) Recommended spares

While the award for mandatory spares will be finalised at the time of the award of contract, recommended spares will be finalised within twelve (12) months thereafter.

#### 1.05.00 **Project Progress Review Meetings**

Keeping in mind the overall responsibility of the Contractor it is intended that periodic progress reviews on the entire activities of execution in respect of Sagardighi Thermal Power Plant unit #5 will be held initially at least once in two (2) months at Kolkata/site. During peak period it may be held once in a month. These meetings will be attended by reasonably higher officials of the Contractor and their leading sub- contractors and will be used as a forum for discussing all areas where progress needs to be speeded up. Actions will be placed on the concerned agencies and decisions will be taken to expedite/speed up the progress. Minutes of such meetings will be issued reflecting the major discussions and decisions taken and circulated to all concerned for reference and action. The Contractor shall be further responsible for ensuring that suitable steps are taken to meet various targets decided upon such meetings.

In addition to the above, and to streamline the construction and erection at site, a suitable frequency and forum of periodic meetings between the Contractor and the Owner will be decided upon as part of erection coordination procedure. Site co-ordination meeting may be held on weekly basis.



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#### 1.06.00 **Owner's Consultant**

The Owner would appoint a consultant to assist him in some of the areas mentioned at 1.01.00 above. The details of interaction and procedures for coordination between Owner/Owner's Consultant and Contractor/Contractor's project management team shall be finalised during contract negotiations.

#### 1.07.00 **Commissioning Management**

1.07.01 For commissioning of the various equipment/system covered under the scope of contract, Owner will form an organisation structure which may consist of the following committees. The Contractor shall nominate his representative on one or more of the committee as decided by the Owner:

- a) Commissioning Teams.
- b) Testing Teams.

1.07.02 Commissioning documents shall be prepared by the Contractor in the following manner and submitted for Owner's approval :

- a) Paper of Principle

This document shall be prepared for the various equipment/ systems under commissioning and shall have the following objectives to fulfill and shall be submitted for Owner's approval at least six (6) months before their actual commissioning :

- i) Establish design data against which Plant Performance will be compared.
- ii) Set-out the testing objectives and proposals.
- iii) Define the documentation required.

- b) **Testing/Commissioning Schedule**

These shall be prepared for the various equipment/systems under consideration and shall contain sections like detailed testing method, programme, safety, individual responsibility and results.

- c) **Standard Check Lists**

Standard checklists are intended for use at the completion of erection to ensure correct erection, testing and to a limited extent operation for repetitive items.





### 1.07.03 Test Reports

After the completion of commissioning activity of equipment/ systems, the Contractor shall prepare the test reports which shall include all the relevant information related to various commissioning checks, tests carried out, any deviations/commissions noticed with respect to the intended design requirements, sequence of various commissioning activities as actually adopted vis-à-vis as recommended in the procedures, programme schedules achieved and any other such information as required. These test reports shall be submitted in requisite number of copies to the Owner and this should be duly signed jointly by the Owner/Consultant and the Contractor/Equipment supplier, who are involved during the commissioning activities.

### 2.00.00 SITE SERVICES

These services shall be rendered by the Bidder as part of the overall project management service. The services shall broadly include but not be limited to the following :

- 2.01.00 Arranging material despatch from the shop by rail/road and/or sea as applicable.
- 2.02.00 Monitoring movement of materials & follow-up as necessary with Railways, road transport, port clearance etc. from the time of despatch F.O.R. works/F.O.B. port of shipment by Contractor till receipt of the same at site.
- 2.03.00 Unloading of materials at Railway Station/Railway Siding inside project area, transportation to site store, assessment of lost/damaged items in transit and arranging insurance claims and replacement of lost/damaged items. The Contractor shall submit to the Owner's Engineer a report detailing all the receipts during the week.
- 2.04.00 Issuing materials from site store/open yard from time to time for erection as per the construction programme. The Contractor shall be the custodian of all the materials issued till the plant is officially taken over by the Owner after complete erection and successful trial run & commissioning.
- 2.05.00 Transportation of materials to their respective places of erection and erection of the complete plant & equipment as supplied under this specification.
- 2.06.00 Trial run and commissioning of individual equipment/sub-systems and the plant as a whole to the satisfaction of the Owner, including supply of temporary equipment & services for chemical cleaning, steam blowing as well as performance guarantee tests.

For Coal Handling Plant, satisfactory operation of the system, amongst others, shall consist of operation without spillage or choking anywhere even during monsoon.





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Provision for preservation of individual equipment after trial run and commissioning e.g. Nitrogen blanketing etc. as necessary shall also be in the scope of the Bidder.

- 2.07.00 Supply and application of the final paints lubricating oils and all consumable till completion of facilities and hand over..
- 2.08.00 For the purpose of erection and commissioning the Contractor's scope of work shall include but not be limited to the following :
- 2.08.01 Deployment of all skilled and unskilled manpower required for erection, supervision of erection, watch & ward, commissioning and other services to be rendered under this specification.
- 2.08.02 Deployment of all erection tools & tackle, construction machinery, transportation vehicles and all other implements in adequate number and size, appropriate for the erection work to be handled under the scope of this specification.
- Supply of commissioning spares.
- 2.08.03 Supply of all chemicals and consumables, e.g. Regeneration chemicals, alum, lime, polyelectrolyte, resin, welding electrodes, cleaning agents, diesel oil, grease, lubricant etc. as well as materials required for temporary supports, scaffolding etc. as necessary for such erection commissioning work till completion of facilities and hand over, except those listed under exclusion elsewhere in this specification.
- 2.08.04 Construction of all civil/structural/architectural works, including construction of foundation for all equipment supplied as required, grouting of equipment on foundation after alignment, and all other incidental civil activities as detailed elsewhere.
- 2.08.05 All structural steel fabrication and erection work as detailed elsewhere in the specification.
- 2.08.06 Providing support services for the Contractor's erection staff e.g. construction of site offices, temporary stores, residential accommodation and transport to work site for erection personnel, insurance cover, watch & ward for security and safety of the materials under the Contractor's custody etc. as required.
- 2.08.07 Maintaining proper documentation of all the site activities undertaken by the Contractor as per the proforma mutually agreed with the Owner; submitting monthly progress reports as also any such document as and when desired by the Owner; taking approval of all statutory authorities e.g. Boiler Inspector, Factory Inspector, Inspector of Explosives etc. for respective portions of work under the jurisdiction of such statutes or laws.
- 2.08.08 The Contractor shall provide 'Industrial Relations' unit and 'Medical' unit to take care of his erection staff and the Owner shall have no obligation in this regard.





## 2.09.00 Site Organisation

The Contractor shall maintain a site organisation of adequate strength in respect of manpower, construction machinery and other implements at all times for smooth execution of the contract. This organisation shall be reinforced from time to time, as required, to make up for slippages from the schedule without any commercial implication to the Owner. The site organisation shall be headed by a competent construction manager having sufficient authority to take decisions at site.

On award of contract, the Contractor shall submit to the Owner a site organisation chart indicating the various levels of experts to be deployed on the job. The Owner reserves the right to reject or approve the list of personnel proposed by the Contractor. The persons, whose bio-data have been approved by the Owner, will have to be posted at site and deviations in this regard will not generally be permitted.

The Contractor shall also submit to the Owner for approval a list of construction equipment, erection tools, tackle etc. prior to commencement of site activities. These tools & tackle shall not be removed from site without written permission of the Owner.

## 2.10.00 General Guidelines for Field Activities

2.10.01 The Contractor shall execute the works in a professional manner so as to achieve the target schedule without any sacrifice on quality and maintaining highest standards of safety and cleanliness.

2.10.02 The Contractor shall co-operate with the Owner and other Contractors working in site and arrange to perform his work in a manner so as to minimise interference with other Contractors' works. The Owner's Engineer shall be notified promptly of any defect in other Contractor's works that could affect the Contractor's work. If rescheduling of Contractor's work is requested by the Owner's Engineer in the interest of overall site activities, the same shall be complied with by the Contractor. In all cases of controversy, the decision of the Owner shall be final and binding on the Contractor without any commercial implication to owner.

2.10.03 The Owner's Engineer shall hold weekly meetings of all the Contractors working at Site at a time and a place to be designated by the Owner's Engineer. The Contractor shall attend such meetings and take notes of discussions during the meeting and the decisions of the Owner's Engineer and shall strictly adhere to those decisions in performing his Work. In addition to the above weekly meeting, Owner's Engineer may call for other meetings either with individual contractors or with selected number of contractors and in such a case the Contractor, if called will also attend such meetings.

2.10.04 Time is the essence of the Contract and the Contractor shall be responsible for performance of his Work in accordance with the specified construction schedule. If at any time the Contractor is falling behind the schedule, he shall





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take necessary action to make good of such delays by increasing his work force or by working overtime or otherwise accelerate the progress of the work to comply with the schedule and shall communicate such action in writing to the Owner's Engineer, satisfying that his action will compensate for the delay. The Contractor shall not be allowed any extra compensation for such action.

- 2.10.05 The Owner's Engineer shall however not be responsible for provision of additional labour and or materials or supply or any other services to the Contractor except for the co-ordination work between various Contractors as set out earlier.
- 2.10.06 The works under execution shall be open to inspection & supervision by the Owner's Owner's Engineer at all times. The Contractor shall give reasonable notice to the Owner before covering up or otherwise placing beyond the reach of inspection any work in order that same may be verified, if so desired by the Owner.
- 2.10.07 Every effort shall be made to maintain the highest quality of workmanship by stringent supervision and inspection at every stage of execution. Manufacturer's instruction manual and guidelines on sequence of erection and precautions shall be strictly followed. Should any error or ambiguity be discovered in such documents, the same shall be brought to the notice of the Owner's Owner's Engineer. Manufacturer's interpretation in such cases shall be binding on the Contractor.
- 2.10.08 The Contractor shall comply with all the rules and regulations of the local authorities, all statutory laws including Minimum Wages, Workmen Compensation etc. The contractor shall engage maximum number of local unskilled and semi skilled labours for construction works. All registration and statutory inspection fees, if any, in respect of the work executed by the Contractor shall be to his account.
- 2.10.09 All the works such as cleaning, checking, leveling, blue matching, aligning, assembling, temporary erection for alignment, opening, dismantling of certain equipments for checking and cleaning, surface preparation, edge preparation, fabrication of tubes and pipes as per general Owner's Engineering practice at site, cutting grinding, straightening, chamfering, filling, chipping, drilling, reaming, scrapping, shaping, fitting-up bolting/welding, etc., as may be applicable in such erection and are necessary to complete the work satisfactorily, are to be treated as incidental and the same shall be carried out by the Contractor as part of the work.
- 2.10.10 In case of any class of work for which there is no such specification as laid down in the contract such as, blue matching, welding of stainless steel parts, etc., the work shall be carried out in accordance with the instructions and requirements of the Owner's Engineer.
- 2.10.11 It may sometimes be necessary to remove some of the erected structural members to facilitate erection of bigger/pre-assembled equipment. In such cases, the removal and re-erection of such members, which are essential, and if so agreed by the Owner's Engineer, will have to be done by the Contractor.





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- 2.10.12 Attachment welding of necessary instrumentation tapping points, thermocouple pads, root valves, condensing vessels, flow nozzles and control valves etc., both for regular measurement and performance testing to be provided on equipment, its auxiliaries or pipelines covered within the scope of this tender, will also be the responsibility of the Contractor and the same will be done as per the instructions of Owner's Engineer. The erection and welding of all above items will be the Contractor's responsibility, even if :
- a) Product groups under which these items are re-leased are not covered in the scope of this tender.
  - b) Items are supplied by an agency other than the Contractor.
- 2.10.13 Preservation of all materials/equipment under custody of the Contractor during storage, pre-assembly & erection, commissioning etc., shall be the responsibility of the Contractor. All necessary preservatives and consumables like paints, etc., shall be arranged by the Contractor. Necessary touch up painting, periodic application of preservatives/paints on pressure parts/other equipment even after erection until completion of work shall be carried out by the Contractor. The Contractor shall fabricate piping, install lub oil systems and carry out the acid cleaning of fabricated piping. The Contractor shall also service the lub oil system, carryout the hydraulic test of oil coolers, etc.
- 2.10.14 It is responsibility of the Contractor to do the alignment etc. if necessary, repeatedly to satisfy Owner's Engineer, with all the necessary tools & tackles, manpower, etc. The alignment will be complete only when jointly certified so, by the Contractor's Owner's Engineer & Owner. Also the Contractor should ensure that the alignment is not disturbed afterwards.
- 2.10.15 Additional platforms for approaching different equipment as per site requirement, which may not be indicated in drawings, shall be fabricated and erected by the Contractor. The materials required for these works shall be supplied by the Contractor and he will have to fabricate them to suit the requirement.
- 2.10.16 Equipment and material, which are wrongly installed, shall be removed and reinstalled to comply with the design requirement at the Contractor's expense, to the satisfaction of the Owner/ Consultant.
- 2.10.17 Before erection of any equipment on a foundation, the Contractor shall check and undertake if necessary rectification of foundation bolts, reaming of holes, drilling of dowels, matching of bolts and nuts, making new dowel pin, etc.
- 2.10.18 Assistance for calibrating/testing the power cylinders, valves, gauges, instruments, etc., and setting of actuators coming under various groups shall be provided by Contractor.
- 2.10.19 It shall be the responsibility of the Contractor to provide ladders on columns for initial works till such time stairways are completed. For this, the ladder should not be welded on the column and should be prefabricated clamping type. No



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temporary welding on any structural member is permitted except under special circumstances with the approval of Owner.

- 2.10.20 Structural materials required for the supporting/operating platforms required for the valves at various levels for the safe operation of valves will be arranged by the Contractor.
- 2.10.21 For civil, structural and architectural works, volume IIG/1 & IIG/2 may be referred. For Instrumentation and Electrical works Vol. IIE and Vol. IIF1 & F2 may be referred.
- 2.11.00 Safety
- 2.11.01 Safety and overall cleanliness of work site shall be given top priority. The Contractor shall ensure the safety of all workmen, materials and equipment either belonging to him or to others working at site. He shall observe safety rules & codes applied by the Owner at site without exception.
- 2.11.02 The Contractor shall notify the Owner of his intention to bring to site any equipment or material which may create hazard. The Owner shall have the right to prescribe the conditions under which such equipment or material may be handled and the Contractor shall adhere to such instructions. The Owner may prohibit the use of any construction machinery, which according to him is unsafe. No claim for compensation due to such prohibition will be entertained by the Owner.
- 2.11.03 Storage of petroleum products & explosives for construction work shall be as per rules and regulation laid down in Petroleum Act, Explosive Act and Petroleum and Carbide of Calcium Manual. Approvals as necessary from Chief Inspector of Explosives or other statutory authorities shall be the responsibility of the Contractor.
- 2.11.04 The Contractor shall be responsible for safe storage of his and his sub-contractor's radioactive sources.
- 2.11.05 All requisite tests & inspection of handling equipment, lifting tools & tackle shall be periodically done by the Contractor. Defective equipment shall be removed from service. Any equipment shall not be loaded in excess of its recommended safe working load.
- 2.11.06 All combustible waste and rubbish shall be collected and removed from the worksite at least once each day. Use of undercoated canvas paper, corrugated paper, fabricated carton, plastic or other flammable materials shall be restricted to the minimum and promptly removed.
- 2.11.07 The Contractor shall provide adequate number of fire protection equipment of the required types for his stores, office, temporary structures, labour colony etc. Personnel trained for fire-fighting shall be made available by the Contractor at site during the entire period of the Contract.





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- 2.11.08 All electrical appliances used in the work shall be in good working condition and shall be properly earthed. No maintenance work shall be carried out on live equipment. The Contractor shall maintain adequate number of qualified electricians to maintain his temporary electrical installation.
- 2.11.09 All workmen of the Contractor working in construction site shall wear safety helmets, safety boots and safety belts. The Contractor shall take appropriate insurance cover against accidents for his workmen as well as third party.
- 2.11.10 All the worksites shall be provided with adequate lighting facilities e.g. flood lighting, hand lamps, area lighting etc. by the Contractor for proper working environment during night times.
- 2.11.11 Adequate number of temporary toilets/urinals (men & women separate) shall be provided at work places with soak pits. Adequate drinking water facilities and rest rooms shall be provided for workers to take food and rest.
- 2.11.12 All safety precautions shall be taken for welding and cutting operations as per IS-818.
- 2.11.13 All safety precautions shall be taken for foundation and other excavation marks as per IS-3764.
- 2.12.00 Taking Delivery & Storage
- 2.12.01 The Contractor shall arrange issue of all equipment and materials to be erected under the contract from the stores/open yard at site by signing on standard indent forms. After completion of work, detailed auditing of the materials so issued shall be submitted to the Owner.
- 2.12.02 The Contractor shall arrange for proper and safe storage of materials till the same are taken over by the Owner as per terms of the contract. Manufacturer's instructions for preservation shall be strictly followed.
- 2.12.03 All empty containers, packing materials, gunny bags, transport frames and also surplus and unused materials reconciliation prior to completion of contract shall be the property of the Owner and returned to the Owner by the Contractor.
- 2.13.00 Site Welding & Heat Treatment
- 2.13.01 Welding shall be done in accordance with IS-813, IS-816, IS-9595 & other relevant IS/International standards and as per instructions of Contractor. Only those welders, who are qualified as per IS-817 for ordinary welds and as per IBR/ASME Section-IX for high pressure welds, shall be employed in the job.
- 2.13.02 All welders shall be tested and approved by Owner's Engineer before they are actually engaged on the work even though they may possess the requisite certificates. The Owner reserves the right to reject any welder without assigning any reason. The welder identification code as approved by the Owner's Engineer shall be stamped by the welder on each joint done by them. The





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Contractor will be responsible for the periodic renewal, re-testing of the welders as demanded by Owner.

- 2.13.03 The Owner's Engineer is entitled to stop Contractor's any welder from his work if his work is unsatisfactory for any technical reason or there is a high percentage of the rejection of joints welded by him, which in the opinion of Owner's Engineer will adversely affect the quality of welding even though the welder has earlier passed the tests. The welders having passed the tests do not relieve the Contractor from his contractual obligations, to check the performance of the welders.
- 2.13.04 All charges for testing of welders including destructive and non- destructive tests if conducted by Owner or by the inspection authority at site shall have to be borne by the Contractor. The necessary test materials and consumables will have to be arranged by the Contractor and all testing facility made available, as required.
- 2.13.05 All welded joints shall be subject to acceptance by Owner's Engineer. Inspection of welds shall be in accordance with IS-822 or equivalent code.
- 2.13.06 Preheating/post-heating and stress relieving after welding are part of fabrication and erection work and shall be performed by the Contractor in accordance with the instruction of Owner's Engineer. Contractor shall arrange to supply heating equipment with automatic recording devices. Also the Contractor shall have to arrange for the labour, heating elements, thermocouples, compensating cables, insulation materials like mineral wools, asbestos cloth, ceramic beads, asbestos rope, etc. required for the heat-treatment and stress relieving works. During pre- heat/stress relieving operations, the temperature shall be measured at one or more points as required by attaching thermocouples and recorded on a continuous printing type recorder. All the record graphs for the heat treatment works carried out shall be got signed by the Owner's Engineer prior to the commencement of each cycle and handed over to Owner's Engineer on completion. The graphs will be the property of Owner. The Contractor has to provide thermo-chalks temperature recorders, thermocouple attachments, units, graph sheets, etc. required for the job and maintain them in good condition.
- 2.13.07 All electrodes shall be baked and dried in the electric/electrode drying oven to the required temperature and for the period specified by the Owner's Engineer before they are used in erection work. The electrodes used shall be as per IS-814, IS-815, IS-1442, IS-7280 and other codes as applicable, and shall be of approved reputed manufacture. The electrodes shall meet the requirement of the pipe material. No electrode manufactured more than 12 months ago and the type covered under certificate issued after conducting tests more than 6 months ago shall be used. All electrodes shall be preserved at works and at site as per manufacturer's recommendations.
- 2.13.08 Oxy-acetylene flame or Exothermic chemical heating for stress relieving is not permitted. Heating shall be by means, of electric induction coil or electric resistance coil.





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- 2.13.09 It may become necessary to adopt inter layer radiography/MPT/UT depending upon the site/technical requirement necessitating interruptions in continuation of the work and making necessary arrangement for carrying out the above work.
- 2.13.10 Gas tungsten arc welding process (TIG) shall be adopted for all root pass welds except for structural works until 4.75 mm thickness is deposited. Subsequent welding after root pass can be carried out by manual metal arc welding with coated electrodes. For pipes of thickness less than 6 mm the entire welding has to be carried out by TIG welding.
- Fillet weld shall be made by shielded metal arc process as per applicable codes.
- However, the Owner's Engineer will have the option of changing the method of welding as per site requirement. The method adopted for manual arc welding shall be weaving technique and the width of weaving shall not exceed 1.5 times of the dia. of the electrode.
- In case of deviation from welding process and electrodes, the Contractor shall take approval of the Owner prior to adoption of same.
- 2.13.11 The root pass for butt joints shall be such as to achieve full penetration with complete fusion of root edges.
- 2.13.12 Each pass shall be cleared and freed of slag before the next pass is deposited.
- 2.13.13 On completion of each run, craters, weld irregularities, slag etc. shall be removed by grinding or chipping.
- 2.13.14 Each layer of welding shall have an even and smooth appearance.
- 2.13.15 Welding sequence shall be adjusted in such a way that distortion due to welding shrinkage is minimised. Further any movement, shock or vibration during welding shall be avoided to prevent weld cracks.
- 2.13.16 Proper protection of welders and the work shall be taken during periods of rain. No welding shall be carried out when surfaced to be welded are wet from any cause.
- 2.13.17 Following will be stages of inspection during welding:
- a) Two pieces to be joined shall be individually checked for the weld edge preparation and profile dimensionally and to the template. Dye penetrant check shall be carried out on edge prepared surfaces at random. The percentage will depend upon on criticality as specified by Owner's Engineer.
  - b) Joint fit up will be a stage of inspection. Misalignment after fit up may vary from 0.3 mm to 1.6 mm depending on outside diameter and thickness.







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- c) All joints shall be offered for visual inspection after root run. Subsequent welding should be made only after the approval of root run.
- 2.13.18 All welded joints shall be painted with anti-corrosive paint immediately on completion of radiography and stress-relieving.
- 2.14.00 For further details on procedures of work at site on civil, architectural, electrical and instrumentation & control services, refer Volume: II-E, II-F1 & F2 and II-G/1 G/2 & G/3 of this specification.
- 3.00.00 **PROTECTION AND CARE**
- 3.01.00 All construction and erection activities for this project are to be carried out in the plant premises.
- 3.02.00 Generator Stator Lifting may be considered by either of the two options as mentioned below:
  - a) With the help of two (2) nos. turbine room cranes.
  - b) With the help of separate lifting arrangement to be provided by the Bidder from outside the TG building A-row column before the construction of A-row building wall.



## The West Bengal Power Development Corporation Limited

(A Government of West Bengal Enterprise)

Corporate Identity No.: U40104WB1985SGC039154

Registered & Corporate Office: Bidyut Unnyan Bhavan,

Plot - 3/C, LA - Block, Salt Lake City, Sector - III, Kolkata - 700 098

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Ref. No. WBPDC/Corp./SGMP03/AV/8/047

Date: 16.06.2020

To,  
Shri A.K. Singhal, GM  
PS- MKTG. BHEL House,  
Siri Fort, New Delhi 110 049

Sub : Vendor List of Sagardighi Thermal Power Extension Project Unit No.5 (1X660MW)

Ref : E-mail from BHEL PS-MKTG dtd. 29<sup>th</sup> August, 2019

Dear Sir,

Please find the reviewed Vendor List for the captioned Project.

BHEL may note that some Vendors have been identified under 'DR' category for which BHEL is requested to provide detail credentials of the Vendor in line with the tender requirements for Approval consideration from WBPDC.

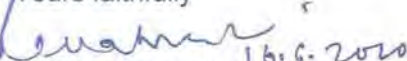
The entire Vendor List is divided under the following sub heads-

- |    |                           |   |            |
|----|---------------------------|---|------------|
| a) | Mechanical Aux.Packages   | : | Annexure-A |
| b) | Mechanical Equipment List | : | Annexure-B |
| c) | FGD Plant Equipment List  | : | Annexure-C |
| d) | CHP Equipment List        | : | Annexure-D |
| e) | AHP Equipment List        | : | Annexure-E |
| f) | Electrical Equipment List | : | Annexure-F |
| g) | C&I Equipment List        | : | Annexure-G |
| h) | FPA Equipment List        | : | Annexure-H |
| i) | HVAC System               | : | Annexure-I |
| j) | PSER Erection Vendors     | : | Annexure-J |

This is for your information and further necessary action from your end.

Thanking you,

Yours faithfully

  
16.6.2020  
Kalyanbrata Chakrabarty  
GM (Projects)

Bandel Thermal Power Station  
GM-26846369,DGM(O)  
26846447, DGM(M) 26846403,  
Senior Manager(P&A)-26845086  
Senior Manager-26845083  
Guest House-26845201  
Fax : 2684 6151

Santalidih Thermal Power Station  
GM-260227  
Senior Manager(P&A)260226  
Senior Manager(F&A)260341  
Electrical Control Room-260228  
Guest House260342/260203  
Fax:260217 STD Code-3251

Kolaghat Thermal Power Station Ph:  
GM 231110,DGM(O)231254  
DGM(M)231261  
DGM(U)231255  
DGM(Accts.)231290  
STD Code-03228  
E mail: [ktpsdcl@cal.vsnl.net.in](mailto:ktpsdcl@cal.vsnl.net.in)

Bakreswar Thermal Power Project  
GM- 220201DGM(Const.)-220210  
Senior Manager(P&A)/(F&A)-220202  
Guest House(Abdarapur)225475,225346  
PBX:220694, Fax-220214  
Email:[bktpp@cal2.vsnl.net.in](mailto:bktpp@cal2.vsnl.net.in)  
STD Code:03462



**SAGARDIGHI THERMAL Power EXTENSION PROJECT  
PHASE-III, UNIT#5 (1 x660 MW)**

SL NO.	Item Description	Vendor Name	Remarks
1	OXYGEN DOSING SYSTEM	ENPRO INDUSTRIES PVT.LTD. MARKAL KHED,PUNE	Approved
		POWER PIPING COMPANY ,Mandaiyur	DR
		PSI ENGINEERING SYSTEMS (P) LTD., Chennai	Approved
		Positive Metering Pumps (I) Pvt. Ltd.,Nasik	DR
		V.K PUMP INDUSTRIES PVT LTD, Nasik	Approved
2	CHEMICAL DOSING SYSTEM	ENPRO INDUSTRIES PVT.LTD., MARKAL KHED,PUNE	Approved
		PSI ENGINEERING SYSTEMS (P) LTD., Chennai	Approved
		SWELORE ENGG. PVT. LTD, AHMEDABAD	Approved
		TECHNO CONSULTANTS , GHATKOPAR (W) MUMBAI	Approved
		MILTON ROY INDIA (P) LTD.	Approved
		V.K PUMP INDUSTRIES PVT LTD, Nasik	Approved
3	CONDENSATE POLISHING UNIT	BGR ENERGY SYSTEMS LIMITED.,	Approved
		DRIPLEX WATER ENGINEERING INTERNATIONAL PRIVATE LIMITED, Hardwar	Approved
		ION EXCHANGE (INDIA) LTD	Approved
		THERMAX LTD. PUNE	Approved
		VA TECH WABAG LTD	Approved
4	MILL REJECT SYSTEM (PNEUMATIC TYPE)	MECAWBER BEEKAY PVT LTD., GREATER NOIDA	Approved
		UNITED CONVEYOR CORPORATION (INDIA) PVT.LTD.,KOLKATA	Approved
5	COLTCS	GEA BGR ENERGY SYSTEM INDIA LTD., Nellore	Approved
		TAPROGGE GmbH, Noida	Approved
		TECHNOS, FRANCE	Approved
		EIMCO WATER TECHNOLOGIES ,LLC, USA	Approved
		KLUMP & KOLLER GmbH	Approved
		FILTRATION ENGINEERS LTD.	Approved
		MULTITEX FILTRATION ENGINEERS LIMITED,	Approved
6	CW TREATMENT PLANT (Items to be procured from the approved Vendor List)	CLEAR WATER LTD.	Approved
		THERMAX LTD.	Approved
		DRIPLEX WATER ENGG. LTD.	Approved
		CHEMBOND ASHLAND WATER TECHNOLOGIES LTD.,MUMBAI	Approved
		VA TEC WABAG LTD	Approved
7	CHLORINATION PLANT (Items to be procured from the approved Vendor List)	PERFECT CHLORO SYSTEMS	Approved
		METITO POLLUTION CONTROL INDIA LTD	Approved

**SAGARDIGHI THERMAL Power EXTENSION PROJECT  
PHASE-III, UNIT#5 (1 x660 MW)**

Sl. No.	Item Description	Vendor Name	Remarks
1	VIBRATION ISOLATION	GERB	Approved
2.	STEEL GATE / GLOBE / NR VALVES  'BHEL' Make Valves are approved for only for 1500 CLASS or below.	WEIR B.D.K VALVES INDIA PVT. LTD. KIRLOSKAR BROTHERS LTD. LEADER VALVES LTD. KSB VALVES FOURESS ENGG.INDIA LTD. VAG VALVES AUDCO INDIA DEWARANCE Hawa Valves (India) Pvt. Ltd. HAWA ENGINEERS LTD. INTERVALVE POONAWALLA LTD. MICON VALVES (INDIA) PVT. LTD.	Approved Approved Approved Approved Approved D R Approved D R Approved Approved Approved D R
3.	BALL VALVES	FLOW CHEM INDUSTRIES FISHER SANMAR LIMITED KIRLOSKAR BROS. LTD. LEADER VALVES LTD. KSB VALVES WEIR B.D.K VALVES INDIA PVT. LTD. VAG VALVES A.V. VALVES LTD Hawa Valves (India) Pvt. Ltd. INTERVALVE POONAWALLA LTD.	Approved Approved Approved Approved Approved Approved Approved Approved Approved Approved
4.	CAST IRON GATE /GLOBE/ NRV/ SAFETY RELIEF VALVES	H.SARKER & COMPANY G.M.DALUI & SONS PVT.LTD. KIRLOSKAR BROS. LTD. LEADER VALVES LTD. VENUS PUMP & ENGG. WORKS	Approved Approved Approved Approved Approved
5.	SAFETY RELIEF VALVE (TUBE SIDE AND SHELL SIDE)	BHEL-HPBP TRICHY	Approved for Class 1500 or below
6.	Safety Valve, Safety relief Valve & ERV  'BHEL' Make Valves are approved for only for 1500 CLASS or below.	SEMPELL GmbH./Germany DRESSER CONSOLIDATED./USA DRESSER CONSOLIDATED./United Kingdom TYCO VALVES & CONTROLS./USA MEIWA CORPORATION./Japan BOPP&REUTHER,SICHERHEITS-UND/Germany REINEKE MESS-UND REGELTECHNIL GMBH/Germany VALVTECHNOLOGIES./USA BOPP&REUTHER,SICHERHEITS-UND/Germany VALVTECHNOLOGIES./USA	Approved Approved Approved Approved Approved Approved Approved Approved Approved Approved
7	GUN METAL VALVES	A.V.VALVES LTD, LEADER VALVES LTD., VALTECH INDUSTRIES	Approved Approved Approved

Sagardighi Extn. U#5 (PROJ3)

Mech.Equipments

Ref: SGMP03/AV/8/047



**SAGARDIGHI THERMAL Power EXTENSION PROJECT  
PHASE-III, UNIT#5 (1 x660 MW)**

Sl. No.	Item Description	Vendor Name	Remarks
8	BUTTER FLY VALVES (STEAM SERVICE)	FOURESS ENGG.INDIA LTD.	Approved
		INSTRUMENTATION LTD.	Approved
		BDK PROCESS CONTL. HUBLI	Approved
9.	BUTTER FLY VALVES (WATER SERVICE)	WEIR B.D.K VALVES INDIA PVT. LTD.	Approved
		FOURESS ENGG.INDIA LTD.	Approved
		INSTRUMENTATION LTD.	Approved
		LARSEN & TOUBRO LTD.	Approved
		KIRLOSKAR BROS. LTD.	Approved
		TYCO VALVES & CONTROLS INDIA PVT.LTD.	Approved
10.	SPRING LOADED BYPASS VALVES/ PLUG VALVES/ ANGLE DRAIN VALVES	WEIR VALVES & CONTROLS M.E.	Approved
		WEIR B.D.K VALVES INDIA PVT. LTD.	Approved
		FISHER SANMAR LIMITED	Approved
		LARSEN & TOUBRO LTD	Approved
		LEADER VALVES LTD.	Approved
		REINEKE MEB-UND REGELTECHNIK GMBH	Approved
		SEMPELL AG, GERMANY	Approved
		VELAN INC., CANADA	Approved
11.	AIR RELEASE VALVES	H.SARKER & COMPANY	Approved
		LEADER VALVES LTD.	Approved
		VENUS PUMP & ENGG. WORKS	Approved
		G.M.DALUI & SONS PVT.LTD.	Approved
		A.V. VALVES LTD	Approved
12.	DUAL PLATE CHECK VALVES	VENUS PUMP & ENGG. WORKS	Approved
		FLUIDLINEVALVES COMPANY PRIVATE LTD.	Approved
13.	FLOAT VALVES	H.SARKER & COMPANY	Approved
		G.M.DALUI & SONS PVT.LTD.	Approved
		LEADER VALVES LTD.	Approved
14	CONDENSATE PUMP-LP	SAM TURBO INDUSTRY PVT LIMITED	Approved
		SULZER PUMPS INDIA PVT LTD	Approved
		KIRLOSKAR BROTHERS LTD	Approved
		CLYDE PUMPS INDIA PVT LTD,	Approved
15.	FUEL OIL PUMPS (POSITIVE DISPLACEMENT PUMPS)	TUSHACO PUMPS PVT. LTD.,	Approved
		ALEKTON ENGG.INDUSTRIES PVT.LTD.	Approved
		U.T.PUMPS & SYSTEMS (P) LTD.	DF
		ALLWEILER INDIA PVT.LTD.,	Approved
16.	PGB SPECIAL OIL-ISO VG 320	INDIAN OIL CORPN.LTD.,	Approved
		HINDUSTAN PETROLEUM CORPN. LTD.	Approved
		CASTROL INDIA LIMITED	Approved
		EXXONMOBIL LUBRICANTS PVT LTD	Approved
		SHELL INDIA MARKETS PRIVATE LIMITED	Approved
17.	JACKING OIL PUMPS WITH MOTOR (SCREW TYPE) FOR MAIN TURBINE	TUSHACO PUMPS LIMITED	Approved
		ALLWEILER AG ,GERMANY	Approved

Sagardighi Extn. U# 5 (PRO13)

Mech Equipments



**SAGARDIGHI THERMAL Power EXTENSION PROJECT  
PHASE-III, UNIT#5 (1 x660 MW)**

Sl. No.	Item Description	Vendor Name	Remarks
19.	AUX. OIL PUMP (AOP) & EMERGENCY OIL PUMP WITH MOTOR (EOP) FOR MAIN TURBINE	KSB PUMPS LIMITED	Approved
		MATHER & PLATT PUMPS	Approved
		KBL	Approved
20.	VACUUM PUMPS	EDWARDS LIMITED, UK	Approved
		NI-TECH INC. USA	DR
		NASH ELOM INDUSTRIES, GERMANY	Approved
21	LUB OIL TRANSFER PUMPS	MATZ PUMPS PVT.LTD.	DR
		TUSHACO PUMPS PVT.LT	Approved
		IDEX INDIA PVT LTD	DR
		DELTA P D PUMPS PVT LTD	Approved
		ALLWEILER INDIA PRIVATE LIMITED	Approved
22	CONCRETE VOLUTE PUMP	KIRLOSKAR BROS. LTD.	Approved
		CLYDE UNION PUMPS	Approved
		FLOWERVE CORPORATION	Approved
		BHEL HYD BASED ON MHI COLLABORATION	DR
23.	MISC.PUMPS (VERTICAL)	KIRLOSKAR BROS. LTD.	Approved
		KSB PUMPS LTD.	Approved
		SULZER PUMPS INDIA LTD.	Approved
		WEIR,UK	Approved
		WPIL LIMITED	Approved
		FLOWMORE	Approved
		BHARAT PUMPS & COMPRESSORS LTD	Approved
		WILO MATHER & PLATT PUMPS PVT. LTD.	Approved
24.	BOILER WATER RECIRCULATION PUMP	TORISHIMA PUMP MFG CO.LTD, Japan	Approved
		KSB AKTIENGESSELLSCHAFT, Germany	DR
25.	PUMPS (HORIZONTAL) Type-I (FLOW<300 CMH)	KIRLOSKAR BROS. LTD.	Approved
		MATHER & PLATT PUMPS LTD.	Approved
		KSB PUMPS LTD.	Approved
		SULZER PUMPS INDIA LTD.	Approved
		WEIR,UK	Approved
		WPIL LIMITED	Approved
26.	PUMPS (HORIZONTAL) Type- II (FLOW>300 CMH)	FLOWMORE LTD.	Approved
		WPIL LIMITED	Approved
27.	SUMP PUMPS / SUBMERSIBLE PUMPS/ SLUDGE PUMP	KISHOR PUMPS PVT.LTD	Approved
		KIRLOSKAR BROS. LTD.	Approved
		KSB PUMPS LTD.	Approved
		FLOWMORE LTD.	Approved
		JASCO PUMP PVT. LTD.	Approved
		SAM TURBO	Approved
28.	OIL MODULE AND ACCESSORIES	HYDAC (INDIA) PVT. LTD.	Approved
		ALLWEILER INDIA PRIVATE	Approved
		AEL APPARATEBAU GMBH LEISNIG	Approved
		VDL DELMAS GMBH	Approved

Sagardighi Extension (PROJ)  
Mech. Equipments



**SAGARDIGHI THERMAL Power EXTENSION PROJECT  
PHASE-III, UNIT#5 (1 x660 MW)**

Sl. No.	Item Description	Vendor Name	Remarks
		FLENCO FLUID SYSTEM S.R.L (FOR KELAG AG	Approved Approved
29.	LUBE OIL PUMPS (CENTRIFUGAL)FOR TDBFP	KSB PUMPS LTD. KIRLOSKAR EBARA, KIRLOSKARWADI SULZER, MUMBAI. FLOWSERVE SANMAR LTD.,	Approved Approved Approved Approved
30.	LUBE OIL PUMPS (SCREW TYPE) FOR TDBFP	ALLWEILER, GERMANY IMO PUMP, USA TUSHACO, DAMAN LEISTRITZ (EMPIRE), GERMANY	Approved Approved Approved Approved
31.	JACKING OIL PUMP TDBFP	HAGULLAND DENSION TUSHACO PUMPS PVT. LTD., DELTA P D PUMPS PVT LTD	Approved Approved Approved
32.	EHA FOR TURBINE VALVES	BOSCH REXROTH AG HORST THIELE MASCHINENBAU HYDRAULISCHE GERATE GMBH, GERMANY	Approved Approved
33.	HPSU FOR TURBINE VALVES	HYDAC (INDIA) PVT LTD REINEKE MESS-UND REGELTECHNIK GMBH BOSCH REXROTH (INDIA) PRIVATE LIMITED; HYDAC SYSTEM GMBH KEICHER ENGINEERING AG	Approved Approved Approved Approved Approved
34.	OIL ACCUMULATOR	BOLENZ & SCHAFER MASCHINENFABRIK, Germany HYDAC INDIA PVT LTD, Navi Mumbai PARKER HANNIFIN CORPORATION, USA	Approved Approved Approved
35.	VACUUM BREAKER VALVE ASSY	MULLER CO-AX AG INSTRUMENTATION LIMITED CRANE PROCESS FLOW	Approved Approved DF
36.	SCANNER AIR FAN	C.DOCTOR & CO.PVT.LTD. PATELS AIRFLOW LTD. AIR CONTROL & CHEMICAL ENGG. CO.LTD.	Approved Approved Approved
37.	OIL PURIFICATION UNIT (OIL CENTRIFUGE)/PORTABLE OIL PURIFIERS	ALFA LAVAL LIMITED, INDIA SERVIZE INDUSTRIAL, ITALY ALFA-LAVALSEPARATION AB - SWEDEN	Approved DF Approved
38.	ELECTRICAL HOIST	REVA INDUSTRIES LTD CONSOLIDATED HOIST PVT LTD TUOBRO FERGUSON(INDIA)PVT.LTD HERCULES HOISTS LTD. UNIVERSAL HOIST - O- FABRIK BRADY & MORRIS ENGINEERING CO. LTD. TRACTEL TIRFOR INDIA PVT. LTD.	Approved Approved Approved Approved Approved Approved Approved
		UNIVERSAL HOIS -O-FABRIK HERCULES HOISTS LTD. TUOBRO FERGUSON(INDIA)PVT.LTD	Approved Approved Approved

Sagardighi Extension Unit#5 (PROJ3)

Mech. Equipments



**SAGARDIGHI THERMAL Power EXTENSION PROJECT  
PHASE-III, UNIT#5 (1 x660 MW)**

Sl. No.	Item Description	Vendor Name	Remarks
39	CHAIN PULLEY BLOCK	BRADY & MORRIS ENGINEERING CO. LTD.	Approved
		TRACTEL TIRFOR INDIA PVT. LTD.	Approved
		UNIVERSAL HOIS -O-FABRIK	Approved
		HERCULES HOISTS LTD.	Approved
		TUOBRO FURGUSON(INDIA)PVT.LTD	Approved
40	DOUBLE GIRDER EOT CRANES UPTO 50T	UNIQUE INDUSTRIAL HANDLERS PVT.LTD	Approved
		MUKAND LIMITED,	Approved
		REVA INDUSTRIES LTD.	Approved
		HEAVY ENGG. CORPORATION LTD.	Approved
		UNIVERSAL HOIST-O-FABRIK,	Approved
		CONSOLIDATED HOISTS PVT LIMITED	Approved
41	D/G EOT CRANES UP TO 100T	FURNACE & FONDRIE EQUIPMENT CO.	Approved
		FURNACE & FONDRIE EQUIPMENT CO.	Approved
		Grip Engineers Pvt. Ltd.,	Approved
		HEAVY ENGG. CORPORATION LTD.	Approved
		MUKAND LIMITED	Approved
		REVA INDUSTRIES LTD.	Approved
		TUOBRO FURGUSON (INDIA) PVT LTD	Approved
		UNIQUE INDUSTRIAL HANDLERS PVT LTD.	Approved
42	D/G EOT CRANES ABOVE 100T	FURNACE & FONDRIE EQUIPMENT CO.	Approved
		HEAVY ENGG. CORPORATION LTD.	Approved
		MUKAND LIMITED	Approved
		REVA INDUSTRIES LTD.	Approved
		UNIQUE INDUSTRIAL HANDLERS PVT LTD.	Approved
43	Single Girder EOT / HOT Misc. Cranes	BRADY & MORRIS ENGINEERING CO. LTD.	Approved
		CONSOLIDATED HOISTS PVT LTD	Approved
		REVA INDUSTRIES LTD.	Approved
		TRACTEL TIRFOR INDIA PVT. LTD.	Approved
		Universal Hoist-O-Fabrik	Approved
44	MILL HANDLING EQUIPMENT	GRIP ENGINEERS PVT LTD, HYDERABAD	Approved
		LIFTING EQUIPMENT & ACCESSORIES ,NEWDELHI	Approved
		REVA INDUSTRIES LIMITED,FARIDABAD	Approved
		CONSOLIDATED HOIST,PUNE	Approved
		EDDYCRANES ENGINEERS PVT,MUMBAI	Approved
		CENTURY CRANE ENGINEERS (P) LTD.	Approved
		UNIVERSAL HOIST-O- FABRIK,MUMBAI	Approved
45	FURNACE MAINTENANCE PLATFORM	N.V.SKY CLIMBER EUROPE S.A	Approved
		N.V.SKY MAN INTERNATIONAL S.A.	Approved
		ALTREX B.V, Netherlands	DR
46	QUICK ERECT SCAFFOLD	INSTANT UPRIGHT LIMITED,DUBLIN	Approved
47	ELEVATOR-PASSENGER CUM GOODS	KONE ELEVATOR INDIA LTD.	Approved
		OTIS ELEVATOR	Approved



**SAGARDIGHI THERMAL Power EXTENSION PROJECT  
PHASE-III, UNIT#5 (1 x660 MW)**

Sl. No.	Item Description	Vendor Name	Remarks
48.	CASTABLE REFRACTORY	BASKAR REFRACTORIES AND S.W PIPES(P)LTD	Approved
		THE ACE REFRACTORIES LTD.	Approved
		DALMIA REFRACTORIES	Approved
		SOUVENIOR CERAMICS	Approved
		MAHAKOSHAL REFRACTORIES PVT. LTD,	DF
		CASTWEL INDUSTRIES	DF
49.	POURABLE INSULATION	BASKAR REFRACTORIES & STONEWARE PIPES(P)LTD	Approved
		THE ACE REFRACTORIES LTD.	Approved
		DALMIA REFRACTORIES	Approved
		INDUSTRIAL ASSOCIATES,	Approved
		CASTWEL INDUSTRIES	DF
50.	FIRE BRICKS	BASKAR REFRACTORIES AND STONEWARE PIPES (P) LTD	Approved
		DALMIA REFRACTORIES	Approved
51.	WOOL MATTRESS	ROCKWOOL INDUSTRIES LTD	Approved
		MINWOOL ROCK FIBRES LTD	Approved
		LAPINUS ROCKWOOL PVT. LTD	Approved
		ROCKWOOL INDIA LTD.	Approved
		LLOYD INSULATION (I) LTD.	Approved
		LLOYD ROCKFIBRES LTD.	Approved
		DHANBAD ROCKWOOL INSULATION PVT LTD	Approved
		GOENKA ROCKWOOL ( INDIA ) PVT LTD.,	Approved
		JAMSHEDPUR MINERAL WOOL MFG.CO.	Approved
52.	MINERAL WOOL MATTRESS	JAMSHEDPUR MINERAL WOOL MFG.CO.	Approved
		ROCKWOOL (INDIA) PVT LTD.	Approved
		ROCKWOOL INDUSTRIES	Approved
		DHANBAD ROCKWOOL INSULATION PVT LTD	Approved
		GOENKA ROCKWOOL ( INDIA ) PVT LTD.,	Approved
53.	THERMAL INSULATION OF STEAM TURBINE/THERMAL INSULATION OF TURBINE INTEGRAL PIPING/THERMAL INSULATION- ROCKWOOL MATTRESSES/ PIPE SECTIONS	LLOYD INSULATIONS	Approved
		ROCKWOOL	Approved
		HEINRICH TAPP GMBH	Approved
		EUGEN ARNOLD GMBH	Approved
		Dhanbad Rockwool Insulation (P) Ltd.	Approved
		GOENKA ROCKWOOL (INDIA ) PVT.LTD.	Approved
54.	THERMAL INSULATION - ANCILLARY MATERIAL	LLOYD INSULATIONS ( INDIA ) LIMITED	Approved
		ALLIED INSULATIONS (INDIA), GHAZIABAD	Approved
		ENERGY SAVING & ALLIED PRODUCTS	Approved
55.	INSULATION-BED MATERIALS	BHASKAR REFRACTORIES&SW PIPES P LTD, Faridabad	Approved
		SOUVENIOR CERAMICS, Faridabad	Approved
		ALWAR REFRACTORIES PVT LTD, Jaipur	Approved
		CHAMPION CERAMICS PVT LTD, Champa	DR

Sagardighi Extn. L#5 (PROJ3)

Mech. Equipments



**SAGARDIGHI THERMAL Power EXTENSION PROJECT  
PHASE-III, UNIT#5 (1 x660 MW)**

Sl. No.	Item Description	Vendor Name	Remarks
56.	INSULATION:CALCIUM SILICA	HYDERABAD INDUSTRIES LTD., Faridabad	DR
		NEWKEM PRODUCTS CORPORATION, Mumbai	DR
57.	INSULATION:CERAMIC WOOL	LLOYD INSULATIONS (INDIA) LIMITED, Chennai	Approved
58.	INSULATION:WOVEN WIRE CLO	BANARASWALA METAL CRAFTS PVT.,COIMBATORE	Approved
		BOKARIA WIRENETTING INDUSTRIES,CHENNAI	Approved
		JEETMULL JAICHANDLALL (MADRAS),CHENNAI	Approved
		KIRAN WIRE NETTING CO.,CHENNAI	Approved
		QUALITY WIRE PRODUCTS,NAVI MUMBAI	Approved
59	STEAM TRAPS	SPIRAX MARSHALL PVT.LTD.	Approved
		PENNANT ENGINEERING PVT.LTD.	Approved
		ESCO STEAMCON PVT. LTD.	Approved
		FORBES MARSHALL PVT. LTD.	Approved
60	AIR TRAPS	PENNANT ENGINEERING PVT.LTD.	Approved
		SPIRAX MARSHALL PVT.LTD.	Approved
		ESCO STEAMCON PVT. LTD.	Approved
		FORBES MARSHALL PVT. LTD.	Approved
61	GRAVIMETRIC FEEDER	STOCK INDIA	Approved
62	COMPRESSED AIR SYSTEM	ATLAS COPCO (INDIA) LTD.	Approved
63	SELF CLEANING STRAINERS	FILTRATION ENGINEERS (I) PVT. LTD.	Approved
		GEA BGR ENERGY SYSTEM INDIA LTD.	Approved
		MULTITEX FILTRATION ENGINEERS LIMITED	Approved
64	DEBRIS FILTER	GEA BGR ENERGY SYSTEM INDIA LTD.	Approved
		MULTITEX FILTRATION ENGINEERS LIMITED	Approved
		TAPROGGE GmBH	Approved
65	ALUMINIUM SHEETS/ COILS/CLADDING	BHARAT ALUMINIUM CO.LTD.	Approved
		INDIAN ALUMINIUM CO.LTD.	Approved
		HINDALCO INDUSTRIES LTD.	Approved
		NATIONAL ALUMINIUM COMPANY LTD.	Approved
		JINDAL ALUMINIUM LIMITED	Approved
66	CORRUGATED AL SHEET	HINDALCO INDUSTRIES LTD.,Chennai	Approved
		JINDAL ALUMINIUM LIMITED, Bangalore	Approved
		MPIL STEEL STRUCTURES LTD.,Thane	Approved
67	HOC TYPE GAS DRIER	DELAIR INDIA PVT. LTD.	Approved
		ATLAS COPCO (INDIA) LTD.	Approved
68	REFRIGERATION TYPE GAS DRIER	DELAIR INDIA PVT. LTD.	Approved
		SUMMIT	Approved
		SAVRO	Approved
		JINDAL ELECTRONICS PVT. LTD.	Approved
		SPAN MANUFACTURING CO. PVT.	DR
		MELLCON ENGINEERS PVT. LTD.	Approved

Sagardighi Extn. Unit#5 (PROJ)

Mech. Equipments



**SAGARDIGHI THERMAL Power EXTENSION PROJECT  
PHASE-III, UNIT#5 (1 x660 MW)**

Sl. No.	Item Description	Vendor Name	Remarks
69	MISC. TANKS (SHOP)	GENERAL MECHANICAL WORKS	Approved
		UNITECH MACHINES LTD.	Approved
		TECHNO ELECTRIC & ENGG. CO. LTD.	Approved
		THERMOPADS PVT LIMITED	Approved
		VIJAY TANKS & VESSELS LTD	Approved
		THERMOSYSTEMS PVT. LTD.	Approved
70	MISC. TANKS(SITE FABRICATED)	TECHNO ELECTRIC and ENGG. CO. LTD.	Approved
		THERMOSYSTEMS PVT. LTD. HYDERABAD	Approved
		UNITECH MACHINES LTD.	Approved
71.	FLAME ARRESTOR ( MISCELLANEOUS TANKS )	PROCESS INSTRUMENTS	Approved
		ASIAN INDUSTRIAL VALVES	Approved
		ACCOUSTICS INDIA PVT. LTD.	Approved
		MULTITEX FILTERS PVT. LTD.	Approved
72	M.E. BELLOWS	FLUIDINE ENGRS.INDIA PVT.LTD	Approved
		EXPANSION JOINT SYSTEMS INC. USA	Approved
		MUNRO & MILLER FITTINGS LTD., U.K	Approved
		SENIOR FLEXONICS, U.K.	Approved
		SUR INDUSTRIES PVT.LTD.,KOLKATA	Approved
		CORBIS	Approved
		FLEXATHERM EXPANLOW PVT LTD	Approved
		MB METALLIC BELLOWS PVT. LTD,	Approved
		FLEXICAN BELLOWS & HOSES (P) LTD	Approved
73	EXPANSION BELLOWS-NON METALLIC	LONE STAR INDUSTRIES	Approved
		EAGLE BURGMANN K.E. PVT.LTD, Chennai	Approved
		AIROCHEM ENGINEERING COMPANY, Kolhapur	Approved
		PATELS AIRFLOW LIMITED,Ahmedabad	Approved
74	HEAT EXCHANGERS (PLATE TYPE)	MECHWELL INDUSTRIES LTD, Mumbai	Approved
		ALFA LAVAL (INDIA) LTD.	Approved
		GEA ECOFLEX INDIA PVT LTD	Approved
		TRANSTER INDIA PRIVATE LIMITED	Approved
		L&T	Approved
75	JOURNAL BEARING BFP & BP/THRUST CUM JOURNAL BEARING FOR CEP/THRUST BEARING (BFP & BP)	IDMC LIMITED	Approved
		COLHERENE, UK	Approved
		WAUKESHA BEARINGS (GLACIER), UK	Approved
		KINGSBURY, USA	Approved
76	THRUST BEARING FOR CWP	MITCHELL, UK	Approved
		MICHELL BEARINGS,	Approved
		OSBORNE ENGINEERING LIMITED	DR
		OSAKA ASAHI METAL MFG. CO. LTD.	DR
77.	HYDRAULIC COUPLING	MICHELL BEARINGS (INDIA) LLP	Approved
		VOITH TURBO PVT LTD	Approved
		VOITH TURBO PVT. LTD. - HYDERABAD, INDIA	Approved
78.	DISCONNECTING COUPLING FOR TDBFP	VOITH TURBO GMBH & CO. KG. - GERMANY	Approved
		ZURN INC, USA	Approved

Sagardighi Thermal Power Extension Project

Mech. Equipments

Ref: SGMP03/AV/8/047



**SAGARDIGHI THERMAL Power EXTENSION PROJECT  
PHASE-III, UNIT#5 (1 x660 MW)**

Sl. No.	Item Description	Vendor Name	Remarks
79.	SUCTION STRAINERS (BFP, BP & CEP)	OTOKLIN	Approved
		MULTITEX	Approved
		GUJARATH OTOFILT	Approved
		FILTRATION ENGINEERS INDIA PVT LTD	Approved
		JAY-EESH ENGINEERING COMPANY	Approved
80.	MECHANICAL SEAL (BFP/BP & CEP)	BURGMANN, GERMANY.	Approved
		EAGLE POONAWALA LTD.PUNE	Approved
		FLOWERVE SANMAR, CHENNAI	Approved
81.	CONNECTING COUPLING FOR CEP, DRIP PUMP, CWP, BFP & BP	FLEXIBOX LTD., UK	Approved
		TURBOFLEX, UK	Approved
		BIBBY TURBOFLEX (FORMERLY EUROFLEX), UK	Approved
		EUROFLEX TRANSMISSION LTD., HYDERABAD.	Approved
		CUBIC TRANSMISSION PVT. LTD.	DR
82	CONNECTING COUPLING (MEMBRANE TYPE/GEAR TYPE) FOR TDBFP	JOHN CRANE SEALING SYSTEMS, UK	Approved
		EUROFLEX TRANSMISSION, HYDERABAD.	Approved
		RENK AG, GERMANY	Approved
		JOHN CRANE, UK	Approved
		KOPFLEX, USA	Approved
		BIBBY TURBOFLEX (FORMERLY EUROFLEX), UK	Approved
		AMERIDRIVES (ZURN), USA	Approved
		LUFKIN, USA/FRANCE	Approved
		BHS, GERMANY	Approved
		FLENDER GRAFFENSTADEN, FRANCE	Approved
83	GEAR BOX FOR TDBFP	RENK AKTIENGESELLSCHAFT -	Approved
		WALCHAND NAGAR, PUNE	Approved
		RENK AG, GERMANY	Approved
		LUFKIN, USA/FRANCE	Approved
		FLENDER GRAFFENSTADEN, FRANCE	Approved
		BHS, GERMANY	Approved
		VOITH TURBO BHS - GETRIEBE GMBH,	Approved
		RENK AKTIENGESELLSCHAFT -	Approved
84.	BARE RUBBER BELLOWS	TRIVENI ENGG & IND LTD	Approved
		CORI ENGINEERS PVT. LTD CHENNAI.	Approved
		SRM ESOFLEX PVT. LTD. KOLKATTA	Approved
85.	SPRING SUPPORTS / HANGERS	CORBIS	Approved
		SARATHI ENGG. ENTERPRISES PVT. LTD.	Approved
		HYDERABAD PIPING & ENERGY PRODUCTS (P) LTD. NEW DELHI	Approved
		SHAPE BAHADARABAD	Approved
		DARSHANI-INDIA	Approved
86	SELF LUBRICATING BEARING	PAL ENGINEERING YAMUNANAGAR	Approved
		TEN MAT LTD UK (FEROFORM T 814 TUBES)	Approved

Sagardighi Extn. Unit#5 (PROJ)  
Mech. Equipments



**SAGARDIGHI THERMAL Power EXTENSION PROJECT  
PHASE-III, UNIT#5 (1 x660 MW)**

Sl. No.	Item Description	Vendor Name	Remarks
	TUBES FOR BF VALVES	THORDON	Approved
		THORPLAS TUBES, CANADA	Approved
87	KNIFE GATE VALVES	VAAS	Approved
		TYCO, USA	Approved
		VELAN, UK/USA	Approved
		INDURE PVT. LTD.	Approved
		ORBINOX INDIA (P) LTD.	Approved
		JASH ENGINEERING LIMITED	Approved
		GALAXY CONTROLS PVT LTD.,	Approved
88	MS AND GI PIPES	SAIL	Approved
		JINDAL	Approved
		INDUS TUBES	Approved
		SURYA ROSHNI	Approved
		TATA	Approved
89	STAINLESS STEEL PIPES	RATNAMANI METAL & TUBES	Approved
90	VACUUM PUMP / MECHANICAL EXHAUSTER (LIQUID RING TYPE)	VACUNAIR	Approved
		GARDNER DENVER, KOREA	Approved
		EDWARDS LIMITED, UK	Approved
91	STRAINER	STRAINWELL INDIA	Approved
		ACME FLUID SYSTEMS	Approved
		SRK STRAINERS & VALVES INDIA	Approved
		FILTRATION ENGINEERS INDIA PVT LTD	Approved
		GUJARAT OTOFILT,	Approved
92	CONICAL STRAINERS	FILTRATION ENGINEERS (I) PVT. LTD.	Approved
		GUJARAT OTOFILT	Approved
		JAY-EESH ENGINEERING COMPANY	Approved
		MULTITEX FILTRATION ENGINEERS LIMITED	Approved
		OTOKLIN GLOBAL BUSINESS LIMITED	Approved
93	CONDENSER TUBES	RATNAMANI METALS & TUBES LTD	Approved
		REMI EDELSTAHL TUBULARS LTD	Approved
		RATNADEEP METAL & TUBES LTD.	Approved
94	GRINDING ROLLS	AIA Engineering Ltd., Ahmedabad	Approved
		Magotteaux Industries Pvt. Ltd., Rajkot	Approved
95	BULL RING SEGMENTS	AIA Engineering Ltd., Ahmedabad	Approved
		Magotteaux Industries Pvt. Ltd., Rajkot	Approved
96	PGB SPECIAL OIL-ISO VG 320	INDIAN OIL CORPN.LTD.,	Approved
		HINDUSTAN PETROLEUM CORPN. LTD.	Approved
		CASTROL INDIA LIMITED	Approved
		EXXONMOBIL LUBRICANTS PVT LTD	Approved
		SHELL INDIA MARKETS PRIVATE LIMITED	Approved

Sagardighi Extn. Units (PROJ)  
Mech. Equipments



**SAGARDIGHI THERMAL Power EXTENSION PROJECT  
PHASE-III, UNIT#5 (1 x660 MW)**

Sl. No.	Item Description	Vendor Name	Remarks
97	CANISTER DRAINAGE PUMP SUBMERSIBLE/ BOOSTER PUMPS OF CVP	KIRLOSKAR BROTHERS LTD	Approved
		KSB PUMPS LIMITED,	Approved
		SULZER PUMPS INDIA LIMITED	Approved
		CLYDE PUMPS LTD.	Approved
98	SPIRAL WOUND GASKETS	CHAMPION SEALS (INDIA) PVT LTD.,	Approved
		STARFLEX SEALING (I) PVT .LTD	DR
		DYNAMIC GASKETS PVT LTD	DR
		SPIRASEAL GASKETS PVT LTD	DR
		GOODRICH GASKET PRIVATE LIMITED,	DR
99	PTFE SHEETS	As per BHEL Approved Sources	
100	AVERAGING PITOT TUBE	TECHNOMATIC	Approved
		EMERSON PROCESS MANAGEMENT (I) PVT	Approved
		MINCO (INDIA ) PVT. LTD.	DR
		SWITZER PROCESS INSTRUMENTS	Approved
101	SEALING COMPOUND	As per BHEL Approved Sources	
102	H2, N2 & CO2 CYLINDERS (EMPTY)	BHARAT PUMPS AND COMPRESSORS	Approved
		SARJU IMPEX LTD	Approved
		EVEREST KANTO CYLINDER LIMITED	Approved
		RAMA CYLINDERS PVT LTD.	DR
103	STROBOSCOPE	ZENTRONIC SYSTEMS	Approved
		BEM-MESSTECHNIK GMBH	Approved
		IAG AUTOMATION PVT LTD	Approved
104	AIR CYLINDER	EASTERN PNEUMATICS PRIVATE LTD., Kolkata	Approved
		INSTRUMENTATION LTD.,Kerala	Approved
		KELTRON CONTROLS,Aroor	Approved
		NUCON PNEUMATICS PVT.LTD. Medak	Approved
		VELJAN HYDRAIR LIMITED, Hyderabad	Approved
		DUNCAN ENGINEERING LIMITED, Pune	Approved
		NEWTON PNEUMATICS, Chennai	Approved
105	SLIDING BEARING	Avi Oilless die Components India Pvt. Ltd, Pune	DR
		NEXGEN FLUOROPOLYMERS PVT.LTD, Alwar	DR
106	BLOWERS	ACME AIR EQUIPMENTS CO PVT LTD,Ahmedabad	Approved
		AERZEN MACHINES INDIA PVT.LTD., Vadodara	Approved
		RKR,GEBLASE UND VERDICHTER GMBH, Germany	Approved
		SWAM PNEUMATICS PVT LTD.	Approved
107	DIRECT WATER LEVEL GUAGE	CLARK RELIANCE CORPN, USA	Approved
		IGEMA GmbH, Munster Germany	Approved
		NISAN SCIENTIFIC PROCESS,Mumbai	Approved

Sagardighi Extn. Unit#5 (PROJ3)

Mech. Equipments

**SAGARDIGHI THERMAL Power EXTENSION PROJECT  
PHASE-III, UNIT#5 (1 x660 MW)**

Sl. No.	Item Description	Vendor Name	Remarks
		PENTAIR VALVES & CONTROLS INDIA, Baroda	Approved
108	HEA IGNITOR ASSY	UNISON INDUSTRIES, USA	Approved
		IGNITION SYSTEM Inc., USA	Approved
		DURAG, Germany	Approved
		FIVES COMBUSTION SYSTEMS PVT. LTD	Approved
		TESI SPA, Italy	Approved
		TURBINE TECHNICS, INC., Florida USA	Approved
109	HP FILL & PURGE FILT	PALL INDIA PVT LTD, Mumbai	Approved
		VENS HYDROLUFT (P) LTD, Chennai	Approved
110	VARIABLE ORIFICE	BMW STEELS LTD., UTTAR PRADESH	DF
		ELECTRO PORCELAIN DIVN., BANGALORE	DF
		PROMECON GmbH., GERMANY	Approved
111	Lub oil system for FANS (ID, FD & PA)	PSI ENGINEERING Systems pvt ltd	Approved
		SOUTHERN LUBRICATION PVT LTD	Approved
		YUKEN INDIA LTD	Approved
112	STEAM COIL AIR PRE HEATR	C DOCTOR INDIA PVT LTD	Approved
		PATEL AIR TEMP(INDIA) LTD	Approved
		BARODA EQUIPMENT &VESSEL PVT LTD	Approved
		NU WAY HEATTRANSFER PVT LTD	Approved
		CHINTAMANI THERMAL TECHNOLOGIES PVT LTD	Approved
		PAR ENERGY INFRA PVT.LTD	Approved
113	AIR RECEIVER	VEE SONS ENERGY SYSTEM PVT LTD	Approved
		PATEL AIR TEMP(INDIA) LTD	Approved
		C DOCTOR INDIA PVT LTD	Approved
		AIRCON HANDLING SYSTEMS PVT LTD	Approved
		BARODA EQUIPMENT &VESSELS PVT LTD	Approved



**SAGARDIGHI THERMAL Power EXTENSION PROJECT  
PHASE-III, UNIT#5 (1 x660 MW)**

SL. NO.	Item Description	Vendor Name	Remarks
1	Slurry Recirculation pumps	BHEL, Hyderabad	DR
		Duchting Pumpen, Germany	Approved
		KSB, Germany	Approved
		KSB India	DR
		Weir Minerals, Australia	Approved
		Weir Minerals, India	DR
		Andritz China	
		Andritz India	DR
		Xiangyang WuerWu China	
2	Oxidation Blowers	BHEL, Hyderabad	DR
		ITO, Japan	Approved
		GEMSL, UK	Approved
		Aerzen, Germany	Approved
		Aerzen, India	Approved
		Howden, India	Approved
		Boldrocchi, India	Approved
		Siemens, Italy/Germany	Approved
		Boldrocchi, Italy	Approved
3	Slurry pumps	Duchting Pumpen, Germany	Approved
		Weir Minerals, Australia	Approved
		Weir Minerals, India	DR
		Andritz China	
		Andritz India	DR
		Metso Minerals USA	Approved
		Metso Minerals India	DR
		KSB Germany	Approved
		KSB India	DR
		Krebs USA	Approved
		Krebs India	DR
		Xiangyang WuerWu China	
4	Agitators	Ekato, Germany	Approved
		Ekato, India	DR
		STC, Germany	Approved
		REMI-STC, India	DR
		Nippon Gears, Japan	Approved
		SPX, USA	Approved
		SPX, India	DR
		Chemineer, China	

SL. NO.	Item Description	Vendor Name	Remarks
		Zhejiang Great wall mixers china	
		Mixing Solutions, USA	Approved
		Mixing Solutions, India	DR
		Milton Roy Mixing, France	Approved
		Milton Roy Mixing, India	Approved
		Tschamber, Germany	Approved
5	Mist Eliminator	REA Plastik Tech GmbH, Berlin Germany	Approved
6	Wet Ball Mills	Christian Pfeiffer, Germany	Approved
7	Vacuum Belt Filter and Hydrocyclone	Xuhe, Japan	Approved
8	Rubber lining	Steuler-KCH GmbH	Approved
		Rubber Source Inc.	Approved
		Blair Rubber Company	Approved
9	Rubber lining Applicator	Labrex, Puducherry	Approved
10	Alloy C276/Alloy 59 liner	ATI, Relentless Innovation	Approved



**SAGARDIGHI THERMAL Power EXTENSION PROJECT**  
**PHASE-III, UNIT#5 (1 x660 MW)**

SL. NO.	Item Description	Vendor Name	Remarks
1	PIPES & CONDUITS/ACCESSORIES	As per BHEL approved source.	
2	EM BRAKES	SIEGERLAND-BREWSSEN, GERMANY	Approved
		STROM KRAFT CONTROLS, MUMBAI	Approved
		BCH Electric Limited	Approved
		SIEMENS India Ltd.	Approved
	Caliper Brakes,EHT Gear Boxes,Industrial Valves,	KATEEL Engineering Industry Pltd	DR
3	SOLENOID VALVES	ASCO, Chennai	Approved
4	AIR CONDITIONING SYSTEMS	shall be as per approved sources listed in Package items in Main Plant Package area.	
5	VENTILATION SYSTEM	shall be as per approved sources listed in Package items in Main Plant Package area.	
6	VALVES	shall be as per approved sources listed in Mechanical Equipment in Main Plant Package area.	
7	DUST EXTRACTION SYSTEM	C.Doctor & Company Private Ltd.,	Approved
		DUSTVEN Pvt .Ltd., Bangalore	Approved
		THERMEX	Approved
		Batliboi Environmental Engg Ltd.,	Approved
		TPS,DELHI	Approved
		F. Harley	Approved
8	DUST SUPPRESSION SYSTEM	SPRAYING SYSTEMS INDIA PVT. LTD	Approved
		KAVERI ULTRA POLYMER LTD.	Approved
		F. HARLEY & COMPANY. PVT. LTD.	Approved
		TPS INFRASTRUCTURE LTD.	Approved
9	E O T CRANE / MANUAL HOIST	shall be as per approved sources listed in Mechanical Equipment in Main Plant Package area.	
10	PUMPS & ACCESSORIES	shall be as per approved sources listed in Mechanical Equipment in Main Plant Package area.	
		PHOENIX CONVEYOR BELT INDIA PVT LTD	Approved
		SEMPERTRANS INDIA PRIVATE LIMITED	Approved
		HILTON-FORECH	Approved

Sagardighi Extn. UHS (PROJ3)

CHP-Mech. Package

Ref: SGMPO3/AV/8/047



## SAGARDIGHI THERMAL Power EXTENSION PROJECT

## PHASE-III, UNIT#5 (1 x660 MW)

11	CONVEYOR BELT	MRF	Approved
		YOKOHAMA	Approved
		FORECH INDIA LTD, KOLKATA	Approved
		HINDUSTAN RUBBERS, SILVASA	Approved
		NORTHLAND RUBBER MILLS, NEW	Approved
		ORIENTAL RUBBER INDUSTRIES PVT LTD.	DR
		JONSON RUBBER INDUSTRIES	Approved
		EUREKA COVEYOR BELTINGS PVT LTD.	Approved
		FLEXER RUBBER PVT LTD	Approved
12	BELT VULCANIZER	SHAW ALMEX	Approved
		S. V. DATTAR	Approved
		NILOS	Approved
13	STRUCTURAL STEEL	Follow Civil Structural Vendor Approval List.	
14	COAL SAMPLING UNIT	ADVANCED SYSTEMS SAMPLING PVT LTD	Approved
		THERMO RAMSAY, AUSTRALIA	Approved
		ERIEZ MAGNETICS EUROPE LTD., CAERPHILLY	Approved
		EASTMAN CRUSHER Co. (P) Ltd.	Approved
15	BELT WEIGHER SCALES	THERMO RAMSAY, AUSTRALIA	Approved
		AVERY INDIA LTD., NEW DELHI	Approved
		TRANSWEIGH	Approved
		SCHENCK PROCESS INDIA LIMITED	Approved
16	FLAP GATES	PRECISION PROCESSING EQUIPMENT CO.	Approved
		DA ENGG.	Approved
		MERIT CHENNI	Approved
		MMHE	Approved
		MSE	Approved
		HINDUSTAN M/C TOOLS CORPORATION, KOLKATA	Approved
		CONTINENTAL PROFILES LTD., FARIDABAD	Approved
17	Flow elements, Condensate pots, Manifolds etc for process instrumentation	shall be as per approved sources listed in C&I in Main Plant Package area.	
18	GRATINGS	PATNY SYSTEMS, HYDERABAD	Approved
		PINAX STEEL INDUSTRIES PVT LTD	Approved
		INDIANA GRATINGS PVT. LTD.	Approved

Sagardighi Extn. Unit#5 (PR-13)

CHP-Mech. Package



**SAGARDIGHI THERMAL Power EXTENSION PROJECT**  
**PHASE-III, UNIT#5 (1 x660 MW)**

		CAUVERY ENGINEERING WORKS	Approved
19	GEAR BOXES	R&D MULTIPLES (METAL CAST) PVT. LTD.	Approved
		ESSENTIAL POWER TRANSMISSION PVT.LTD	Approved
		FLENDER	Approved
		NEW ALLENBURY	Approved
		KATEEL Engineering Industry Pltd	DR
		PREMIUM TRANSMISSION LIMITED	Approved
		SHANTHI GEARS LIMITED	Approved
20	ERW PIPES	STEEL AUTHORITY OF INDIA LTD.	Approved
		WELSPUN GUJARAT STAHL ROHERN LTD	Approved
		TUBES INDIA	Approved
		JCO GAS PIPE LIMITED	Approved
		RATNAMANI METALS & TUBES LTD	Approved
		MAHARASHTRA SEAMLESS LIMITED	Approved
		JINDAL PIPES LIMITED	Approved
21	COMPRESSORS	ATLAS COPCO (INDIA) LIMITED	Approved
		ELGI EQUIPMENTS LTD	Approved
		INGERSOLL- RAND (INDIA) LIMITED	Approved
22	Bull Dozer	BHARAT EARTH MOVERS LIMITED	Approved
23	Twin Wagon Trippler	THYSSENKRUPP INDUSTRIES INDIA PV	Approved
24	Feeders (Apron ; Grizzly; Vibrating; Paddle)	FL Smidth	
		Metso Minerals(I) Pvt.Ltd.	Approved
		LARSEN & TOUBRO LTD, ECC DIVN	Approved
		ELECON ENGINEERING COMPANY LTD	Approved
		TRF LTD., JAMSHEDPUR	Approved
		THYSSENKRUPP INDUSTRIES INDIA PVT	Approved
25	Crusher	LARSEN & TOUBRO LTD	Approved
		TRF LIMITED	Approved
		ELECON ENGINEERING COMPANY LTD	Approved
		THYSSENKRUPP INDUSTRIES INDIA PV	Approved
		SANDVIK ASIA PRIVATE LIMITED	DR
		MCNALLY SAYAJI ENGINEERING LIMITED	Approved
		Amps Engineering & Equipments Pvt Ltd	DR
		Devas Engineering Systems	DR
		GOLDEN ENGINEERING INDUSTRIES	DR
		INDIANA CONVEYORS PVT LTD	DR
		VISHWA INDUSTRIAL COMPANY LTD.,	DR
		NEW ERA CONVEYORS PVT LTD.,	DR

Sagardighi Extn. U#5 (PROJ3)

CHP-Mech. Package

Ref: SGMPO3/AV/8/047



## SAGARDIGHI THERMAL Power EXTENSION PROJECT

## PHASE-III, UNIT#5 (1 x660 MW)

26	Idlers	TURBO ENGINEERS (CBE),	DR
		ROLLWELL CONVEYOR COMPONENTS PVT LTD	DR
		ELECON ENGINEERING CO. LTD.	Approved
		ARUDRA	Approved
		TRF LIMITED	Approved
		MCNALLY BHARAT, ENGG. CO. LTD.	Approved
		TEGA	Approved
		BENGAL TOOLS.	Approved
		ARYAN CLEAN COAL TECHNOLOGIES PVT LTD.,	DR
		Bevcon Wayors Pvt Ltd	DR
		I & B ENGINEERS PVT LTD	DR
		TECHNO IMPEX	DR
27	Pulleys	INDIANA CONVEYORS PVT LTD	DR
		AMPS ENGINEERING & EQUIPMENTS PVT LTD	DR
		Devas Engineering Systems	DR
		VISHWA INDUSTRIAL COMPANY LTD.,	DR
		NEW ERA CONVEYORS PVT LTD.,	DR
		TURBO ENGINEERS (CBE),	DR
		BENGAL TOOLS	Approved
		MCNALLY BHARAT ENGG. CO. LTD.	Approved
		ELECON	Approved
		ARUDRA	Approved
		ROLLWELL CONVEYOR COMPONENTS PVT LTD	DR
		ARYAN CLEAN COAL TECHNOLOGIES PVT LTD.,	DR
		BEVCON WAYORS PVT.LTD.	DR
		I & B ENGINEERS PVT LTD	DR
		TECHNO IMPEX	DR
28	Internal / External Scrapers & Skirt Board Sealing System	As per BHEL approved source.	
29	Roller SCREENS	POSCO PLANT ENGINEERING CO., LTD.,	DR
		ELECON	Approved
		msel	Approved
		Thyssen	Approved
		Electro Zavod (India) Pvt Ltd.	DR
30	RPG GATES	BENGAL TOOL	Approved
		MSEL	Approved
		DA ENGG.	Approved
		HMTC ENGINEERING CO (KOLKATA) PVT LTD	Approved

## SAGARDIGHI THERMAL Power EXTENSION PROJECT

## PHASE-III, UNIT#5 (1 x660 MW)

31	HVAC System	shall be as per approved sources listed in Package items in Main Plant Package area.	
32	REDUCTION GEAR BOX	PREMIUM ENERGY TRANSMISSION	Approved
		FLENDER LIMITED	Approved
		ELECON ENGINEERING CO. LTD.	Approved
33	FLUID COUPLING	VOITH	Approved
		PREMIUM ENERGY TRANSMISSION	Approved
		FLUIDOMAT	Approved
34	FLEXIBLE GEAR COUPLING	GMB MFG. (P) LTD., KOLKATA	Approved
		HI-CLIFF	Approved
		FENNER	Approved
		LOVEJOY	Approved
		WELLMAN	Approved
		CONCORD	Approved
		ELECON ENGINEERING COMPANY LIMITED	Approved



**SAGARDIGHI THERMAL Power EXTENSION PROJECT  
PHASE-III, UNIT#5 (1 x660 MW)**

SL. NO.	Item Description	Vendor Name	Remarks
1	Ash Slurry Pumps	SAM TURBO INDUSTRY PRIVATE LTD	Approved
		WIER MINERALS (India) Pvt. Ltd	Approved
		INDURE PVT. LTD.	Approved
		METSO MINERALS (INDIA) PVT LTD.,	Approved
2	Water Pumps & Accessories	KIRLOSKAR BROTHERS LIMITED	Approved
		Flowmore Limited, Gurgaon	Approved
		BEACON WEIR LTD, CHENNAI	Approved
		Kishor Pumps Pvt. Ltd., Chennai	Approved
		Maxflow pumps india Pvt Ltd.	Approved
		Wilo Mather and Platt Pumps Pvt Ltd	Approved
3	ERW Pipes	STEEL AUTHORITY OF INDIA LTD.	Approved
		WELSPUN GUJARAT STAHL ROHERN LTD	Approved
		TATA	Approved
		JCO GAS PIPE LIMITED	Approved
		TUBES INDIA	Approved
		RATNAMANI METALS & TUBES LTD	Approved
		MAHARASHTRA SEAMLESS LIMITED	Approved
		JINDAL PIPES LIMITED	Approved
4	Compressors	ATLAS COPCO (INDIA) LIMITED	Approved
		ELGI EQUIPMENTS LTD	Approved
		INGERSOLL- RAND (INDIA) LIMITED	Approved
5	FLUIDIZING AIR HEATER	ESCORTS	Approved
		SPHEREHOT	Approved
		RAYCOLD	Approved
		INDURE PVT. LTD.	Approved
6	Cast Basalt Lined bends/ fittings/ pipes	TURBO ENGINEERS (CBE)	Approved
		INDURE PVT. LTD.	Approved
		DEMECH	Approved
		ENVIRO ABRASION	Approved
		Densen Technologies, Thane	Approved
		Deccan Mechanical and Chemical Industries Pvt. Ltd.,	Approved
7	ALLOY C.I. FITTINGS & LINERS	MENON METALLIKS	Approved
		CRAWLEY & RAY	Approved
		SAM CASTINGS	Approved
		CRESENT	Approved

8	E O T CRANE / MANUAL / Electric HOIST	shall be as per approved sources listed in Mechanical Equipment in Main Plant Package area.	
9	Gear Box	R&D MULTIPLES (METAL CAST) PVT. LTD.	Approved
		ESSENTIAL POWER TRANSMISSION PVT.LTD	DR
		KATEEL Engineering Industry Pltd	DR
		PREMIUM TRANSMISSION LIMITED	Approved
		New Allenburry	Approved
10	Couplings	ESCO COUPLINGS & TRANSMISSIONS PVT LTD	Approved
		PREMIUM TRANSMISSION LIMITED	Approved
		ELECON ENGINEERING COMPANY LIMITED	Approved
11	Air conditioning	shall be as per approved sources listed in Package items in Main Plant Package area.	
12	Ventilation System	shall be as per approved sources listed in Package items in Main Plant Package area.	
13	Valves/Gate	shall be as per approved sources listed in Mechanical Equipment in Main Plant Package area.	
14	TWIN LOBE TYPE ROTARY FLUDIZING AIR BLOWER	SWAM PNEUMATICS	Approved
		KAY INTERNATIONAL	Approved
		EVEREST	Approved



SAGARDIGHI THERMAL Power EXTENSION PROJECT PHASE-III, UNIT#5 (1 x660 MW)			
Sl. NO.	Item Description	Vendor Name	Remarks
1	Electrical Valve Actuators	AUMA (I) LTD., BANGALORE	Approved
		AUMA, GERMANY	Approved
		LIMITORQUE (I) LTD, FARIDABAD	Approved
		LIMITORQUE, US	Approved
		ROTORK CONTROLS (I) LTD, CHENNAI & BANGALORE	Approved
		ROTORK, UK	Approved
		NIPPON GEAR CO., JAPAN	DR
2	OIL FILLED TRANSFORMER ( More than 10 MVA)	BHEL	Approved
		GE	Approved
		AREVA T & D INDIA LIMITED	Approved
		FUJI	Approved
		ABB	Approved
		ALSTOM	Approved
3	OIL FILLED SERVICE TRANSFORMER ( Applicable only for less than 10 MVA)	KIRLOSKAR ELECTRIC CO.LTD. Mysore	Approved
		BHEL	Approved
		SCHNEIDER ELECTRIC INFRASTRUCTURE LIMITED	DR
		TOSHIBA TRANSMISSION & DISTRIBUTION SYSTEMS(i) PVT.LTD.,MEDAKH	DR
		CROMPTON GREAVES LTD.	Approved
		AREVA T & D INDIA LIMITED ,	Approved
		MARSONS LIMITED	Approved
		VOLTAMP TRANSFORMERS LTD.	Approved
4	SEGREGATED PHASE BUSDUCTS	BHEL	Approved
		L&T	Approved
		SIEMENS	Approved
		ALSTOM LTD.	Approved
		BEST & CROMPTON	Approved
5	ISOLATED PHASE BUSDUCT	BHEL	Approved
		SIMELECTRO, FRANCE	Approved
6	HT MOTORS (above 500 kW)	ABB	Approved
		BHEL	Approved
		SIEMENS	Approved
7	HT MOTORS (upto 500 kW)	ABB	Approved
		BHEL	Approved
		SIEMENS	Approved
		CROMPTON GREAVES	Approved

8	ELECTRIC LT MOTOR (ABOVE 90 KW)	CG POWER AND INDUSTRIAL SOLUTIONS LIMITED	Approved
		MARATHON ELECTRIC MOTORS INDIA LIMITED	Approved
		ABB	Approved
		SIEMENS	Approved
9	ELECTRIC LT MOTOR (UPTO 90 KW)	CG POWER AND INDUSTRIAL SOLUTIONS LIMITED	Approved
		MARATHON ELECTRIC MOTORS INDIA LIMITED	Approved
		ABB	Approved
		SIEMENS	Approved
		KIRLOSKAR	Approved
		BHARAT BIJLEE	Approved
10	HT SWITCHGEAR (11KV, 3.3 KV)	AREVA LTD.	Approved
		BHEL	Approved
		Schneider	Approved
		SIEMENS LTD	Approved
11	LT Switch Gear Panel [PMCC, PCC & MCC]	Siemens India Ltd	Approved
		GE India Industrial pvt Ltd	Approved
		Schneider Electric India pvt Ltd	Approved
		ABB	Approved
		AREVA LTD.	Approved
		LARSEN & TOUBRO LTD.	Approved
12	TRANSFORMER (DRY TYPE)	VOLTAMP	Approved
		AREVA	Approved
		CGL	Approved
		BHEL	Approved
13	NON SEGREGATED PHASE BUS DUCTS	KGS Engineering Limited	Approved
		L&T	Approved
		SIEMENS	Approved
		ALSTOM LTD.	Approved
		BEST & CROMPTON	Approved
14	ACDB, DCDB, , MLDB, ELDB, PDB, WELDING DB, VENTILATION DB	Siemens India Ltd	Approved
		GE India Industrial pvt Ltd	Approved
		Unilec Engineers Ltd	Approved
		Schneider Electric India pvt Ltd	Approved
		ABB	Approved
		AREVA LTD.	Approved
15	LOCAL STARTER PANEL, LOCAL CONTROL PANEL, LIGHTING PANEL	L & T	Approved
		Schneider	Approved
		L & T	Approved
		Siemens	Approved
		UNILEC ENGINEERS LTD.	Approved
		AREVA LTD.	Approved
16	Vacuum Interrupter, 3.6kV/40kA	PYROTECH	Approved
16	Vacuum Interrupter, 3.6kV/40kA	Bharat Electronics Ltd.	Approved
17	Vacuum Interrupter, 12kV/50kA	Eaton Incorporation	Approved



18	Air Circuit Breaker (ACB)	ABB	Approved
		Schneider	Approved
		L & T	Approved
		Siemens (3WL model only)	Approved
		AREVA LTD.	Approved
		GE-POWER	Approved
19	Molded case circuit breakers (MCCB)/Motor Protection Circuit Breaker (MPCB)/ Power Contactor/Aux. Contactor/ Thermal Overload Relay (OLR)/SFU	ABB	Approved
		Schneider	Approved
		L & T	Approved
		Siemens	Approved
		GE-POWER	Approved
20	Miniature Circuit Breaker (MCB)	ABB	Approved
		Schneider	Approved
		L & T	Approved
		Siemens	Approved
		GE-POWER	Approved
		LEGRAND	Approved
21	Electronic Motor Protection Relay (EMPR)	ABB	Approved
		Schneider	Approved
		Siemens	Approved
		GE-POWER	Approved
22	Current transformer / Voltage Transformers (VT/PT)/ Control Transformers(CST) upto 1.1KV	Automatic Electric	Approved
		Prayog Electricals	Approved
		Precise Electricals	Approved
		Kappa Electricals	Approved
		Pragati Electricals	Approved
		Indcoil	Approved
23	Interposing Relays	Jyoti	Approved
		OEN	Approved
		PLA	Approved
		Schneider	Approved
		GUARDIAN	Approved
		OMRON	Approved
24	Numerical Relay	Asea Brown Boveri Ltd., Vadodara	Approved
		Asea Brown Boveri Limited, Bangalore	Approved
		GE (Alstom)	Approved for MICOM Series
		Siemens Ltd.	Approved for SIPROTEC Series
		Schnieder Electric Infrastructure limited	Approved for MICOM Series

25	Static / Electromechanical / Auxiliary / Tripping Relays	Asea Brown Boveri Ltd., Vadodara	Approved
		Asea Brown Boveri Limited, Bangalore	Approved
		Schnieder Electric Infrastructure limited	Approved
		GE T & D India Limited	Approved
		Siemens Ltd.	Approved
		Alstom, Chennai	Approved
26	Energy Meters	SCHNEIDER CONZERVE	Approved
		Secure Meters (SEMS)	Approved
27	Multifunction Meter	Secure Meters (SEMS)	Approved
		SIEMENS Ltd.	Approved
		Schneider	Approved
28	Alarm Annunciators	MINILEC India Pvt Ltd.	Approved
		Accord Electro-Technics Pvt. Ltd.	Approved
		Alan Instrumentation Pvt. Ltd.	Approved
		JVS Electronics Pvt. Ltd.	Approved
		PROCON Instrumentation (P) Ltd.	Approved
		VESTAL Electronics	Approved
29	Timer/ TIME DELAY RELAY	ABB	Approved
		Schneider	Approved
		L & T	Approved
		Siemens	Approved
		GE-POWER	Approved
30	Digital Indicating meters	Automatic Electric Limited (AEL)	Approved
		RISHABH Instruments Pvt Ltd.	Approved
		L&T	Approved
		MECO Instrument Pvt. Ltd.	Approved
		MASIBUS AUTOMATION & INSTRUMENTATIO, GANDHI NAGAR	Approved
		Secure	Approved
		Schneider/conzerv	Approved
31	Analog Indicating meters	Automatic Electric Limited (AEL)	Approved
		MECO Instrument Pvt. Ltd.	Approved
		RISHABH Instruments Pvt Ltd.	Approved
		ABB	Approved
		GOSSEN	Approved
		YOKOGAWA	Approved
		PYROTECH Electronics Pvt. Ltd.	Approved
32	Transducers	SELEC Controls Pvt. Ltd.	Approved
		Camille Bauer, Germany	Approved
		Automatic Electric Limited (AEL)	Approved
		ELSTER Metering Pvt Ltd, Mumbai	Approved
		Siemens	Approved
		MASIBUS Automation and Instruments (P) Ltd.	Approved
33	Control / Selector Switches	Southern Transducers Pvt. Ltd.	Approved
		KAYCEE Industries Ltd., Mumbai	Approved
		L & T (Salzer)	Approved
		Reliable Electronic Components Pvt. Ltd (RECOM)	Approved
		SETON Electrical Products	Approved
		SWITRON Devices	Approved

34	Discrepancy switch	Asea Brown Boveri Limited(ABB)	Approved
		Control Dynamics	Approved



35	FUSE Base with holder	ABB	Approved
		Schneider	Approved
		L & T	Approved
		Siemens	Approved
		GE-POWER	Approved
36	FUSES (Power/Control)	GE-Power	Approved
		Siemens	Approved
		L & T	Approved
		Schneider	Approved
		COPPER BUSSMANN	Approved
		ABB	Approved
37	Indicating Lamp	Siemens	Approved
		Vaishno	Approved
		L & T (ESBEE)	Approved
		Schneider	Approved
		ABB	Approved
		SECO	Approved
		TEKNIK	Approved
38	Push Button	Siemens	Approved
		Vaishno	Approved
		L & T (ESBEE)	Approved
		TEKNIK	Approved
		Schneider	Approved
		ABB	Approved
39	Disturbance Recorders / Event Logger	Asea Brown Boveri Limited (ABB)	Approved
		Alstom T&D India Ltd, Chennai	Approved
		Ametek Power Instruments, USA	Approved
		QUALITROL HATHWAY, UK	Approved
40	Time Synchronizer	SERTEL, Chennai	Approved
		ARBITER, USA	Approved
		SEL, USA	Approved
		MASIBUS Automation and Instruments (P) Ltd.	Approved
41	(Indoor) CT / PT up to 11 kV, CBCT,Aux. CT / PT (ICT)	Prayog Electricals (P) Ltd.	Approved
		Pragati Electricals Pvt. Ltd.	Approved
		Silkaans Elect. Mfg. Co. Pvt. Ltd.	Approved
42	Surge Suppressor/Arrestor (Less than 15KV)	Raychem	Approved
		CGL	Approved
		Elpro	Approved
		Oblum Electrical Industries (P) Ltd.	Approved
43	Bus Transfer Scheme Panel(Numerical )	Aartech Solonics Ltd.	Approved
		Asea Brown Boveri Ltd.	Approved
44	Data Concentrator	ABB	Approved
		Schneider	Approved
		SIEMENS	Approved
		GE(ALSTOM)	Approved

45	Ethernet Switches	RUGGEDCOM	Approved
		NETGEAR	Approved
		HIRSCHMANN	Approved
		MOXA	Approved
		CISCO	Approved
46	Terminals Block	Phoenix	Approved
		Connect well	Approved
		Elemex	Approved
		Wago	Approved
47	Cable Glands	HEX	Approved
		Commet	Approved
		DOWELLS	Approved
		Jainson	Approved
		3D	Approved
48	Cable Lugs	Sunil & Co.	Approved
		HEX	Approved
		Commet	Approved
		DOWELLS	Approved
		Jainson	Approved
49	Local Motor Starter	3D	Approved
		Sunil & Co.	Approved
		L & T	Approved
		Schneider	Approved
50	LPBS ( NON-FLAME PROOF)	ABB	Approved
		BCH	Approved
		L&T	Approved
		SCHNEIDER	Approved
51	LPBS (FLAME PROOF)	Tecknic Controls	Approved
		SIEMENS	Approved
52	Industrial Switch & Socket / Receptacles	BALLIGA	Approved
		EX-PROTECTA	Approved
		Schneider	Approved
		Anchor	Approved
		Bajaj	Approved
		Philips	Approved
		crompton Greaves	Approved
		BEST & CROMPTON ENGG. LIMITED	Approved
53	ISOLATING SWITCH	AJMERA INDUSTRIES & ENGG. WORKS	Approved
		BCH Electric	Approved
		SALZER, L&T	Approved
		SIEMENS	Approved
		ALSTOM LTD.	Approved
		GE -- POWER	Approved
		SCHNEIDER	Approved
		ABB	Approved
		KAYCEE	Approved



54	SYNCHROSCOPE	AUTOMATIC ELECTRIC	Approved
		GEC - ALSTHOM	Approved
55	EARTH LEAKAGE CB	SCHNEIDER	Approved
		L&T	Approved
		SIEMENS	Approved
		ABB	Approved
56	EARTH LEAKAGE RELAY [ELR] ALONGWITH CBCT	AREVA	Approved
		PRO'KDEVICES	Approved
57	EARTH LEAKAGE RELAY [ELR] ALONGWITH CBCT	AREVA	Approved
		PRO'KDEVICES	Approved
58	PANEL SPACE HEATER	C&S ELECTRIC	Approved
		SPACEAGE	Approved
59	Neutral Grounding Transformer	Pragati Electricals Pvt. Ltd., Thane	Approved
		Prayog Electricals Pvt. Ltd., Pune	Approved
60	Lightning Arrester for Busduct	Elpro International Ltd., Pune	Approved
		Oblum Electronics, Hyderabad	Approved
61	Surge Capacitor	ABB Ltd., Bangalore	Approved
		Madhav Capacitor Pvt. Ltd., Pune	Approved
62	NEUTRAL GROUNDING RESISTOR	LACHHMAN ELECTRONICS, NEW DELHI	Approved
		RSI SWITCHGEAR PVT. LTD., Bhiwadi Extn, INDIA	Approved
		RESITECH ELECTRICALS PVT.LTD. KOLKATA	Approved
		S.R.NARKHEDE ENGG.PVT.LTD. PUNE	Approved
63	TREFOIL CLAMPS	AJMERA INDUSTRIAL & ENGINEERING WORKS, MUMBAI	Approved
		ELECTROMAC INDUSTRIES, MUMBAI	Approved
		MOULDED FIBREGLASS PRODUCTS, KOLKATA	Approved
		SUMIP COMPOSITES PVT.LTD. Ahmedabad	Approved
64	CABLE TRAYS & ACC	INDUSTRIAL PERFORATION (I) PVT.LTD.	Approved
		PREMIER POWER PRODUCTS (CAL) PVT. LTD., Howrah	Approved
		PATNY SYSTEMS (P) LTD	Approved
		PARMAR METALS PVT.LTD.	Approved
		UNITECH FABRICATORS and ENGINEERS PVT LTD	Approved
		RATAN PROJECTS & ENGINEERING CO. PVT.LTD., Howrah	Approved
		RABI ENGINEERING WORKS PVT. LTD., Kolkata	Approved

65	CABLE TRAY SUPPORT SYSTEM- WELDED(GALV)	INDUSTRIAL PERFORATION (I) PVT.LTD., Kolkata	Approved
		PREMIER POWER PRODUCTS (CAL) PVT. LTD., Howrah	Approved
		UNITECH FABRICATORS and ENGINEERS PVT LTD	Approved
		PATNY SYSTEMS (P) LTD	Approved
		RATAN PROJECTS & ENGINEERING CO. PVT.LTD., Howrah	Approved
		RABI ENGINEERING KOLKATA	Approved
		HOWRAH	Approved
66	ABOVE GROUND EARTHING MATERIALS	INDUSTRIAL PERFORATION (I) PVT.LTD., Kolkata	Approved
		PREMIER POWER PRODUCTS (CAL) PVT. LTD., Howrah	Approved
		PATNY SYSTEMS (P) LTD, HYDERABAD	Approved
		UNITECH FABRICATORS and ENGINEERS PVT LTD	Approved
		RATAN PROJECTS & ENGINEERING CO. PVT.LTD., Howrah	Approved
		RABI ENGINEERING WORKS PVT. LTD.	Approved
67	CABLE TERM.& JOINT KITS	3M Electro and Communication India P.Ltd	Approved
		RAYCHEM RPG PRIVATE LIMITED	Approved
68	FIRE SEALING SYSTEM	3M INDIA LIMITED, Bangalore	Approved
		HILTI India Pvt. Ltd., New Delhi	Approved
		LLOYD INSULATIONS (INDIA) LIMITED, Chennai	Approved
		MULTI KILFIRE PVT LTD, VADODARA	Approved
		VIJAY SYSTEMS ENGINEERS PVT.LTD., MUMBAI	Approved
69	ELECTRICAL - HEAT TRACING	THERMOPADS PVT.LTD.,	Approved
		XICON INTERNATIONAL LTD.	Approved
		THERMON INDIA PVT. LTD.	Approved
		RAYCHEM RPG LIMITED	Approved
70	HT XLPE CABLES	CABLE CORPORATION OF INDIA LTD.	Approved
		UNIVERSAL CABLES LTD.	Approved
		KEC INTERNATIONAL LIMITED	Approved
		RAVIN CABLES LIMITED	Approved
		KEI INDUSTRIES LTD., ALWAR	Approved
		POLYCAB WIRES PVT. LTD. Daman	Approved
		UNIVERSAL CABLES LTD., SATNA	Approved
71	LT XLPE POWER CABLE	GEMSCAB INDUSTRIES LTD.	Approved
		SUYOG ELECTRICALS LTD.	Approved
		RAVIN CABLES LIMITED	Approved
		CORDS CABLE INDUSTRIES LTD., BHIWADI DIST.	Approved
		CMI LTD.	Approved
		CRYSTAL CABLE INDUSTRIES LTD., HOWRAH	Approved
		KEI INDUSTRIES LTD., ALWAR	Approved
		KEC INTERNATIONAL LIMITED, Silvassa	Approved

	POLYCAB WIRES PVT. LTD., Daman	Approved
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72	LT PVC CONTROL CABLE	Advance Cable Technologies (P) Ltd., Bengaluru	Approved
		CORDS CABLE INDUSTRIES LTD., BHIWADI DIST.	Approved
		CMI LTD.	Approved
		CRYSTAL CABLE INDUSTRIES LTD., HOWRAH	Approved
		KEI INDUSTRIES LTD., ALWAR	Approved
		KEC INTERNATIONAL LIMITED, Silvassa	Approved
		POLYCAB WIRES PVT. LTD., Daman	Approved
		RAVIN CABLES LIMITED	Approved
		UNIVERSAL CABLES LTD., SATNA	Approved
73	SCREENED CONTROL CABLES	CORDS CABLE INDUSTRIES LTD., BHIWADI DIST.	Approved
		DELTON CABLES LTD. FARIDABAD	Approved
		KEI INDUSTRIES LTD., ALWAR	Approved
		POLYCAB WIRES PVT. LTD., Daman	Approved
		THERMO CABLES LTD. HYDERABAD	Approved
74	LT XLPE FIRE SURVIVAL CABLES	KEI INDUSTRIES LTD., ALWAR	Approved
		POLYCAB WIRES PVT. LTD., Daman	Approved
75	DC LEAD ACID BATTERIES	EXIDE INDUSTRIES LTD, KOLKATA	Approved
		HOPPECKE BATTERIEN GMBH & CO.KG,	Approved
76	DC Ni-Cd BATTERIES	HBL Power Systems Ltd Hyderabad	Approved
77	DC BATTERY CHARGER	CHHABI ELECTRICALS PVT.LTD.(I)	Approved for Capacity < 100 AH
		AMAR RAJA POWER SYSTEMS, TIRUPATHI	Approved for Capacity < 100 AH
		Chloride Power Systems & Solutions Ltd., Kolkata	Approved
		HBL POWER SYSTEMS LTD,	Approved
		STATCON ENERGIAA PRIVATE LIMITED,Hapur	Approved
78	MS ROD FOR BELOW GROUND EARTHING	RASHTRIYA ISPAT NIGAM LIMITED	Approved
		STEEL AUTHORITY OF INDIA LTD.	Approved
79	STATION LIGHTING SYSTEM	BAJAJ ELECTRICALS LTD., PUNE	Approved
		CROMPTON GREAVES LTD.	Approved
		PHILIPS INDIA LTD.	Approved
80	LIGHTING TRANSFORMERS	SUDHIR TRANSFORMERS LIMITED	Approved
		INDCOIL TRANSFORMERS PVT LTD	Approved
81	LIGHTING MAST	BAJAJ ELECTRICALS LIMITED	Approved
		CROMPTON GREAVES CONSUMER ELECTRICALS LIMITED	Approved

82	LIGHTING POLE	BOMBAY TUBE & POLES CO..	Approved
		BAJAJ ELECTRICALS LTD.	Approved
83	LIGHTING WIRE	CORDS CABLE INDUSTRIES LTD	Approved
		DELTON CABLES LTD.	Approved
		KEC	Approved
		KEI INDUSTRIES LTD.	Approved
		NICCO CORPORATION LTD.	Approved
		POLYCAB WIRES PVT.LTD	Approved
		TORRENT CABLES LTD.	Approved
		UNIVERSAL CABLES D.	Approved
		Finolex	Approved
		CMI Energy India Pvt. Ltd.	Approved
		Elkay Telelinks Ltd.	Approved
		Havells India Ltd	Approved
		Paramount Communications Ltd.	Approved
		Ravin Cables Ltd	Approved
		Special Cables Pvt. Ltd.	Approved
		Anchor	Approved
		CABLE CORPORATION OF INDIA	Approved
		RR Kabel Limited	Approved
		Thermo Cables Limited	Approved
84	HVR Transformer and EC Panel	ADOR POWERTRON LTD.,	DR
		BHARAT HEAVY ELECTRICALS LIMITED	Approved
		KRAFT POWERCON INDIA PRIVATE LTD	DR
85	Rubber Bellow for Bus Duct	Cori Engineers Pvt. Ltd., Chennai	Approved
		Resistoflex Pvt. Ltd., Noida	Approved
		United Rubber Industries, Mumbai	Approved
86	Epoxy Insulator for Bus Duct Package	A-Bond Strands Pvt. Ltd., Chennai	Approved
		Baroda Bushing & insulator, Vadodara	Approved
		Baroda Mould & Dies, Vadodara	Approved
		Ganpati Fibertech India (P) Ltd.	Approved
87	Epoxy Seal Off Bushing for Bus Duct Package	A-Bond Strands Pvt. Ltd., Chennai	Approved
		Baroda Bushing & insulator, Vadodara	Approved
		Baroda Mould & Dies, Vadodara	Approved
88	Current Transformer for Bus Duct Package	Instrans Engg & Mfg, Bangalore	Approved
		Pragati Electricals Pvt. Ltd., Thane	Approved
		Prayog Electricals Pvt. Ltd., Pune	Approved
		Silkaans Electrical Mfg. Co. Pvt. Ltd., Bangalore	Approved
89	Voltage/ Potential Transformer for Bus Duct Package	Instrans Engg & Mfg, Bangalore	Approved
		Pragati Electricals Pvt. Ltd., Thane	Approved
		Prayog Electricals Pvt. Ltd., Pune	Approved
		Silkaans Electrical Mfg. Co. Pvt. Ltd., Bangalore	Approved



90	Hot Air Blowing Equipment for Bus Duct	Elmech Pneumatic Industries	Approved
		Melcon Engg. New Delhi	Approved
		Powergear Ltd	Approved
91	Air Pressurization Equipment for Bus Duct Package	Elmech Pneumatic Industries, New Delhi	Approved
		Melcon Engineers Pvt. Ltd., New Delhi	Approved
		Powergear Ltd	Approved
92	LAVT & NG Cubicle Assembly for Bus Duct Package	BHEL-RUDRAPUR	Approved
		Pyrotech Electronics Pvt. Ltd., Udaipur	Approved
		RSI Switchgear Pvt. Ltd., Gurgaon	Approved
		Busbar Systems India Ltd.	Approved
		Powergear Ltd.	Approved



93	Copper Strip Flexible/Copper Braided Flexible for Bus Duct Package	B.B. Electro Technique, Mumbai/Thane	Approved
		Shree Cable & Conductors Pvt. Ltd., Bhopal	Approved
94	DG SET ENGINE	CUMMINS	Approved
		MITSHUBISHI	DR
		CATERPILLAR	Approved
95	ALTERNATOR	NIDEC-LEROY SOMER	Approved
		CATERPILLAR	Approved
		KIRLOSKAR ELECTRIC	Approved
		CUMMINS GEN TECH.(STAMFORD)	Approved
96	DG SET ASSEMBLERS	JAKSON LTD.	Approved
		POWERICA LTD.	Approved
97	DG SET BATTERY BANK	EXIDE	Approved
		HBL	Approved
		CUMMINS	Approved
98	DG SET CONTROL PANELS / AUX.DIST. BOARD	JAKSON LTD	Approved
		PYROTECH	Approved
99	ALUMINUM TUBE	Hindalco Industries Limited	Approved
		Jindal Aluminium Ltd Bangalore Karnataka	Approved
		Balco	Approved
		Alom Extrusions Ltd.	Approved
100	CLAMPS & CONNECTORS	Electromech & Transtech Private Limited Kolkata West Bengal	Approved
		Klemmen Engineering Corporation Chennai Tamil Nadu	Approved
		Peevee Engineering Enterprises Bangalore Karnataka	Approved
		Utsav Electro-Mech Pvt Ltd Vadodara Gujarat	Approved

101	SWITCHYARD CONTROL PANELS	ABB India Limited	Approved
		GE T&D India Limited Noida Uttar Pradesh	Approved
		Schneider Electric Infrastructure Limited Noida Uttar Pradesh	Approved
		Siemens Ltd	Approved
102	SPACER COUPLING (REGIFLEX TYPE)	SIEMENS LTD	Approved
		ESCO COUPLING NV	Approved
		KTR Couplings (India) pvt.ltd	Approved
		UNIQUE TRANSMISSION INDIA P LTD.	Approved
		ESCO COUPLING & TRANSMISSION PVT LTD.	Approved
		Cubic Transmission pvt ltd unit-II	Approved
		RATHI TURBOFLEX PVT LTD	Approved
		Dipl.ing.Herwarth Reich GMBH	Approved
		Reich India ltd	Approved
		KTR KUPPLUNGSTECHNIK Gmbh	Approved
103	BAY CONTROL UNIT	ALSTOM	Approved
		SIEMENS	Approved
		ABB	Approved
104	FRP JUNCTION BOXES/ JUNCTION BOXES(POWER/CONTROL), LIGHTING JB	Jakson Engineers Limited	Approved
		Jasper Engineers Private Limited	Approved
		Mika Engineers	Approved
		Popular Switchgears Pvt Ltd	Approved
		Pyrotech Electronics Pvt Ltd	Approved
		RSI Switchgear Private Limited	Approved
		Sarvana Switchgears	Approved
		Unilec Engineers Ltd	Approved
105	MARSHALLING KIOSK	Mika Engineers Thane Maharashtra [MSE: MICRO]	Approved
		Popular Switchgears Pvt Ltd Nashik Maharashtra	Approved
		Pyrotech Electronics Pvt Ltd Udaipur Rajasthan	Approved
		RSI Switchgear Private Limited Bhiwadi Rajasthan	Approved
		RST Electricals Pvt. Ltd. Sahibabad Uttar Pradesh	Approved
		Sarvana Switchgears Bangalore Karnataka	Approved
		Unilec Engineers Ltd Gurgaon Haryana	Approved
106	PIPE STRUCTURE	Advance Steel Tubes Ltd. Ghaziabad Uttar Pradesh	Approved
		Associated Power Structures Pvt. Ltd. Vadodara Gujarat upto 400 kV System	Approved
		Goodluck India Limited Sikandrabad Uttar Pradesh	Approved
		Vijay Transmission Pvt. Ltd Raipur Chhattisgarh	Approved
		New Modern Technomech Pvt Ltd	Approved
		Rs Infraprojects Pvt. Ltd. Noida Uttar Pradesh	Approved
		UTKARSH TUBES & PIPES LIMITED Kolkata	Approved
		DEEPAK FASTNERS LTD	Approved



107	STRUCTURE HARDWARE	NAVEEN METAL INDUSTRIES, KOLKATA	Approved
		NEW INDIA ENGINEERING CORPORATION	Approved
		TECHMAN (INDIA)	Approved
108	SHIELD WIRE	Bharat Wire Ropes Ltd	Approved
109	STRING INSULATOR HARDWARE	Asbesco ( India ) Pvt. Ltd.	Approved
		Electromech & Transtech Private Limited	Approved
		EMC	Approved
		ITPPL	Approved
		TYCO	Approved
		Tag Corporation, Chennai	Approved
		IAC	Approved

110	400 kV SF6 BREAKERS	ABB	Approved
		CGL	Approved
		SIEMENS	Approved
		GE T&D India Limited	Approved
111	400 kV SWITCHYARD CURRENT TRANSFORMER	ABB	Approved
		CGL	Approved
		GE T&D India Limited	Approved
		BHEL	Approved
		SIEMENS	Approved
112	400 kV SWITCHYARD PT/POTENTIAL TRANSFORMER/VOLTAGE TRANSFORMER	ABB	Approved
		CGL	Approved
		SIEMENS	Approved
		ALSTOM	Approved
		BHEL	Approved
113	400 kV ISOLATOR	SIEMENS	Approved
		ABB	Approved
		GE T&D India Limited	DR
114	400 kV EARTH SWITCH	SIEMENS	Approved
		ABB	Approved
115	400 kV LATTICE STRUCTURE	GOOD LUCK STEEL TUBES LTD., BULANDSHAHAH (UP)	Approved
		UTKARSH TUBES AND PIPES LIMITED, KOLKATA, WEST BENGAL	Approved
		Richardson & Cruddas (1972) Ltd, NAGPUR	Approved
116	ACSR CONDUCTOR	HINDUSTAN VIDYUT PRODUCTS LTD., HARYANA	Approved
		GUPTA POWER INFRASTRUCTURE LTD., BHUBANESWAR	Approved
		HIREN ALUMINIUM Ltd., SILVASSA DADRA & NAGAR HAVELI	Approved
117	RAIL POLE	SAIL	Approved
		RINL	Approved
		TATA	Approved
118	CABLE for ROLLED -E-CHAIN BAY CONTROL UNIT	IGUS	Approved
		ALSTOM	DR
		SIEMENS	DR
		ABB	DR

119	Control and Relay Panel / SAS	ABB India Limited	Approved
		GE T&D India Limited	Approved
		Siemens Ltd	Approved
120	400KV LIGHTNING ARRESTOR	Crompton Greaves Ltd	Approved
		Elpro International Ltd	Approved
		Oblum Electrical Industries Pvt Ltd	Approved
121	400 kV DISC INSULATOR/ LONG ROD INSULATOR (120KN)/ BUS POST INSULATOR( For Switchyard)	BHEL	Approved
		NGK BIRLA, JAYASHREE	Approved
		W.S. INDUSTRIES LTD,CHENNAI	Approved
		INDIAN POTTERIES	Approved
		Saravana Global Energy Limited	Approved
		Aditya Birla Insulators (A unit of Aditya Birla Nuvo Ltd.)	Approved
		Modern Insulators Ltd.	Approved
ESP/HVR (Jhansi Works)			
122	CRGO Steel-ESP/HVR TRANSFORMERS UPTO 95 KVP, 1400 mAmps	Bralco Resources,Canada (Mill-A K Steel, USA)	Approved
		Nippon Steel Corporation , Japan	Approved
		Kawasaki Steel , Japan	Approved
		TKES , Germany	Approved
		POSCO, Korea	Approved
		Viz Stal, Russia	Approved
123	PICC (PAPER INSULATED COPPER CONDUCTOR)Conductor-ESP/HVR TRF	Shree Cables & Conductor, Bhopal	Approved
		BCPL , Raisen / Mandideep	Approved
		Shakti Insulated Wires, Ankleshwar / Mumbai	Approved
		Delta Trans Conductors Pvt. Ltd. Mumbai	Approved
		KSH International,I Mumbai	Approved
		Signet Conductors, Rewa	Approved
		NKM Sales, Mandideep	Approved
		Electromech, Rewa	Approved
		Chandra Metals, Allahabad	Approved
		Malwa Strips, Dewas	Approved
		Precision Wires India Ltd,	Approved
		Mimani Indore.	Approved
RIMA TRANSFORMER	Approved		
124	Press Board	Senapathy Whitley, Bangalore	Approved
		Raman Boards, Mysore	Approved
		H Weidman / Weidman Systems, Switzerland	Approved



125	Transformer Oil (Mineral Oil)-ESP/HVR TRF	Apar Industries, Mumbai	Approved
		Savita Oil Tech. Ltd. Mumbai	Approved
		Raj Petro Specialties Mumbai	Approved
		COLOMBIA PETRO CHEM, INDIA	Approved
		Savita Chemicals India Pvt. Silvasa	Approved
126	Transformer Oil (Silicon Oil)	GE Momentive Silicon, USA	Approved
		DOW Corning, USA	Approved
		Shin-ETSU, Singapore	Approved
127	Synthetic Rubber Bonded Cork Sheet	James Walker, UK	Approved
		NU Cork Product, Gurgaon	Approved
		Gujrat Cork And Rubber, Valsad	Approved
		Indian Cork Industries	Approved
128	OTI	Perfect Control, Chennai	Approved
		Precimeasure, Bangalore	Approved
129	Buchholz Relay	ATVUS Industries, Kolkata	Approved
		Press-N-Forge, Mumbai	Approved
		A.J Service, Mumbai	Approved
130	MOG	Sukrut Udyog, Pune	Approved
		ATVUS Industries, Kolkata	Approved
		Yogya Enterprises, Jhansi	Approved
		Press-N-Forge, Mumbai	Approved
Power Transformers Oil Filled( JHANSI WORKS)			
131	CRGO STEEL (Supplier)	AK STEEL, Netherlands/ USA	Approved
		NIPPON STEEL, JAPAN	Approved
		VIZSTAL, RUSSIA (Only M4 grade)	Approved
		POSCO, KOREA	Approved
132	PAPER INSULATED COPPER CONDUCTOR (PICC)	SHREE CABLES & CONDUCTORS BHOPAL	Approved
		KSH INTERNATIONAL CHAKAN,PUNE	Approved
		RIMA TRANSFORMER & CONDUCTORS BANGALORE	Approved
		BCPL, MANDIDEEP	Approved
		PRECISION WIRES INDIA LTD, SILVASSA.	Approved
		SHAKTI INSULATED WIRES PVT LTD, ANKLESHWAR	Approved
		CHANDRA METALS LTD. TELIARGANJ	Approved
DELTA TRANS CONDUCTORS(P)LTD. MUMBAI	Approved		



133	CONTINUOUSLY TRANSPOSED CONDUCTOR	ASTA INDIA PVT LTD	Approved
		KSH INTERNATIONAL PVT LTD	Approved
		PRECISION WEIR INDIA LTD	Approved
		SAMDONG	Approved
134	PRECOMPRESSED PRESSED BOARDS	ABB INDIA LIMITED, MYSORE	Approved
		ABB AB, SWEDEN.	Approved
		SENAPATHY WHITELEY PVT.LTD. BANGALORE	Approved
135	INSULATING OIL	Apar Industries, Mumbai	Approved
		Savita Oil Tech. Ltd. Mumbai	Approved
		Raj Petro Specialties Mumbai	Approved
		BPCL	Approved
136	BUCCHOLZ RELAY	P&B WEIR ELECTRICAL-UNIT 10, U.K	Approved
		PRESS-N-FORGE, MUMBAI	Approved
		A.J .SERVICES ( PRAYOG), MUMBAI	Approved
		SUKRUT ELECTRIC CO.PVT.LTD. PUNE	Approved
		VIAT INSTRUMENTS PVT. LTD. KOLKAT/AHMEDABAD	Approved
137	PRESSURE RELIEF VALVE	MESSKO GMBH GERMANY	Approved
		QUALITROL COMPANY LLC USA	Approved
		RAJSHI ENGINEERS JHANSI	Approved
		Atvus, Kolkata	Approved
		SUKRUT UDYOG PUNE	Approved
138	AIR CELL	PRONAL ASIA MANUFACTURING MALAYSIA	Approved
		UNIRUB TECHNO INDIA PVT. LTD. PUNE	Approved
139	MOLG	QUALITROL COMPANY LLC, USA	Approved
		MESSKO GMBH GERMANY	Approved
		Atvus, Kolkata	Approved
		PRESS-N-FORGE, MUMBAI	Approved
		YOGYA ENTERPRISES, JHANSI	Approved
		SUKRUT UDYOG PUNE	Approved
140	OTI / WTI/ RTD	PRECIMEASURE CONTROLS (PVT.) LTD., BANGALORE	Approved
		PERFECT CONTROL, CHENNAI	Approved
141	QFI/WFI	SUKRUT UDYOG	Approved
		VIAT INSTRUMENTS PVT LTD	Approved

142	CONDENSER BUSHING-OIP	BHEL	Approved
		CGL	Approved
		GE T&D	Approved
143	ON LOAD TAP CHANGER	M/S BHEL BHOPAL	Approved
144	RADIATORS	TTP TECHNOLOGIES PVT LTD	Approved
		CTR MANUFACTURING INDUSTRIES LTD	Approved
		GURURAJ RADIATORS PVT LTD	Approved
		HI-TECH RADIATORS PVT LTD	Approved
		P.E. ENGINEERS PVT LTD	Approved
		TRANSPARES LIMITED	Approved
		BHEL, BHOPAL	Approved
145	<del>N2 FIRE PROTECTION SYSTEM</del>	As per Approved Vendors of Fire Detection system Package for the Main Plant.	
146	BUSHING-RIP	NANJING, CHINA	DR
		HSP, GERMANY	DR
		TRENCH, CHINA	DR
		ABB, SWITZERLAND	DR
		MOSER GLAZER, SWITZERLAND	DR
		YASH HIGH VOLTAGE INSULATORS (up to 145 kV), VADODARA	DR
Dry Type Transformers( JHANSI WORKS)			
147	CRGO STEEL (Supplier)	Mill-A K Steel, USA/ Netherlands	Approved
		Metal One Corp.( Mill-Nippon Steel, Japan)	Approved
		TKES , Germany	Approved
		Novex Trading, Switzerland ( Mills - Viz Stahl	Approved
		POSCO IPPC, Pune (Mill-Posco, Korea)	Approved
148	COPPER CONDUCTOR	Mimani Wires, Indore	Approved
		Malwa Strips, Dewas	Approved
		Copral Insulated, Hosur	Approved
		BCPL, Raisen/ Mandideep	Approved
		M P Cupro metals, Bhopal	Approved
		SCR Wires, Tunkur	Approved
		Chandra Metals, Allahabad	Approved
		Pearl, Bangalore	Approved
		COSMOS Conductors, Tunkur	Approved
		Vimlesh Industries, Sonipat	Approved
		Permal Wallace Ltd. Bhopal	Approved
		Mica Ply, Bhopal	Approved

149	Fiber Glass Sheet	Glass Fiber Ltd. Mumbai	Approved
		Surendra Engg. Bhopal	Approved
		Texplas, Haridwar	Approved





150	Epoxy Insulators	Baroda Mould and Die, Vadodara	Approved
		Baroda Bushing, Baroda	Approved
		India Insulator, Miraj	Approved
		Epothane Civelec, Ghaziabad	Approved
		Quality Engg. & In sulation products, Bhopal	Approved
		A-Bond Strands PVI. Ltd, Chennai	Approved
151	Epoxy Casting Materials	Huntsmann Chennai	Approved
		Atul Ltd, Val sad	Approved
152	Sheet Metal Enclosure	Electro Auto Bhopal	Approved
		Shrao Engg. Bhopal	Approved
		Bansal Fabwel, Jhansi	Approved
		Anupam Industries, Jhansi	Approved
		R Industries, Bhopal	Approved
		Bharat Fabricators, Bhopal	Approved
		Mahadev Ind. Bhopal	Approved
153	Temperature Scanner	Pecon, Ahemdabad	Approved
		Precimeasure, Bangalore	Approved
Power Transformer (Bhopal Works)			
154	PRECOMPRESSED PRESSED BOARDS	ABB INDIA LIMITED, MYSORE	Approved
		ABB AB, SWEDEN.	Approved
		KOKUSAI PULP AND PAPER CO. LTD. JAPAN	Approved
		KREMPEL GMBH GERMANY	Approved
		OJI F-TEX CO. LTD. JAPAN	Approved
		SENAPATHY WHITELEY PVT.LTD. BANGALORE	Approved
		WEIDMANN ELEC.TECHNOLOGY A.G. SWITZERLAND	Approved
		ENPAY ENDUSTRIYEL PAZARLAMA VE YATIRIM A.S. TURKIYE	Approved



155	TRANSFORMER TANK	BHARAT HEAVY ELECTRICALS LTD BHOPAL	Approved
		BHOPAL ENGINEERING GOVINDPURA BHOPAL	Approved
		DUNHIL PRODUCTS GOVINDPURA BHOPAL	Approved
		ELECTRO AUTO INDUSTRIES GOVINDPURA BHOPAL	Approved
		E.M. ELECTRO MECHANICALS PVT.LTD GOVINDPURA BHOPAL	Approved
		GTV ENGINEERING LTD. GOVINDPURA BHOPAL	Approved
		MECH & FAB INDUSTRIES GOVINDPURA BHOPAL	Approved
		SIGMA HEAVY ENGG. INDUSTRIES GOVINDPURA BHOPAL	Approved
		SATYAM (FAB) INDUSTRIES PVT. LTD., BHOPAL	Approved
		SHRAO ENGG.WORKS GOVINDPURA BHOPAL	Approved
156	STEEL PLATE	STEEL AUTHORITY OF INDIA LTD	Approved
		IISCO	Approved
		RINL	Approved
		TISCO	Approved
157	CRGO STEEL (Supplier)	AK STEEL INTERNATIONAL B.V., USA (Regd. office at Netherlands)	Approved
		JFE SHOJI TRADE CORPORATION, JAPAN (Auth. Agent POSCO PUNE)	Approved
		NIPPON STEEL, JAPAN (Auth. Trader METAL ONE JAPAN)	Approved
		VIZSTAL, RUSSIA (Auth. Trader NOVEX TRADING	Approved
		POSCO KOREA (Auth. Agent POSCO-PUNE)	Approved
158	INSULATING OIL	APAR INDUSTRIES LTD., CHEMBUR, MUMBAI	Approved
		RAJ PETRO SPECIALITIES PVT LTD MUMBAI	Approved
		SAVITA OIL TECHNOLOGIES LTD. MUMBAI	Approved
159	PAPER INSULATED COPPER CONDUCTOR (PICC)	SHREE CABLES & CONDUCTORS BHOPAL	Approved
		KSH INTERNATIONAL CHAKAN,PUNE	Approved
		RIMA TRANSFORMER & CONDUCTORS BANGALORE	Approved
		BCPL, MANDIDEEP	Approved
		BHANDARY POWER LINE, MANIPAL	Approved
		PRECISION WIRES INDIA LTD, SILVASSA.	Approved
		SHAKTI INSULATED WIRES PVT LTD, ANKLESHWAR	Approved
		CHANDRA METALS LTD. TELIARGANJ	Approved
		M.P.CUPRO METALS PVT.LTD.BHOPAL.	Approved
		DELTA TRANS CONDUCTORS(P)LTD. MUMBAI	Approved

160	CONTINUOUSLY TRANSPOSED COPPER CONDUCTOR (CTC)	KSH INTERNATIONAL CHAKAN,PUNE	Approved
		PRECISION WIRES INDIA LTD, SILVASSA.	Approved
		SAMDONG KOREA	Approved
		ASTA, INDIA VADODARA	Approved
161	UNIMPREGNATED DENSIFIED WOOD	PERMALI WALLACE PVT. LTD. GOVINDPURA, BHOPAL	Approved
		SURENDRA COMPOSITES PVT LTD RAISEN	Approved
162	ON LOAD TAP CHANGER/ OFF CIRCUIT TAP CHANGER	BHEL BHOPAL	Approved
		ABB AB COMPONENTS SWEDEN	Approved
		MASCHINENFABRIK REINHAUSEN GERMANY	Approved
163	OIL CONDENSOR BUSHING	BHEL BHOPAL	Approved
		GE T&D INDIA LIMITED, HOSUR	Approved
		GRID SOLUTIONS, A GE AND ALSTOM JOINT VENTURE, ITALY	Approved
		ABB AB COMPONENTS, SWEDEN	Approved
		CG POWER & INDUSTRIAL SOLUTIONS LTD, NASHIK	Approved
164	BUCHLOZ RELAY	P&B WEIR ELECTRICAL-UNIT 10, U.K	Approved
		SUKRUT ELECTRIC CO.PVT.LTD. PUNE	Approved
		VIAT INSTRUMENTS PVT. LTD. KOLKATA	Approved
		VIAT INSTRUMENTS PRIVATE LIMITED UNIT- II SANAND	Approved
165	OTI / WTI/ RTD	PRECIMEASURE CONTROLS (PVT.) LTD., BANGALORE	Approved
		PERFECT CONTROL, CHENNAI	Approved
166	PRESSURE RELIEF VALVE	MESSKO GMBH GERMANY	Approved
		QUALITROL COMPANY LLC USA	Approved
		RAJSHI ENGINEERS JHANSI	Approved
		SUKRUT UDYOG PUNE	Approved
167	AIR CELL	PRONAL ASIA MANUFACTURING MALAYSIA	Approved
		UNIRUB TECHNO INDIA PVT. LTD. PUNE	Approved
168	MOLG	QUALITROL COMPANY LLC, USA	Approved
		MESSKO GMBH GERMANY	Approved
		SUKRUT UDYOG PUNE	Approved
169	OIL FLOW INDICATOR	SUKRUT UDYOG, PUNE	Approved
		VIAT INSTRUMENTS PRIVATE LIMITED UNIT- II AHMEDABAD	Approved



170	OIL PUMP	FLOW OIL PUMPS PVT. LTD. BANGALORE	DR
		NXL FLOW INSTRUMENTS BANGALORE	DR
		SPP PUMPS LIMITED ENGLAND	DR
171	COOLING FAN & MOTOR ASSLY	EPC ELECTRICAL PVT.LTD. KOLKATA	Approved
		MARATHON ELECTRIC MOTORS(INDIA)LTD KOLKATA	Approved
172	RADIATOR	BHEL BHOPAL	Approved
		CTR MANUFACTURING INDUSTRIES LTD. PUNE	Approved
		TTP TECHNOLOGIES PVT. LTD. BANGALORE	Approved
173	MARSHALLING BOX / CONTROL CABINET/RTCC	ASHOKA ELECTRONICS, BHOPAL	Approved
		ENTERPRISING ENGINEERS,BHOPAL	Approved
		PURNIMA ELECTRICAL INDUSTRIES , BHOPAL	Approved
		PYROTECH ELECTRONICS PVT. LTD. (UNIT-IV), UDAIPUR	Approved
		R.S.I.SWITCH GEAR PVT LTD. BHIWADI	Approved
174	TERMINAL CONNECTOR	KLEMMEN ENGINEERING CORPN., CHENNAI	Approved
		PEE VEE ENGG.ENTERPRISES, BANGALORE	Approved
175	GAS COLLECTING DEVICE	SUKRUT UDYOG, PUNE	Approved
		YOGYA ENTERPRISES, JHANSI	Approved
176	N2 BASED FIRE PROTECTION SYSTEM	CTR MANUFACTURING INDUSTRIES LTD. NAGPUR	DR
		EASUN-MR TAP CHANGERS (P) LTD, CHENNAI	DR
		SERGI TRANSFORMER EXPLOSION PREVENTION, GURGAON (HARYANA)	DR
		VENDERE SALES SERVICES (I) PVT. LTD. AURANGABAD	DR
		GK POWER TRANSMISSION COMPANY PVT. LTD., NAGPUR	DR
177	FIBRE OPTIC HOT SPOT TEMP MONITORING SYSTEM	LUXTRON CORPORATION DBA LUMASENSE TECHNOLOGIES, USA	DR
		MACHTECH ENGINEERING SOULUTIONS LLP, VASAI	DR
		PRECIMEASURE CONTROLS (PVT.) LTD, BANGALORE	DR
		QUALITROL COMPANY LLC, USA	DR

178	ONLINE DGA	A.EBERLE GMBH AND CO. KG GERMANY	DR
		MTE METER TEST EQUIPMENT AG SWITZERLAND (Installation & Commissioning of DGA by MTE-INDIA, New Delhi)	DR
		MORGAN SCHAFFER INC CANADA (M/S Doble)	DR
		GE KELMAN (Auth. Agent PCI PRECISION CASTING LIMITED DELHI)	DR
		QUALITROL COMPANY LLC USA	DR
		CHROMATOGRAPHY & INSTRUMENTS COMPANY, VADODARA	DR
179	INSULATOR	M/S BHEL ELECTRO-PORCELAIN DIVN. BANGALORE	Approved
		M/S CJI PORCELAIN PVT. LTD. KHURJA	DR
		M/S KHYATI CERAMICS. KALOL	DR
	HT MOTOR COMPONENTS (Bhopal Works)		
180	CACA COOLER	FITWELL CORPORATION	Approved
		KARNATAKA ENGINEERING ENTERPRISES	Approved
		LAXMI ENGG. IND.	Approved
		MEHTA INDUSTRIES	Approved
181	CACW COOLER	FITWELL CORPORATION	Approved
		KARNATAKA ENGINEERING ENTERPRISES	Approved
		LAXMI ENGG. IND.	Approved
		MEHTA INDUSTRIES	Approved
182	ANTIFRICTION BEARING	SKF	Approved
		FAG	Approved
183	COPPER SECTION/ ROUND/FLAT ROTOR BAR	BHANWARDEEP COPPER STRIPS(P)LTD	Approved
		COPPER STRIPS PVT LTD	Approved
		CHANDRA METALS LTD.	Approved
		MALWA STRIPS PVT.LTD.	Approved
		OMEGA ROLLING MILLS PVT LTD.	Approved
184	FORGED SHAFT	BHARAT FORGE LIMITED	Approved
		BAY-FORGE LTD.	Approved
		BHARAT HEAVY ELECTRICALS LTD	Approved
		GHAZIABAD ISPAT UDYOG LTD	Approved
		KISCO CASTINGS (INDIA) LTD.	Approved
		KISAAN STEELS PVT.LTD	Approved
		PUNJAB HAMMERS PVT.LTD.	Approved
		PAHLADRAI STEEL FORGING WORKS,	Approved
		STEEL AUTHORITY OF INDIA LIMITED	Approved
185	ENAMELLED MICA TAPED COPPER CONDUCTOR.	M.P.CUPRO METALS PVT.LTD.	Approved
		NKM CABLES & STRIPS(PVT)LTD.	Approved
		SHREE CABLES & CONDUCTORS (P) LTD	Approved
		VIMLESH INDUSTRIES(P)LTD.	Approved



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186	MICA TAPED CONDUCTORS	BHANWARDEEP COPPER STRIPS(P)LTD	Approved
		BCPL CONDUCTORS PVT.LIMITED	Approved
		COSMOS CONDUCTORS PVT.LTD.	Approved
		COPRAL INSULATED CONDUCTORS PVT.,LTD.	Approved
		CHANDRA METALS LTD.	Approved
		MIMANI WIRES PVT LTD	Approved
		MALWA STRIPS PVT.LTD.	Approved
		M.P.CUPRO METALS PVT.LTD.	Approved
		NKM CABLES & STRIPS(PVT)LTD.	Approved
		SHREE CABLES & CONDUCTORS (P) LTD	Approved
		VIMLESH INDUSTRIES(P)LTD.	Approved
187	RTD/BTD	JINDAL ELECTRONICS PRIVATE LIMITED	Approved
		TECHNO INSTRUMENTS	Approved
Note:-			
1	SUB ITEMS (not covered specifically in the Vendor List) for Power Transformer, DTT and HVR Transformer from BHEL Units.		BHEL Approved sources
2	SUB ITEMS (not covered specifically in the Vendor List) for HT Motors to be supplied from IS Motors.		BHEL Approved sources
3	SUB ITEMS (not covered specifically in the Vendor List) FOR Busduct package, supplies from BHEL- Rudrapur Unit		BHEL Approved sources

SAGARDIGHI THERMAL Power EXTENSION PROJECT PHASE-III, UNIT#5 (1 x660 MW)			
Sl No	Item	Vendor Name	Status
1	Severe Service Control Valve for BFP Re-Circulation / SH & RH Attenuation Control Valve	DRESSER VALVE INDIA PVT. LTD, Coimbatore	Approved
		CONTROL COMPONENTS INC.	Approved
		KSB MIL CONTROLS LIMITED	Approved but only for 9000 Series Valves
2	Oil Trip Valves ( FUEL OIL SYSTEM)	INSTRUMENTATION LTD., KERALA	Approved
		KSB MIL CONTROLS LIMITED, THIRISSUR DIST	Approved
		Kuehne Armaturen GmbH, Germany	DR
		SAMSON CONTROLS PRIVATE LIMITED	Approved
		MASCOT VALVES PVT. LTD, AHMEDABAD	Approved
3	NORMAL SERVICE CONTROL VALVE	DRESSER VALVE INDIA PVT. LTD, Coimbatore	Approved
		EMERSON PROCESS MANAGEMENT CHENNAI LIMITED, Chennai	Approved
		INSTRUMENTATION LTD., PALAKKAD	Approved
		Koso India Private Limited, Nashik	Approved
		PARCOL S.P.A.	Approved
		SEMPELL GmbH.	Approved
		DAUME REGELARMATUREN GMBH	DR
		KSB MIL CONTROLS LTD. Thrissur	Approved
		Valitalia S.P.A. , Italy	Approved
		WALDEMAR PRUSS ARMATURENFABRIK GMBH, Germany	Approved
4	Severe Service Control Valve for AUX PRDS	Control Component India Pvt. Ltd. Chittoor	Approved
		Daume Regelarmaturen GmbH, Isernhagen, Germany	Approved
		HOLTER REGELARMATUREN GmbH & CO., HOLTESTUKENBR OCK	Approved
		Koso India Private Limited, Nashik	Approved
		PARCOL S.p.A Canegrate MI, ITALY	Approved
5	VALVE:SOOT BLOWER PR	DRESSER VALVE INDIA PVT. LTD, Coimbatore	Approved
		CONTROL COMPONENTS INC.	Approved
		KSB MIL CONTROLS LIMITED	Approved
6	LP STARTUP CONTROL VALVES	CONTROL COMPONENT INDIA PVT LTD	Approved
		INSTRUMENTATION LTD.,	Approved
		EMERSON PROCESS MANAGEMENT CHENNAI	DR
		WELLAND & TUXHORN AG	Approved
		KOSO INDIA PRIVATE LIMITED.	Approved
		KSB MIL CONTROLS LIMITED	Approved



Sl No	Item	Vendor Name	Status
7	HIGH PR. STARTUP SCV	CONTROL COMPONENT INDIA PVT LTD, Bangalore	Approved
		SEMPELL GmbH., Germany	Approved
		KOSO INDIA PRIVATE LIMITED., Nashik	Approved
		PARCOL S.P.A., Milan Italy	Approved
8	HPBP Control Valve	SULZER-CCI AG, SWITZERLAND	Approved
		CONTROL COMPONENT INDIA PVT LTD, Bangalore	Approved
9	LP BYPASS SYSTEM	SULZER-CCI AG, SWITZERLAND	Approved
		CONTROL COMPONENT INDIA PVT	Approved
		WELLAND & TUXHORN AG	Approved
		HOLTER REGELARMATUREN GMBH & CO.	DR
10	SEAL STEAM VALVE/ LEAK STEAM VALVE WITH PNEUMATIC ACTUATOR	SAMSON CONTROLS PVT. LTD.	Approved
		INSTRUMENTATION LIMITED	Approved
		KSB MIL CONTROLS LIMITED	Approved
		GE OIL & GAS INDIA PRIVATE LIM	Approved
		WELLAND & TUXHORN AG	Approved
		HOLTER REGELARMATUREN GMBH & CO.	Approved
11	Air Filter Regulator  [Either from OEM/Authorised Source]	Parker Hannifin, Lebanon	Approved
		SHAVO NORGREN(INDIA)PVT LTD, BANGALORE	Approved
		JRU INSTRUMENTS (Formerly PLACKA)	Approved
12	HPT STEAM EVACUATION VALVE	GE OIL & GAS INDIA PRIVATE LTD	Approved
		HOLTER REGELARMATUREN GMBH & CO., GERMANY	Approved
		KSB MIL CONTROLS LIMITED, INDIA	Approved
		INSTRUMENTATION LIMITED	Approved
13	SOLENOID VALVE	ASCO (I) LTD.	Approved
		ROTEX AUTOMATION LTD.	Approved
		NUCON INDUSTRIES PVT LTD	Approved
		IMI NORGREN HERION PVT. LTD.	Approved
14	Bypass Rotameter	EUREKA INDLEQUIPMENT PVT., LTD., PUNE	Approved
		FLUIDYNE INSTRUMENTS PVT. LTD., CHEMBUR, MUMBAI	Approved
		PLACKA INSTRUMENTS INDIA PVT LTD, CHENNAI	Approved



Sl No	Item	Vendor Name	Status
		INSTRUMENTATION ENGINEERS PVT LTD.,JEEEDIMATLA,HYDERABAD	Approved
		TRANSDUCER & CONTROL PVT LTD, HYDERABAD	Approved
15	C&I Laboratory Furniture/ Computer Furniture	ADARSHA CONTROL SYSTEMS PVT. LTD., BANGALORE	Approved
		COSMOS MEDIA PRODUCTS PVT. LTD,GREATER NOIDA,UP	Approved
		FEATHERLITE OFFICE SYSTEMS PVT. LTD,BANGALORE	Approved
		GODREJ AND BOYCE MANUFACTURING CO.,ROORKEY, UTTARAKAND.	Approved
		HARMONY SYSTEMS, GREATER NOIDA, UP	Approved
		OTS OFFICETECH SYSTEMS (P) LTD,BANGALORE	Approved
		PYROTECH WORKSPACE SOLUTIONS PVT. LTD, UDAIPUR	Approved
16	CBLM Sys (3D Type)	APM, Israel	Approved
		EIP TECHNOLOGIES PVT. LTD.NOIDA/ Process Management Mumbai	Approved
17	CBLM Sys (Ultrasonic Or RADAR Type) Panel	ENDRESS + HAUSER INDIA PVT. LTD. MUMBAI	Approved
		KISTLER MORSE AUTOMATION LTD.,HYDERABAD	Approved
		KROHNE MARSHALL PVT LTD.,PUNE	Approved
		VEGA INDIA LEVEL & PRESSURE MEASUREMENT PVT LTD.,MUMBAI.	Approved
		EMERSON PROCESS MANAGEMENT ,MUMBAI.	Approved
		SIEMENS LIMITED, BANGALORE	Approved
18	CBLM Sys(StrainGauge Type) Sensor & Panel	KISTLER - MORSE AUTOMATION LTD., HYDERABAD	Approved
		VENTURE MEASUREMENT,US	Approved
		THERMO RAMSEY INC ,CHICAGO,US	Approved
19	CO Analyser	CHEMTROLS INDUSTRIES LIMITED, POWAI, MUMBAI	Approved
		FORBES MARSHALL CODEL PVT. LTD., PUNE	Approved
		SICK INDIA PVT LTD,MUMBAI.	Approved
		MARVEL ENGG COMPANY, CHENNAI	Approved

Sl No	Item	Vendor Name	Status
20	Compression Fittings	PARKER HANNIFIN INDIA PVT. LTD.,CHENGAL PATTU,TAMILANADU	Approved
		PRECISION ENGG INDUSTRIES, MUMBAI	Approved
		SWAGELOCK,USA	Approved
		TROUVAY & CAUVIN FRANCE	Approved
		HOKE	Approved
		METPRESS ENGINEERING WORKS, KOLKATA	DR
21	Condensate Pots	BALDOTA VALVE AND FITTING COMPANY PVT LTD,MUMBAI	Approved
		FLOWTECH, KOLKATA	Approved
		PRECISION ENGG INDUSTRIES, MUMBAI	Approved
		EXCEL HYDRO-PNEUMATICS PVT LTD,MUMBAI	DR
		PMT ENGINEERS,N.H.NO.-8, NARODA, AHMEDABAD	DR
		HP VALVES & FITTINGS (INDIA) PVT. L,MOGAPPAIR WEST, CHENNAI	DR
		ARCELLOR CONTROLS (INDIA), Ahmedabad	DR
22	Dust Density (Opacity) Monitor(Analyzer)	CODEL INTERNATIONAL LTD ,UK	Approved
		DURAG GMBH AND CO KG, HUMBURG,GERMANY	Approved
		LAND INSTRUMENTS INTERNATIONAL, ENGLAND (UK)	Approved
		SICK MAIHAK GMBH,GERMANY	Approved
23	Dust Density (Opacity) Monitor(panel)	CHEMTROLS INDUSTRIES LIMITED, POWAI,	Approved
		DURAG INDIA INSTRUMENTATION PVT LTD,BANGALORE	Approved
		SICK INDIA PVT LTD,MUMBAI.	Approved
		MARVEL ENGG COMPANY, CHENNAI	Approved
24	E/P Convector(if required)	FAIRCHILD INDIA PRIVATE LIMITED, NOIDA	Approved
		WATSON SMITH LTD ,UK	Approved
25	Smart Positioner	EMERSON PROCESS MANAGEMENT	Approved
		SIMENS	Approved
		ABB	Approved
		ASTEC VALVE & FITTINGS PVT. LTD,MUMBAI	Approved
		AURA INC, NEW DELHI	Approved
		BALDOTA VALVE AND FITTINGS PVT LTD,MUMBAI	Approved
		EXCEL HYDRO-PNEUMATICS PVT LTD, MUMBAI	Approved
		FLOWTECH, KOLKATA	Approved



Sl No	Item	Vendor Name	Status
26	Erection Material	FLUID CONTROLS PVT. LTD,PUNE	Approved
		HP VALVES & FITTINGS (INDIA) PVT LTD, CHENNAI	Approved
		MET LOK HYDRO PENUMATICS PVT LTD,MUMBAI	Approved
		METPRESS ENGINEERING WORKS, KOLKATA	Approved
		PANAM ENGINEERS LTD,MUMBAI	Approved
		PMT ENGINEERS,AHMEDABAD	Approved
		PRECISION ENGG INDUSTRIES, MUMBAI	Approved
		V.K.INDUSTRIES, BANGALORE	Approved
		VIKAS INDUSTRIAL PRODUCTS, NOIDA	Approved
		PAUL INDUSTRIES,HOWRAH	Approved
		NAV DURGA FORGING AND FITTINGS,THANE,MAHARASTRA	Approved
		SANDEEP INDUSTRIES,JALANDHAR,PUNJAB	Approved
27	FGA Insitu (SOX/NOX/CO/CO2)(Analyzer)	CODEL INTERNATIONAL LTD ,UK	Approved
		SICK MAIHAK GMBH,GERMANY	Approved
		CODEL INTERNATIONAL LTD ,UK	Approved
		SICK MAIHAK GMBH,GERMANY	Approved
28	FGA Insitu (SOX/NOX/CO/CO2)(panel)	CHEMTROLS INDUSTRIES LIMITED, POWAI, MUMBAI	Approved
		FORBES MARSHALL CODEL PVT. LTD., PUNE	Approved
		SICK INDIA PVT LTD,MUMBAI.	Approved
		ICE (ASIA) PRIVATE LIMITED, MUMBAI	Approved
29	FGA Sys(SOX/NOX/CO)Samplg Type(Analyzer)	ABB INSTRUMENTATION LTD,GLOUCESTERSHIRE,UK	Approved
		EMERSON PROCESS MANAGEMENT INDIA PVT LTD, MUMBAI	Approved
		FUJI ELECTRIC SYSTEMS CO. , LTD,SHINAGAWA-KU, TOKYO	Approved
		SICK MAIHAK GMBH,GERMANY	Approved
		SIEMENS LIMITED, BANGALORE	Approved
		YOKOGAWA ELECTRIC CORPORATION,TOKYO,JAPAN	Approved
30	FGA Sys(SOX/NOX/CO)Sampling Type(panel)	ABB LTD, Bangalore	Approved
		ADAGE AUTOMATION PRIVATE LIMITED, KHAIRANE MIDC, NAVI MUMBAI	DR
		CHEMTROLS INDUSTRIES LIMITED, POWAI, MUMBAI	Approved
		EMERSON PROCESS MANAGEMENT INDIA PVT LTD, MUMBAI	Approved

Sl No	Item	Vendor Name	Status
		YOKOGAWA INDIA LIMITED, BANGALORE	Approved
31	H <sub>2</sub> GAS ANALYSER CABINET	SIEMENS LTD.	Approved
		YOKOGAWA INDIA LIMITED	Approved
		ABB INDIA LTD	Approved
32	GI Pipes	BALDOTA VALVE AND FITTINGS PVT LTD,MUMBAI	Approved
		BHUWALKA PIPES LIMITED,BANGALORE.	Approved
		FLOWTECH, KOLKATA	Approved
		JINDAL INDUSTRIES LIMITED,NEW DELHI	Approved
		METPRESS ENGINEERING WORKS, KOLKATA	Approved
		NATHMAL DAGA & CO, BANGALORE	Approved
		PIPE CORPORATION PVT LTD, BANGALORE	Approved
		PRECISION ENGG INDUSTRIES,MUMBAI	Approved
		SURYA ROSHNI LTD,BAHADURGARH,HARYANA.	Approved
		V.K.INDUSTRIES, BANGALORE	Approved
		VIKAS INDUSTRIAL PRODUCTS, NOIDA	Approved
		SANDEEP INDUSTRIES,JALANDHAR,PUNJAB	Approved
		MKK METAL SECTIONS PVT LTD,VELLORE,TAMILANADU	Approved
		RIDDHI STEEL AND TUBE LIMITED,AHMEDABAD	Approved
		INDUS TUBES LTD,GHAZIABAD,UP	Approved
33	Impulse Pipes(Alloy steel)	BHARAT HEAVY ELECTRICALS LTD, TIRUCHIRAPALLI,TAMILANADU	Approved
		EVERGREEN SEAMLESS PIPES & TUBES PVT LTD,BANGALORE	DR
		GANPAT METALS PVT. LTD.,MUMBAI	DR
		JINDAL SAW LTD,CHENNAI	Approved
		RIDHI SIDDHI STEEL CORPORATION,MUMBAI	DR
		TROUVAY CAUVIN,GULF	Approved
		SUMITOMO CORPORATION,JAPAN.	Approved
		TPS TECHNITUBE ROHREN WERKE	Approved
		BHARAT HEAVY ELECTRICALS LTD, TIRUCHIRAPALLI,TAMILANADU.	Approved
		EVERGREEN SEAMLESS PIPES & TUBES PVT LTD,BANGALORE	DR
		GANPAT METALS PVT. LTD.,MUMBAI	DR
		HEAVY METAL AND TUBES LTD,AHMEDABAD/MUMBAI	DR



Sl No	Item	Vendor Name	Status
34	Impulse Pipes(Carbon Steel)	INDIAN SEAMLESS METAL TUBES LTD,PUNE.	Approved
		JINDAL SAW LTD,CHENNAI	Approved
		RIDHI SIDDHI STEEL CORPORATION,MUMBAI	DR
		TROUVAY CAUVIN,GULF	Approved
		SUMITOMO CORPORATION,JAPAN.	Approved
		SUMITOMO CORPORATION ASIA & OCEANIA PTE. LTD.,SINGAPORE	Approved
		TPS TECHNITUBE ROHREN WERKE GMBH,DAUN,GERMANY	Approved
35	Impulse Pipes(Stainless Steel)	RATNAMANI METALS & TUBES LTD, AHMEDABAD	Approved
		SUMITOMO CORPORATION,JAPAN.	Approved
		TPS TECHNITUBE ROHREN WERKE	Approved
		EVERGREEN SEAMLESS PIPES & TUBES PVT	DR
		GANPAT METALS PVT. LTD.,MUMBAI	DR
		RIDHI SIDDHI STEEL CORPORATION,MUMBAI	DR
		SUMITOMO CORPORATION,JAPAN.	Approved
36	Instrument Valve	TROUVAY CAUVIN,GULF	Approved
		BALDOTA VALVE AND FITTINGS PVT LTD,MUMBAI	Approved
		BHARAT HEAVY ELECTRICALS LTD, TIRUCHIRAPALLI,TAMILANADU.	Approved
		EXCEL HYDRO-PNEUMATICS PVT LTD, MUMBAI	Approved
		INSTRUMENTATION LIMITED, PALGHAT	Approved
		METPRESS ENGINEERING WORKS, KOLKATA	Approved
		PRECISION ENGG INDUSTRIES, MUMBAI	Approved
37	Lab Items Mechanical	FLUKE TECHNOLOGIES PVT. LTD., ANDHERI( EAST ), MUMBAI	Approved
		GE OIL AND GAS INDIA PVT. LTD,PUNE.	Approved
		ISOTHERMAL TECHNOLOGY PVT. LTD., DELHI	Approved
		NAGMAN INSTMTS. & ELECTRONICS (P) L, CHENBARAMBAKKAM,CHENNAI.	Approved
		WIKA INSTRUMENTS INDIA PVT. LTD., VILLAGE KESNAND, PUNE	Approved
		CHEMTROLS ENGG. (P) LTD.	Approved
		LEVCON INSTRUMENTS (P) LTD.	Approved
		S. B. ELECTRO-MECHANICALS PVT. LTD.	Approved
		V. AUTOMAT & INSTRUMENTS PVT. LTD.	Approved

Sl No	Item	Vendor Name	Status
38	LEVEL GAUGE	DK INSTRUMENTS	Approved
		SIGMA INSTRUMENTS COMPANY	Approved
		IGEMA GMBH	Approved
		ASIAN INDUSTRIAL VALVES AND	Approved
		CESARE BONETTI S.P.A	Approved
39	Level Switch Capacitance Type	LEVCON INSTRUMENTS PVT. LTD.	Approved
		ENDRESS & HAUSER	Approved
40	Level Switch Conductivity Type	EMERSON PROCESS MANAGEMENT(I)PVT. L, M.I.D.C.PAWANE,NAVI MUMBAI	Approved
		IGEMA GMBH,MUNSTER,GERMANY.	Approved
		LEVELSTATE SYSTEMS LTD,U.K	Approved
		SOLARTRON TRANSDUCER, U.K	Approved
41	Level Switch Float Type	CHEMTROLS INDUSTRIES LIMITED, POWAI, MUMBAI	Approved
		IGEMA GMBH,MUNSTER,GERMANY.	Approved
42	Level Switch Top mounted	CHEMTROLS INDUSTRIES LIMITED, POWAI, MUMBAI	Approved
		D.K.INSTRUMENTS PVT. LTD., DHAKURIA, KOLKATA	Approved
		LEVCON INSTRUMENTS Pvt LTD, KOLKATA	Approved
		PUNE TECHTROL PVT LTD,PUNE	Approved
		IGEMA GMBH,MUNSTER,GERMANY.	Approved
		SBEM PRIVATE LIMITED, PUNE	Approved
		SIGMA INSTRUMENTS COMPANY,BHANDUP(WEST),MAHARASTRA.	Approved
		V.AUTOMAT & INSTRUMENTS PVT. LTD., NEW DELHI	Approved
43	LIE/LIR	CHEMIN CONTROLS AND INSTRUMENTATION, PONDICHERRY	Approved
		PYROTECH ELECTRONICS (P) LTD.,UDAIPUR	Approved
44	LOCAL GAUGE BOARD (LGBs)	PANAM CONTROLS - HYDERABAD, INDIA	Approved
		NAGARJUNA FABRICATORS - HYDERABAD, INDIA	DR
		INSTRUMENTATION LTD. - KOTA, INDIA	Approved
		PYROTECH ELECTRONICS PVT.LTD. - UDAIPUR, INDIA	Approved
		PROCON INSTRUMENTATION PVT.LTD - CHENNAI, INDIA	Approved



Sl No	Item	Vendor Name	Status
45	Oxygen Analyser (LT)	EMERSON PROCESS MANAGEMENT INDIA PVT LTD, MUMBAI	Approved
		EMERSON PROCESS MANAGEMENT INDIA PVT LTD, MUMBAI	Approved
46	Oxygen Analyser (LT) Panel & Accessories	EMERSON PROCESS MANAGEMENT INDIA PVT	Approved
47	Pneumatic Actuator	EMERSON PROCESS MANAGEMENT CHENNAI, CHENNAI	Approved
		INSTRUMENTATION LIMITED, PALGHAT	Approved
		MIL CONTROLS LIMITED, ALWAYE , KERALA	Approved
48	SNUBBERS	LISEGA SE	Approved
		MAURER SOHNE GMBH & CO.KG	Approved
		JIANGSU ROAD DAMPING TECHNOLOGY CO.	Approved
		PIPE SUPPORT SYSTEMS GMBH INTL.	Approved
		QUIRI HYDROMECANIQUE,	Approved
		SANWA TEKKI CORPORATION	Approved
49	Pressure & Differential Pressure Gauges	A.N.INSTRUMENTS PVT LTD, CHENNAI	Approved
		PRECISION MASS PRODUCTS PVT. LTD,GANDHI NAGAR,GUJARAT.	Approved
		BAUMER TECHNOLOGIES INDIA LTD,VAPI	Approved
		FORBES MARSHALL(HYD) LTD., HYDERABAD	Approved
		GAUGES BOURDON (INDIA) PVT. LTD, MUMBAI.	Approved
		GOA THERMOSTATIC INSTRUMENTS, GOA	Approved
		MANOMETER (INDIA) PVT. LTD.,, MUMBAI	Approved
50	Pressure & Differential Pressure Switch (Critical/Tripping applications of Boiler& Turbine)	DELTA CONTROLS LTD	Approved
		SOR INC.	Approved
		ASCROFT, USA	Approved
		DRESSER INDUSTRIES INC.	Approved
51	Pressure & Differential Pressure Switch (Non Critical applicaion)	PRECISION MASS PRODUCTS PVT. LTD,GANDHI NAGAR,GUJARAT.	Approved
		SWITZER PROCESS INSTRUMENTS PVT. LT, T Nagar, CHENNAI	Approved
		ASHCROFT INDIA	Approved
		TRAFAG CONTROLS INDIA PVT. LTD., IMT MANESAR, GURGAON	Approved
		CHEMTROLS SAMIL (INDIA) PVT. LTD., POWAI , MUMBAI	Approved
		INSTRUMENTATION ENGINEERS PVT LTD	Approved

Sl No	Item	Vendor Name	Status
52	Sight Flow Indicator	SIGMA INSTRUMENTS CO.	Approved
		D.K.INSTRUMENTS PVT. LTD.	Approved
		LEVCON INSTRUMENTS Pvt LTD, KOLKATA	Approved
		V.AUTOMAT & INSTRUMENTS PVT LTD.	Approved
		FORBES MARSHALL LTD.	Approved
53	FLOW SWITCH	GENERAL INSTRUMENTS CONSORTIUM	Approved
		KROHNE MARSHALL	Approved
		SWITZER INSTRUMENT CO.	Approved
54	FLOW ELEMENTS (ORIFICE/NOZZLE)	MICRO PRECISION PRODUCTS	Approved
		M/S ESPL KOLKATA	Approved
		IL PALGHAT	Approved
55	IMPACT HEAD TYPE ELEMENT	DETREICH / EMERSON PROCESS	Approved
		MIDWEST	Approved
		STARMECH	Approved
		SWITZER INSTRUMENT CO.	Approved
		VERIS INC.	Approved
		EMERSON PROCESS MANAGEMENT ( INDIA) PVT. LTD.	Approved
56	RRI FOR CVP	BRAUN GMBH INDUSTRIE - ELEKTRONIK	Approved
		SHINKAWA ELECTRIC CO LTD.,	Approved
		BENTLY NEVADA, LLC	Approved
57	Socket Weld Fittings	BALDOTA VALVE AND FITTINGS PVT LTD,MUMBAI	Approved
		METPRESS ENGINEERING WORKS, KOLKATA	Approved
		V.K.INDUSTRIES, BANGALORE	Approved
		MULTIMETAL INDUSTRIES,	DR
		COMFIT & VALVES PVT LTD.	DR
		DYNAFLUID VALVES AND FLOW	DR
		PRESHZINGER ENGINEERING CO PVT LTD.	DR
		FLUID CONTROLS PRIVATE LTD.,	DR
		VALTEX INDIA,	DR
		H.P.VALVES & FITTINGS INDIA PVT LTD	DR
58	Steam and Water analysis Sys(Analyzer)	VIKAS INDUSTRIAL PRODUCTS, NOIDA	Approved
		ABB INDUSTRIES ,SWITZERLAND.	Approved
		ABB INDUSTRIES ,SWITZERLAND.	Approved
		HACH LANGE S.A.R.L,VESENAZ,SWITZERLAND.	Approved
		METTLER-TOLEDO INDIA PVT. LTD., POWAI, MUMBAI	Approved
		EMERSON PROCESS MANAGEMENT,USA	Approved



Sl No	Item	Vendor Name	Status
		SWAN ANALYTISCHE INSTRUMENTE AG, SWITZERLAND.	Approved
		THERMO ORION INC., CHELMSFORD	Approved
59	Steam and Water analysis System(Panel)	ABB LIMITED, PEENYA INDL. AREA, BANGALORE.	Approved
		EMERSON PROCESS MANAGEMENT INDIA PVT LTD,MUMBAI.	Approved
		FORBES MARSHALL PVT LTD, PUNE	Approved
60	THERMOWELL	INDUSTRIAL INSTRUMENTATION	Approved
		GENERAL INSTRUMENTS CONSORTIUM	Approved
		MICRO PRECISION PRODUCTS (P) LTD.	Approved
		DETRIV INSTRUMENTATION &	Approved
		TEMPSSENS INSTRUMENTS (I) PVT.LTD.,	Approved
		GOA INSTRUMENT INDUSTRIES PVT LTD.	Approved
		BAUMER TECHNOLOGIES INDIA PVT.LTD,	Approved
61	Temperature Elements	DETRIV INSTRUMENTATION AND ELECTRONICS	Approved
		OKAZAKI MANUFACTURING COMPANY,JAPAN.	Approved
		PYRO ELECTRIC INSTRUMENTS GOA PVT.LTD,GOA.	Approved
		TECHNO INSTRUMENTS,GANDHINAGAR,GUJARAT.	Approved
		TEMPSSENS INSTRUMENTS (I) PVT LTD,UDAIPUR,RAJASTHAN	Approved
		BAUMER TECHNOLOGIES INDIA LTD,MUMBAI/VAPI	Approved
		WIKA INSTRUMENTS INDIA PVT. LTD,PUNE	Approved
62	Temperature Gauges	A.N.INSTRUMENTS PVT LTD, CHENNAI	Approved
		PRECISION MASS PRODUCTS PVT. LTD,GANDHI NAGAR(Earlier Aschcroft)	Approved
		BAUMER TECHNOLOGIES INDIA LTD,MUMBAI/VAPI	Approved
		FORBES MARSHALL(HYD) LTD., HYDERABAD	Approved
		GOA THERMOSTATIC INSTRUMENTS, GOA	Approved
		WIKA INSTRUMENTS INDIA PVT. LTD,PUNE	Approved
		BALDOTA VALVE AND FITTINGS PVT LTD,MUMBAI	Approved
		EXCEL HYDRO-PNEUMATICS PVT LTD, MUMBAI	Approved
		FLOWTECH, KOLKATA	Approved

Sl No	Item	Vendor Name	Status
63	Valve Manifolds	Parker HANNIFIN INDIA PVT. LTD, LEBANON (M/s Super technical dealer for Parker)	Approved
		METPRESS ENGINEERING WORKS, KOLKATA	Approved
		MICRO PRECISION PRODUCTS PVT LTD, FARIDABAD	Approved
64	Vibration Monitoring System (Sensors, Monitors & Panel)	BENTLY NEVADA INC, MINDEN, U.S.A.	Approved
		MEGGITT SA, SWITZERLAND.	Approved
		SHINKAWA ELECTRIC CO., LTD, TOKYO, JAPAN	Approved
65	Mercury Analyzer	DURAG, BANGALORE (MAKE OF DURAG GERMANY)	Approved
		THERMO FISHER INDIA, MUMBAI (MAKE OF THERMO FISHER SCIENTIFIC CONTROL, USA)	Approved
		ANALYSER INSTRUMENTATION CO PVT LTD, KOTA, RAJASTHAN (MAKE OF PS ANALYTICAL, UK)	Approved
		SICK INDIA PVT LTD, MUMBAI. (MAKE OF SICK GMBH, GERMANY)	Approved
66	24 V DC SMPS based Battery Charger	CHHABI ELECTRICALS PVT. LTD., JALGAON	Approved
		VERTIV ENERGY PVT LTD (FORMERLY EMERSON NETWORK POWER INDIA), Ambernath	Approved
67	24 V DC thyristor based Battery Charger	CHHABI ELECTRICALS PVT. LTD., BANGALORE	Approved
		CHLORIDE POWER SYSTEMS & SOLUTIONS LTD, Kolkata	Approved
		STATCON POWER CONTROLS LTD., KULICHNAGAR, DHAULANA, HAPUR	Approved
68	Cable trays	shall be as per approved sources listed in Electrical Equipment list in Main Plant Package area.	
69	Electronic Transmitter – Pr. / Diff. Pr.	EMERSON PROCESS MANAGEMENT, Navi Mumbai	Approved
		FUJI ELECTRIC CO., LTD, OSAKI 1-CHOME, SHINAGAWA-KU, TOKYO	Approved
		HONEYWELL AUTOMATION INDIA LTD., PUNE	Approved
		YOKOGAWA ELECTRIC CORPORATION, TOKYO 180	Approved



Sl No	Item	Vendor Name	Status
		YOKOGAWA INDIA LIMITED,BANGALORE	Approved
70	Nickel-Cadmium Battery (Fiber type/Pocket type) for UPS and Charger	HBL POWER SYSTEMS LTD,Hyderabad	Approved
71	Flexible conduit (Lead Coated)	BANSAL LABORATORIES AND,GOVINDPURA INDL. AREA, BHOPAL	Approved
		PLICA INDIA PVT LTD,GHAZIABAD, U.P.	Approved
72	Flexible conduit (Zinc Coated)	BANSAL LABORATORIES AND,GOVINDPURA	Approved
		PLICA INDIA PVT LTD,GHAZIABAD, U.P.	Approved
73	HART Communicator	ABB LIMITED,PEENYA INDL. AREA, BANGALORE.	Approved
		EMERSON PROCESS MANAGEMENT, Navi Mumbai	Approved
		HONEYWELL AUTOMATION INDIA LTD.,PUNE	Approved
		YOKOGAWA INDIA LIMITED,BANGALORE	Approved
74	Instrumentation & Control cables (PVC, FRLS Type)	ADVANCE CABLE TECHNOLOGIES (P) LTD.,GEDDALAHALLI,ASWATHNAGAR,BANGAL ORE	Approved
		DELTON CABLES LIMITED, FARIDABAD	Approved
		KEI INDUSTRIES LIMITED,BHIWADI	Approved
		LAPP INDIA PVT. LTD.,PHASE II, ANEKAL TALUK, BANGALORE	Approved
		POLYCAB WIRES PVT. LTD, DAMAN	Approved
		THERMO CABLES LIMITED, HYDERABAD	Approved
75	Junction Box (Explosion Flame Proof)	CHEMIN CONTROLS AND INSTRUMENTATION,PONDICHERRY	Approved
		ELECTRO MECHANICAL (INDIA),KOLKATA	Approved
		FLAMEPACK, Mumbai	Approved
		K.S.INSTRUMENTS PVT LTD,Yeshwantpur, Bangalore	Approved
		KHODAY CONTROL SYSTEMS PVT. LTD.,PEENYA INDUSTRIAL ESTATE, BANGALORE	Approved
		MANISHA COMPOSITEK PVT. LTD.,PUNE	Approved
		PRAMMEN INDUSTRIES,PUDUKKOTTAI	Approved
		PYROTECH ELECTRONICS (P) LTD.,UDAIPUR	Approved
76	Junction Box (FRP )	K.S.INSTRUMENTS PVT LTD,Bangalore	Approved
		CHEMIN CONTROLS AND INSTRUMENTATION,PONDICHERRY	Approved

Sl No	Item	Vendor Name	Status
		MANISHA COMPOSITEK PVT. LTD.,PUNE	Approved
77	Junction Box (Metal)	CHEMIN CONTROLS AND INSTRUMENTATION,PONDICHERRY	Approved
		ELECTRO MECHANICAL (INDIA),KOLKATA	Approved
		K.S.INSTRUMENTS PVT LTD,BANGALORE	Approved
		KHODAY CONTROL SYSTEMS PVT. LTD, BANGALORE	Approved
		MANISHA COMPOSITEK PVT. LTD.,PUNE	Approved
		PRAMMEN INDUSTRIES,PUDUKKOTTAI	Approved
		PYROTECH ELECTRONICS (P) LTD.,UDAIPUR	Approved
78	Junction Boxes (Die cast aluminium)	PYROTECH ELECTRONICS (P) LTD.,UDAIPUR	Approved
		K.S.INSTRUMENTS PVT LTD,Yeshwantpur, Bangalore	Approved
		MANISHA COMPOSITEK PVT. LTD.,PUNE	Approved
79	Lead Acid - Plante Battery for UPS and Charger	shall be as per approved sources listed in Electrical Equipment list in Main Plant Package area.	
80	Lead Acid - Tubular Battery for UPS and Charger	shall be as per approved sources listed in Electrical Equipment list in Main Plant Package area.	
81	ULTRASONIC FLOW METERS	FLEXIM Flexible Industriemesstechnik GmbH	Approved
		NIVUS GMBH	Approved
82	Level Transmitter (RADAR type)	EMERSON PROCESS MANAGEMENT, Navi Mumbai	Approved
		ENDRESS + HAUSER (I) PVT. LTD.,L.B.S. Marg, Vikhroli (West), Mumbai	Approved
		MAGNETROL INTERNATIONAL NV,BELGIUM	Approved
		VEGA GRIESHABER K.G,SCHILTACH	Approved
83	Level Transmitter (Ultrasonic type)	SIEMENS,BANGALORE	Approved
		EMERSON PROCESS MANAGEMENT, Navi Mumbai	Approved
		ENDRESS + HAUSER (I) PVT. LTD.,L.B.S. Marg, Vikhroli (West), Mumbai	Approved
		ENDRESS+HAUSER GMBH+CO.KG,WEIL AM RHEIN	Approved



Sl No	Item	Vendor Name	Status
84	LT Power Cables (PVC / XLPE Insulation)	shall be as per approved sources listed in Electrical Equipment list in Main Plant Package area.	
85	Maintenance & Calibration Equipments (Electrical Package)	shall be as per approved sources listed in Electrical Equipment list in Main Plant Package area.	
86	Rigid Conduit	shall be as per approved sources listed in Electrical Equipment list in Main Plant Package area.	
87	RTD - TT Junction Box (FRP)	K.S.INSTRUMENTS PVT LTD,Yeshwantpur, Bangalore	Approved
		MANISHA COMPOSITEK PVT. LTD.,PUNE	Approved
88	RTD - TT Junction Box (Metal)	CHEMIN CONTROLS AND INSTRUMENTATION,PONDICHERRY	Approved
		ELECTRO MECHANICAL (INDIA),KOLKATA	Approved
		K.S.INSTRUMENTS PVT LTD,Yeshwantpur, Bangalore	Approved
		KHODAY CONTROL SYSTEMS PVT. LTD.,PEENYA INDUSTRIAL ESTATE, BANGALORE	Approved
		MANISHA COMPOSITEK PVT. LTD.,PUNE	Approved
		PRAMMEN INDUSTRIES,PUDUKKOTTAI	Approved
		PYROTECH ELECTRONICS (P) LTD.,UDAIPUR	Approved
89	Thermocouple extension cables (PVC, FRLS Type)	ADVANCE CABLE TECHNOLOGIES (P) LTD.,GEDDALAHALLI,ASWATHNAGAR,BANGALORE	Approved
		DELTON CABLES LIMITED,FARIDABAD	Approved
		KEI INDUSTRIES LIMITED,BHIWADI	Approved
		POLYCAB WIRES PVT. LTD, DAMAN	Approved
		THERMO CABLES LIMITED HYDERABAD	Approved
89	UPS System with ACDB	VERTIV ENERGY PRIVATE LIMITED	Approved
		HITACHI HI-REL POWER ELECTRONICS,Gandhinagar	Approved
90	UPS System with ACDB ((3Ph I/p, 1Ph O/p) IGBT based Rectifier	VERTIV ENERGY PRIVATE LIMITED	Approved
		HITACHI HI-REL POWER ELECTRONICS,Gandhinagar	Approved

Sl No	Item	Vendor Name	Status
91	CCTV SYSTEM (IP BASED-OEM ) WITH ACCESSORIES .	PELCO, USA	Approved
		BOSCH	Approved
		HONEYWELL, USA	Approved
92	CCTV SYSTEM (IP BASED) SYSTEM INTEGRATORS	HARITASA CHECKMATE ELECTRONICS, BANGALORE	Approved
		SCHNEIDER ELECTRIC, BANGALORE	Approved
		TYCO FIRE AND SECURITY, BANGALORE	Approved
		HONEYWELL AUTOMATION, BANGALORE	Approved
		Siemens, BANGALORE	Approved
		SCORE INFORMATION TECHNOLOGIES LTD, KOLKATA	Approved
		WIPRO INFOTECH, BANGALORE	Approved
		ECIL, HYDERABAD	Approved
93	Public Addressing System (IP BASED-OEM)	COMMEND, AUSTRIA	Approved
		INDUSTRONICS, GERMANY	Approved
		ARMTel, RUSSIA	Approved
		ZENITel, SWEDEN	Approved
94	Public Addressing System (IP BASED) SYSTEM INTEGRATORS	AISHAN TECHNOLOGIES INDIA PVT LTD, BANGALORE	Approved
		INDUSTRONIC & INDCOM ENGINEERS	Approved
95	Large Video Screen	BARCO ELECTRONICS, NOIDA	Approved
		PLANER-USA /PYROTECH-UDAIPUR	Approved
		CHRISTIE-USA	Approved
96	MODULAR DESK/CRT Desk	PYROTECH WORKSPACE SOLUTIONS PVT LTD , UDAIPUR	Approved
		CHEMIN CONTROLS AND INSTRUMENTATION , PONDICHERRY	Approved
		COSMOS MEDIA PRODUCTS PVT LTD , NOIDA	Approved
		HARMONY SYSTEMS , NEWDELHI	Approved
97	CONTROL PANEL/RACK	PYROTECH	Approved
		RITTAL	Approved
		BHEL	Approved
98	Dot matrix Printer	WIPRO	Approved
		EPSON	Approved
		TVS	Approved
		LEXMARK	Approved
99	WORKSTATIONS , SERVER, PC'S	DELL	Approved
		HP	Approved



Sl No	Item	Vendor Name	Status
100	PRINTERS (Laser/Inkjet)	HP	Approved
101	TFT MONITOR	DELL	Approved
		HP	Approved
102	MINI UPS FOR HMI	HITACHI HI-REL POWER ELECTRONICS,BANGALORE	Approved
		POWERTRONIX SYSTEMS LTD.,BANGALORE.	Approved
		SCHNEIDER ELECTRIC,BANGALORE	Approved
		EMERSON NETWORK INDIA,BANGALORE	Approved
		EMERSON NETWORK ,PUNE	Approved
103	GIU	DIGITAL INSTRUMENTS & CONTROL SYSTEMS	Approved
		SSM INFOTECH SOLUTIONS PVT LTD.	Approved
		SCHNEIDER ELECTRIC INDIA PVT LTD ,BANGALORE	Approved
		ROCKWELL AUTOMATION INDIA PVT LTD.	Approved
		ADVANCE TECH CONTROLS PVT. LTD.	Approved
104	STATION LAN EQUIPMENT	BHEL Approved Makes	
105	OFC	AKASH SOLAR	Approved
		SYSTIMAX	Approved
		BIRLA ERICSSON,REWA	Approved
		MOLEX	Approved
		TYCO	Approved
106	Turbine Supervisory System	MEGGITT SA,SWITZERLAND.	Approved
		BENTLY NEVADA INC. (GE OIL & GAS), U.S.A.	Approved
		SHINKAWA ELECTRIC CO. LTD., JAPAN	Approved
107	FEP insulated cables	DELTON CABLES, NEW DELHI	Approved
		HABIA CABLES,SWEDEN/CHINA	Approved
		LAPP CABLES, GERMANY	Approved
		LEONI KERPEN, GERMANY	Approved
		THERMOELECTRIC, USA	Approved
108	PTFE Insulated Cables	ADVANCE CABLES TECHNOLOGIES, BANGALORE	Approved
		DELTON CABLES, NEW DELHI	Approved
		THERMOCABLES LIMITED	Approved
		CORDS CABLE INDUSTRIES LIMITED.,	Approved
		TEMPSENS INSTRUMENTS (I) PVT LTD, UDAIPUR	Approved
		UNIVERSAL CABLES LIMITED, SATNA	Approved



Sl No	Item	Vendor Name	Status
109	CONVERTERS/ INVERTORS AC, DC DRIVES	ROCKWELL AUTOMATION INDIA PVT., LTD.,	Approved
		SIEMENS INDIA LTD.	Approved
		KIRLOSKAR ELECTRIC COMPANY LIMITED.,	Approved
		LARSEN & TOUBRO LIMITED	Approved
		HIREL ELECTRONICS, GANDHINAGAR	Approved
		ABB LIMITED	Approved
110	PULSE JET CONTROLLER	SWITCHING CIRCUIT	Approved
		ADVANCE CONCEPT	Approved
		VOLTCRAFT	Approved
		SQUARE M	Approved
		MICRO SYSTEM	Approved
111	PLC / SCADA	ROCKWELL AUTOMATION INDIA PVT., LTD.,	Approved
		GE INTELLIGENT PLATFORMS PVT LTD	Approved
		SIEMENS INDIA LTD.	Approved
		LARSEN & TOUBRO LIMITED	Approved
		ABB LIMITED	Approved
		SCHNEIDER ELECTRIC INDIA PVT.LTD.	Approved
112	LIMIT SWITCHES	KA SCHMERSAL, GERMANY	Approved
		JOHAN VOLLENBROICH, GERMANY	Approved
		IFM ELECTRONIC, GERMANY	Approved
		JAYASHREE ELECTRON PVT. LTD,	Approved
		SIEMENS INDIA LTD.	Approved
		BCH ELECTRIC LIMITED	Approved
		PEPPERL+FUCHS(INDIA) PVT LTD	Approved
		JAI BALAJI & CO., CHENNAI	Approved
		ELECTRO MECHANICAL INDIA, KOLKATA	Approved
		AG SYSTEMS, (AG ELECTRONICS )MUMBAI	Approved
113	PULLCHORD SWITCHES/BELT SWAY SWITCHES ( BELT MONITORING / CONVEYOR SAFETY SWITCHES , AC/DC TACHOGENERATORS , SERVOMOTORS, DIGITAL DRIVES AND SELSYN MOTORS )	JAYASHREE ELECTRODEVICES PVT. LTD.,	Approved
		BETA SYSTEMS ENGINEERING	Approved
		PROTOCONTROL INSTRUMENTS (I) PVT LTD	Approved
		KANTA RUBBER PVT. LTD	Approved
		MAHAVEER ENGINEERING	Approved
		SUMAN CONTROLS, BANGALORE	Approved
		JYOTHI RUBBER UDYOG, GHAZIABAD	Approved
		SLN ENTERPRISES,BANGALORE	Approved

Sl No	Item	Vendor Name	Status
114	SAFETY ITEMS (RUBBER MATS,DANGER BOARDS ETC.)	PROGRESSIVE RUBBER WORKS	Approved
		VARDHAMAN HOSES PRIVATE LIMITED	Approved
		PREMIER POLYFILM LTD	Approved
		RMG POLY VINLY INDIA LTD	Approved
		KAN POWER RUBBER INDUSTRIES, BANGALORE	Approved
		ARADHANA AGENCY	Approved



**SAGARDIGHI THERMAL Power EXTENSION PROJECT  
PHASE-III, UNIT#5 (1 x660 MW)**

SL. NO.	Item Description	Vendor Name	Remarks
1	FIRE PROTECTION, FIRE DETECTION AND ALARM SYSTEM PACKAGE	TECHNICO (INDIA) PVT. LTD.	Approved
		AGNICE FIRE PROTECTION PVT. LTD.	Approved
		HITEK ENGINEERING SERVICES	Approved
		STERLING AND WILSON PVT LTD	Approved
		MX SYSTEMS INTERNATIONAL PVT. LTD.	Approved
		UTC FIRE & SECURITY INDIA LIMITED.	Approved
		NITIN FIRE PROTECTION INDUSTRIES LI	Approved
		TYCO FIRE & SECURITY INDIA	Approved
		FIREPRO SYSTEMS PVT. LTD.	Approved
		CONSILIUM MIDDLE EAST (FZC)	Approved
		DE S TECHNICO PRIVATE LIMITED	Approved
		THERMOSYSTEMS PRIVATE LIMITED.	Approved
2	HYDRANT VALVES	SHAH BHOGILAL	Approved
		SUKAN	Approved
		NEWAGE	Approved
		VENUS	DR
		WINCO	DR
		ASCO STRUMECH PVT. LTD.	Approved
3	FIRE HOSES	NEWAGE	Approved
		CHATTARIA RUBBER	Approved
		Sukan Equipments Pvt Ltd	Approved
		SHAH BHOGILAL JETHALAL & BROTHERS	Approved
4	WATER MONITOR & WATER-CUM FOAM MONITORS	SHAH BHOGILAL	Approved
		HD FIRE	Approved
		NEW AGE	Approved
5	BRANCH PIPE, NOZZLES, COUPLINGS & FIRE BRIGDAE CONNECTIONS	SUKAN	Approved
		VENUS	Approved
		NEW AGE	Approved
		WINCO	DR
		ASCO STRUMECH PVT. LTD.	Approved
		SHAH BHOGILAL JETHALAL & BROTHERS	Approved
6	DELUGE VALVES	HD FIRE	Approved
		TYCO (GRINELL)	Approved
		KIDDE (I) LTD.	Approved
7	HVV/ MVW SPRAY NOZZLE	KIDDE (I) LTD.	Approved
		TYCO	Approved
		HD FIRE	Approved
		ASCO STRUMECH PVT. LTD.	Approved
		NEWAGE FIRE FIGHTING CO. LTD.	Approved
		SHAH BHOGILAL JETHALAL & BROTHERS	Approved



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Vendor List

Annexure-H

SL NO.	Item Description	Vendor Name	Remarks
8	QUARTZOID BULB SPRINKLERS/DETECTORS	TYCO(GRINELL)	Approved
		HD FIRE	Approved
		NEWAGE INDUSTRIES	Approved
9	HYDRO PNEUMATIC TANK	ARC WELD ENGINEERS	Approved
10	MICROPROCESSOR BASED FIRE ALARM PANEL	SIMPLEX	DR
		SCHRACK	Approved
		DETECTOMAT	Approved
		GENT	DR
11	LHS CABLE (FO Type) LHS CABLE (Intelligent Addressable Thermal Sensor Based)	AP SENSING,Germany	Approved
		SENSA,UK	Approved
		Listec (Schrack)	Approved
12	FOAM PUMP	DEL PD PUMPS & GEARS	Approved
13	FOAM TANKS	ARC WELD ENGINEERS	Approved
		HD FIRE PROTECT PVT. LTD.	DR
14	ADDRESSABLE MULTISENSOR TYPE DETECTORS	SIMPLEX	DR
		SCHRACK	Approved
		DETECTOMAT	Approved
		GENT	DR
15	ADDRESSABLE PHOTO ELECTRIC TYPE DETECTORS	SIMPLEX	DR
		SCHRACK	Approved
		DETECTOMAT	Approved
		GENT	DR
16	ADDRESSABLE HEAT DETECTORS	SIMPLEX	DR
		SCHRACK	Approved
		DETECTOMAT	Approved
		GENT	DR
17	INFRA RED DETECTORS	PATOL	Approved
		SYSTEM SENSOR	Approved
18	COATING & WRAPPING MATERIAL/ TAPE (COAL TAR BASED)	IWL LTD.	Approved
		RUSTECH	Approved
19	INERT GAS SYSTEM	GINGEKERR	Approved
		ANSUL	Approved
		SRI	Approved
		SIEMENS	Approved
		UTC FIRE & SECURITY INDIA LIMITED. / (KIDDE)	Approved
20	BATTERY	EXIDE	Approved
		AMCO	Approved
		HOPPECKE BATTERIEN GMBH & CO KG	DR
		AMARA RAJA POWER SYSTEMS LTD	Approved

Sagardighi Extn. U#5 (PROJ3)

FPA System



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Vendor List

Annexure-H

SL. NO.	Item Description	Vendor Name	Remarks
21	FIRE SURVIVAL CABLES	POLYCAB	Approved
		RRKABEL	Approved
		KEI	Approved
		DELTON	Approved
22	HOSE REEL	SIEMENS	DR
		WINCO	Approved
		NEWAGE FIRE FIGHTING CO. LTD.	Approved
		Sukan Equipments Pvt Ltd	Approved
23	FIRE EXTINGUISHER (BIS APPROVED SOURCES WITH VALID LICENSE)	NITIN FIRE PROTECTION INDUSTRIES LI	DR
		KANADIA FYR FYTER PVT. LTD.	Approved
		SAFEX FIRE SERVICES LTD.	Approved
		KIDDE	Approved
24	PROBE TYPE HEAT DETECTOR	TYCO	Approved
<b>Additional Items</b>			
25	LT MOTORS	As per Approved Electrical Vendor List	
26	H.T. MOTORS (SAFE/HAZARDOUS AREA)	SIEMENS LTD	Approved
		ABB INDIA LIMITED, HYD	Approved
		KIRLOSKAR ELECTRIC CO. LTD.	Approved
		CG POWER & INDUSTRIAL SOLUTIONS	Approved
		BHEL BHOPAL	Approved
27	CABLE TRAYS	As per Approved Electrical Vendor List	
28	LEVEL GUAGES ( MAGNETIC TYPE )	As per Approved C&I Vendor List	
29	PRESSURE GAUGES	As per Approved C&I Vendor List	
30	SAFETY RELIEF VALVES	INSTRUMENTATION LTD	Approved
		FORBES MARSHALL LTD.,	Approved
		UNI KLINGER LTD.	DR
		ANDERSON GREENWOOD CROSBY	Approved
31	GASKETS	BHEL Approved Sources	
32	FLANGES	BHEL Approved Sources	
33	STRAINERS (Y-TYPE / T-TYPE /	As per Approved Mechanical Vendor List	
34	VALVES- GATE/GLOBE/REG.GLOBE/NON- RETURN; MAT: CS/AS/SS; PR.CL.#150,#300,#800	LEADER VALVES LIMITED	Approved
		INTERVALVE POONAWALLA LIMITED	Approved
		MICON VALVES (I) PVT. LTD.	Approved
		WEIR BDK VALVES	Approved
		FLOTEK INDUSTRIES	Approved
		L & T VALVES LIMITED	Approved
		FOURESS ENGINEERING (I)PVT.LTD	Approved
		Any other Vendors as per Approved Mechanical Vendor List	

Sagardighi Extn. U#5 (PROJ3)

FPA System

Ref: SGMPO3/AY/8/047



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Vendor List

Annexure-H

SL. NO.	Item Description	Vendor Name	Remarks
35	BUTT WELDED PIPE FITTINGS	BHEL Approved Sources	
36	BOLTING MATERIAL	BHEL Approved Sources	
37	WELDED PIPES UP TO 14" (M.S & G.I)	BHEL Approved Sources	
38	FOAM POURER AND GENERATION EQUIPMENTS FOR FIRE PROTECTION SYSTEMS	SHAH BHOGILAL JETHALAL & BROTHERS	Approved
		NEWAGE FIRE FIGHTING CO. LTD.	Approved
		HD FIRE PROTECT PVT. LTD.	Approved
39	BALANCE PROPORTIONER FOR FIRE PROTECTION SYSTEMS	HD FIRE PROTECT PVT. LTD.	Approved
		SHAH BHOGILAL JETHALAL & BROTHERS	Approved
40	FIRE WATER PUMPS	WPIL LIMITED	Approved
		WILO MATHER AND PLATT PUMPS	Approved
		KIRLOSKAR BROTHERS LTD	Approved
41	HOSE CABINETS FOR FIRE PROTECTION SYSTEMS	SHAH BHOGILAL JETHALAL & BROTHERS	Approved
		NEWAGE FIRE FIGHTING CO. LTD.	Approved
		Sukan Equipments Pvt Ltd	Approved
		ASCO STRUMECH PVT. LTD.	Approved
42	AIR RELEASE VALVES FOR FIRE PROTECTION SYSTEMS	SHAH BHOGILAL JETHALAL & BROTHERS	Approved
		NEWAGE FIRE FIGHTING CO. LTD.	Approved
43	CAST IRON VALVES (GATE/SLUICE AND CHECK)	As per Approved Mechanical Vendor List	
44	SOCKET WELDED / SCREWED WELDED PIPE FITTINGS	BHEL Approved Sources	
45	SOLENOID VALVES	As per Approved C&I Vendor List	
46	PRESSURE AND DIFFERENTIAL	As per Approved C&I Vendor List	
47	N2 BASED FIRE PROTECTION SYSTEM	CTR MANUFACTURING INDUSTRIES LTD. NAGPUR	Approved
		EASUN-MR TAP CHANGERS (P) LTD, CHENNAI	DR
		SERGI TRANSFORMER EXPLOSION PREVENTION, GURGAON (HARYANA)	Approved

Sagardighi Extn. U#5 (PROJ3)

FPA System

Ref: SGMP03/AV/8/047



**SAGARDIGHI THERMAL Power EXTENSION PROJECT  
PHASE-III, UNIT#5 (1 x660 MW)**

Sl. No.	Item Description		Remarks
1	AIRCONDITIONING SYSTEM	Blue Star Ltd.	Accepted
		ADVANCE VENTILATION PVT.LTD.	DF
		ROOTS COOLING SYSTEMS PVT. LTD.	DF
		STERLING AND WILSON PRIVATE LIMITED	Accepted
		VOLTAS LTD.	Accepted
2	VENTILATION SYSTEM	ADVANCE VENTILATION PVT.LTD.,Sonepat	DF
		C.DOCTOR and CO. PVT.LTD , Kolkata	Accepted
		HYDERABAD POLLUTION CONTROLS LIMITED, HYDERABAD	Accepted
		STERLING AND WILSON PRIVATE LIMITED	Accepted
		ROOTS COOLING SYSTEMS PVT. LTD., Noida	DR
		VOLTAS LTD. , THANE WEST	Accepted
3	AIR WASHER & UAF	HYDERABAD POLUTION CONTROL	Approved
		ADVANCE VENTILATION	Approved
		DRAFT AIR	Approved
		BLUE STAR	Approved
		VOLTAS	Approved
		STERLING WILSON	Approved
		ROOTS COOLING SYSTEM	Approved
		C DOCTOR	Approved
4	CENTRIFUGAL FAN	FLAKT	Approved
		KRUGER	Approved
		DRAFT AIR	Approved
		HYDERABAD POLUTION CONTROL	Approved
		ADVANCE VENTILATION	Approved
		PATEL AIR	Approved
		MARATHON	Approved
		C DOCTOR	Approved
		SARLA	Approved
5	FRESH AIR/ SUPPLY/ EXHAUST/ RE UNIT FANS / PROPELLAR	HYDERABAD POLUTION CONTROL	Approved
		ADVANCE VENTILATION	Approved
		KRUGER	Approved
		NICOTRA	Approved
		MARATHON	Approved
		FLAKT	Approved
		C DOCTOR	Approved
		KHAITAN	Approved
6	PUMPS	BEST & CROMPTON	Approved
		JYOTI	Approved
		SAM TURBO	Approved
		KBL	Approved
		KSB	Approved
		M&P	Approved
		VOLTAS	DR
		WORTHINGTON	Approved
		SULZER PUMPS INDIA LTD.	Approved
			Approved

Sagardighi Extension Project (SR013)



**SAGARDIGHI THERMAL Power EXTENSION PROJECT  
PHASE-III, UNIT#5 (1 x660 MW)**

Sl. No.	Item Description		Remarks
1	AIRCONDITIONING SYSTEM	Blue Star Ltd.	Accepted
		ADVANCE VENTILATION PVT.LTD.	DF
		ROOTS COOLING SYSTEMS PVT. LTD.	DF
		STERLING AND WILSON PRIVATE LIMITED	Accepted
		VOLTAS LTD.	Accepted
2	VENTILATION SYSTEM	ADVANCE VENTILATION PVT.LTD.,Sonepat	DF
		C.DOCTOR and CO. PVT.LTD , Kolkata	Accepted
		HYDERABAD POLLUTION CONTROLS LIMITED, HYDERABAD	Accepted
		STERLING AND WILSON PRIVATE LIMITED	Accepted
		ROOTS COOLING SYSTEMS PVT. LTD., Noida	DF
		VOLTAS LTD. , THANE WEST	Accepted
		FLOWSERVE INDIA CONTROL PVT LTD	Approved
7	LV MOTORS (NON FLAME PROOF)	SIEMENS	Approved
		ABB	Approved
		CGL	Approved
		MARATHON	Approved
		KEC	DF
		BHARAT BIJLEE	Approved
		NGEF	Approved
8	AIR FILTER	PUROLATOR	Approved
		FMI	Approved
		ANFILCO	Approved
		JOHN FOWLER	Approved
		SPECTRUM	Approved
		AIR TECH	Approved
		PUROMATIC	Approved
9	INSULTATION MATERIAL	BEARDSHEL	Approved
		ARMAFLEX	Approved
		LLOYDS	Approved
		UP TWIGA	Approved
		AEROCCELL	Approved
10	FIRE DAMPER	CARRYAIRE	Approved
		RAVISTAR (SYSTEM AIR )	Approved
11	GRILL/ DIFFUSER/ VOLUME CONTROL DAMPER	CARRYAIRE	Approved
		RAVISTAR (SYSTEM AIR )	Approved
12	HUMIDISTAT	JHONSON CONTROL	Approved
		HONEYWELL AUTOMATION	Approved
		PENN	Approved
		CARRIER	Approved
		BLUE STAR	Approved

Sagardighi Extn. DRS (PROJ3)

HVAC System



**SAGARDIGHI THERMAL Power EXTENSION PROJECT  
PHASE-III, UNIT#5 (1 x660 MW)**

Sl. No.	Item Description		Remarks
1	AIRCONDITIONING SYSTEM	Blue Star Ltd.	Accepted
		ADVANCE VENTILATION PVT.LTD.	DF
		ROOTS COOLING SYSTEMS PVT. LTD.	DF
		STERLING AND WILSON PRIVATE LIMITED	Accepted
		VOLTAS LTD.	Accepted
2	VENTILATION SYSTEM	ADVANCE VENTILATION PVT.LTD.,Sonepat	DR
		C.DOCTOR and CO. PVT.LTD , Kolkata	Accepted
		HYDERABAD POLLUTION CONTROLS LIMITED, HYDERABAD	Accepted
		STERLING AND WILSON PRIVATE LIMITED	Accepted
		ROOTS COOLING SYSTEMS PVT. LTD., Noida	DR
		VOLTAS LTD. , THANE WEST	Accepted
13	SCREW CHILLER	VOLTAS	Approved
		MCQUAY (DAIKIN)	Approved
		CLIMAVENETA	Approved
14	PRECISION AC	UNIFLAIR	Approved
		BLUEBOX	Approved
		EMERSON PROCESS MANAGEMENT	Approved
		CLIMAVENETA	Approved
15	SPLIT AC	VOLTAS	Approved
		BLUE STAR	Approved
		CARRIER	Approved
		HITACHI	Approved
		DAIKIN	Approved
16	AIR HANDLING UNITS	ZECO	Approved
		CARRYAIRE (flakt)	Approved
		EDGETECH	Approved
		SYSTEM AIR	Approved
17	AHU FAN (CENTRIFUGAL FAN)	C DOCTOR	Approved
		FLAKT	Approved
		KRUGER	Approved
		NICOTRA	Approved
		COMEFRI	Approved
		MARATHON	Approved
		ADVANCE	Approved
		DRAFT AIR	Approved
18	PUMPS	HYDERABAD POLLUTION	Approved
		JYOTI	Approved
		SAM TURBO	Approved
		KBL	Approved
		KSB	Approved
		M&P	Approved
		VOLTAS	Approved

Sagardighi Extension Unit 5 (1 x 660 MW)  
HVAC System



**SAGARDIGHI THERMAL Power EXTENSION PROJECT  
PHASE-III, UNIT#5 (1 x660 MW)**

Sl. No.	Item Description		Remarks
1	AIRCONDITIONING SYSTEM	Blue Star Ltd.	Accepted
		ADVANCE VENTILATION PVT.LTD.	DR
		ROOTS COOLING SYSTEMS PVT. LTD.	DR
		STERLING AND WILSON PRIVATE LIMITED	Accepted
		VOLTAS LTD.	Accepted
2	VENTILATION SYSTEM	ADVANCE VENTILATION PVT.LTD.,Sonepat	DR
		C.DOCTOR and CO. PVT.LTD , Kolkata	Accepted
		HYDERABAD POLLUTION CONTROLS LIMITED, HYDERABAD	Accepted
		STERLING AND WILSON PRIVATE LIMITED	Accepted
		ROOTS COOLING SYSTEMS PVT. LTD., Noida	DR
		VOLTAS LTD. , THANE WEST	Accepted
		BEACON-WEIR	Approved
		WORTHINGTON	Approved
		SULZER PUMPS INDIA LTD.	Approved
		FLOWSERVE INDIA CONTROL PVT LTD	Approved
19	COOLING TOWER	PAHARPUR COOLING TOWER	Approved
20	LV MOTORS (NON FLAME PROOF)	SIEMENS	Approved
		ABB	Approved
		CGL	Approved
		MARATHON	Approved
		BHARAT BIJLEE	Approved
		NGEF	Approved
		JYOTI	Approved
21	AIR FILTER	PUROLATOR	Approved
		FMI	Approved
		ANFILCO	Approved
		TENACITY	Approved
		JOHN FOWLER	Approved
		SPECTRUM	Approved
		AIR TECH	Approved
		PUROMATIC	Approved
22	BALANCING VALVE	ADVANCE	Approved
23	4 WAY MIXING VALVE WITH ACTUATING MOTOR	SIEMENS BUILDING TECHNOLOGY	Approved
		JOHNSON	Approved
		HONEYWELL AUTOMATION	Approved
24	Y / POT STRAINER	MULTITEX	Approved
		GREAVES COTTON	Approved
		JAYPEE	Approved
		OTOKLIN	Approved
		GUJARAT OTOFILT	Approved
		SAROJINI ENTERPRISE	Approved

Sagardighi Extension Unit (PROJ3)

HVAC System



**SAGARDIGHI THERMAL Power EXTENSION PROJECT  
PHASE-III, UNIT#5 (1 x660 MW)**

Sl. No.	Item Description		Remarks
1	AIRCONDITIONING SYSTEM	Blue Star Ltd.	Accepted
		ADVANCE VENTILATION PVT.LTD.	DR
		ROOTS COOLING SYSTEMS PVT. LTD.	DR
		STERLING AND WILSON PRIVATE LIMITED	Accepted
		VOLTAS LTD.	Accepted
2	VENTILATION SYSTEM	ADVANCE VENTILATION PVT.LTD.,Sonepat	DR
		C.DOCTOR and CO. PVT.LTD , Kolkata	Accepted
		HYDERABAD POLLUTION CONTROLS LIMITED, HYDERABAD	Accepted
		STERLING AND WILSON PRIVATE LIMITED	Accepted
		ROOTS COOLING SYSTEMS PVT. LTD., Noida	DR
		VOLTAS LTD. , THANE WEST	Accepted
		FILTRATION ENGINEERS INDIA PVT LTD	Approved
25	STRIP HEATER	ESCORTS	Approved
		RACOLDS	Approved
		ALCO	Approved
		HEATCO	Approved
26	PAN HUMIDIFIER	RAPID COOL	Approved
		HOTSET	Approved
		ALCO	Approved
27	RELIEF / PURGE VALVE	BRASSOMATIC	Approved
28	THERMOSTATS	HONEYWELL AUTOMATION	Approved
		RANCO	Approved
		PENN	Approved
		DANFOSS	Approved
		RANUTROL	Approved
		INDFOSS JHONSON CONTROL	Approved
29	ANTI FREEZE THERMOSTAT	RANCO	Approved
		HONEYWELL AUTOMATION	Approved
		PENN	Approved
		DANFOSS	Approved
		INDFOSS	Approved
30	RH SENSOR/TEMP SENSOR	HONEYWELL AUTOMATION	Approved
		JOHNSON	Approved
		SIEMENS	Approved
		GENERAL INSTRUMENT CONSORTIUM	Approved
31	WATER SOFTENING PLANT	THERMAX	Approved
		ION EXCHANGE	Approved

**SAGARDIGHI THERMAL Power EXTENSION PROJECT  
PHASE-III, UNIT#5 (1 x660 MW)**

Sl. No.	Package Description	Vendor Name	Remarks
1	Civil Sub-structure pkg. (Piling & pile cap)	M/s SIMPLEX INFRASTRUCTURES LIMITED	Approved
		BRIDGE & ROOF CO. (INDIA) LTD.	Approved
		PARESH CONSTRUCTION AND FOUNDATIONS PVT. LTD.	Approved
		L&T GEOSTRUCTURE LLP.	Approved
		AKASHGANGA INFRAVENTURES INDIA LTD.	Approved
		M/s NAVAYUGA ENGINEERING COMPANY LIMITED	DR
2	Civil Super-structure pkg.	M/s JMC PROJECTS (INDIA) LIMITED.	DR
		M/s SIMPLEX INFRASTRUCTURES LIMITED	Approved
		M/s BRIDGE & ROOF CO. (INDIA) LIMITED	Approved
3	Boiler Aux.	M/s POWER MECH PROJECTS LIMITED	Approved
		M/s BRIDGE & ROOF CO. (INDIA) LIMITED	Approved
		M/s INDWELL CONSTRUCTIONS PVT. LIMITED	Approved
		M/s BHAVANI ERECTORS PVT. LIMITED	Approved
4	STG & Aux.	M/s POWER MECH PROJECTS LIMITED	Approved
		M/s INDWELL CONSTRUCTIONS PVT. LIMITED	Approved
5	C&I	M/s POWERTRONIX ENGINEERING PVT. LIMITED	Approved
		M/s EDAC ENGINEERING LIMITED	Approved
6	Electrical	M/s POWERTRONIX ENGINEERING PVT. LIMITED	Approved
		M/s PRV CONSTRUCTIONS PVT LIMITED	Approved
		M/s SIGMA CONSTRUCTION	Approved
		M/s TECHNO ELECTRIC & ENGINEERING CO LIMITED	Approved
		M/s EDAC ENGINEERING LIMITED	Approved
		M/s PACE PROCESS CONTROLS PVT. LIMITED	DR

Sagardighi Extn.U#5(PROJ3)  
PSER ERECTION  
Ref: SGMP03/AV/8/047



**389486/2021/PS-PEM-MAX****WBPDCL**

**EPC Bid Document  
Sagardighi Thermal Power Project  
1x660 MW Unit No. 5, Phase – III**

## **SECTION-VII**

### **ENGINEERING SERVICES**

**Development Consultants Pvt. Ltd.**

**Volume : II-A  
Section : VII  
Engineering Services**



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## SECTION-VII

### OWNER'S ENGINEERING SERVICES

#### 1.00.00 GENERAL

1.01.00 As part of the overall project management activity, the Successful Bidder shall be responsible for proper Owner's Engineering and co-ordination of activities during various phases of execution of the contract. The Successful Bidder shall identify a person, designated as Project Manager, with whom the Owner, the Consulting Owner's Engineer or the Review Consultant shall interact on matters related to Owner's Engineering as well as execution of the contract. The Project Manager shall be the single-point contact person on behalf of the Successful Bidder and shall be responsible for all Owner's Engineering co-ordination. The Owner /Consultant /Review Consultant shall interact with the Project Manager only on all matters of co-ordination between the Owner and the Successful Bidder or on matters involving the Successful Bidder, his manufacturing units and sub-vendors. For the purpose of expediting the Owner or his representative may sometimes interact with the manufacturing units or sub-vendors of the Successful Bidders. However such interaction will not, under any circumstance, dilute the responsibility of the Successful Bidder to provide a fully Owner's Engineered and coordinated package under this contract.

1.02.00 On finalization of the contract, a procedure for exchange of Owner's Engineering information will be mutually agreed and finalized between the Owner and the Successful Bidder.

#### 2.00.00 DESIGN COORDINATION MEETING

The Successful Bidder and his sub-vendors will be called upon to attend design co-ordination meetings with the Owner's Engineer, other Successful Bidders and the Consultants of the Owner during the period of execution of contract. The Successful Bidder including his sub-vendors shall attend such meetings at their own cost at Owner's or Consultant's office in Kolkata/ or at mutually agreed venue as and when required and fully cooperate with such persons and agencies involved during those discussions.

#### 3.00.00 CO-OPERATION WITH OTHER CONTRACTORS AND CONSULTING OWNER'S ENGINEERS

The Successful Bidder shall agree to cooperate with the Owner's other Contractors and Consulting Owner's Engineers and freely exchange with them such technical information as is necessary to obtain the most efficient and economical design and to avoid unnecessary duplication of efforts. The Owner's Engineer shall be provided with copies of all correspondences addressed by the Successful Bidder to other Sub- Vendors and Consulting Owner's Engineers in respect of such exchange of technical information.







- 4.00.00 **GUIDELINES FOR OWNER'S ENGINEERING SERVICES**
- 4.01.00 Prior to commencement of the Owner's Engineering work as part of design submissions, all aspects of design viz., criteria for selection and sizing of all equipment and systems, design margins etc. including that for structural steel and civil work shall be outlined and these shall form the basis for the detailed Owner's Engineering work.
- 4.02.00 Owner's Engineering work shall be performed on modern and proven concepts and internationally accepted good Owner's Engineering practices but fully compatible with the Indian environments. Owner shall have the right to review and approve the Owner's Engineering work by themselves and/or through consultant and ask for any clarifications and changes/modifications to the work performed by Successful Bidder.
- 4.03.00 At any stage during the performance of assignment, the Successful Bidder may be required to make certain changes/modification/improvements in design/drawing/other documents, which in the opinion of the Owner could result in better improved design, layout, operability, plant availability, maintainability, reliability or economy of the plant and its systems/sub-systems in view of revised and more accurate information/data available at a later date(s) or feedback(s) received during execution/operation of similar units. Such changes/modifications/improvements required could be identified by Owner and/or consultant and mutually discussed. Owner requires the Bidder to incorporate such action in the subject assignment appropriately without any additional cost liability and time implication to the Owner and same shall be within the responsibilities and Scope of the Successful Bidder.
- 4.04.00 During the course of review of detailed Owner's Engineering stages, it may be essential in the opinion of Owner to obtain certain classified data for review purposes only. In case Owner so desires, the Bidder shall submit such data to Owner.
- 4.05.00 During the course of review of detailed Owner's Engineering, it may be essential in Owner's opinion to obtain data and information on similar equipment and plants Owner's Engineered by the Bidder. In case Owner so desires the Bidder shall submit such data and information to the Owner.
- 4.06.00 It is not the intent to give details of every single task covered in the total Owner's Engineering work to be carried out by Successful Bidder, however, all Owner's Engineering work required for the satisfactory completion of the plant/systems as specified shall be carried out by the Successful Bidder. Broadly, the following are the minimum requirements in respect of scope of major items of work:
- 4.06.01 Preparation, updating and finalisation of scheme drawings, control and interlock diagrams, detailed and fully dimensioned layout drawings (plant layout and equipment layout detailed plan, elevation and cross-sectional drawings at different elevations/ floor levels) covering all mechanical, electrical, C&I, civil and structural items, equipment, systems and facilities. Drawings and Schedules prepared by the Successful Bidder from time to time, as detailed



designs are developed, shall be submitted for Owner's/ Consultant's approval before the work is taken up. Revisions, corrections, additions to drawings and schedules shall not be considered to change the scope of work.

- 4.06.02 Preparation of detailed technical specifications including data sheets, tender drawings and bill of material for all bought out items, as also finalisation of corresponding sub-Vendors.
- 4.06.03 Review of sub-Vendor's data, drawings, design calculations, schedules, bill of materials, instruction manuals etc. for all equipment, before forwarding them to Owner/Consultant for approval.
- 4.06.04 Preparation of civil construction drawings for all equipment showing foundation details and full details regarding equipment loads, floor openings, details of embedments, etc. required for preparation of civil construction drawings and also as referred at relevant sections of Scope & Exclusions. These documents shall be preceded by appropriate design calculations, static and dynamic analysis as necessary.
- 4.06.05 Preparation and finalisation of process piping and instrumentation diagrams and schematics, complete in all respects for all systems/packages of the power plant.
- 4.06.06 Preparation of consolidated schedules and bills of materials, including line numbers, tag numbers, source of supply, service conditions, specifications, materials, types and connections details, quantities for items of the plant including dampers, steam traps, strainers, instrumentations, ducting.
- 4.06.07 Sizing of all piping and equipment as per the stipulated design criteria; carrying out of flexibility analysis/dynamic analysis as necessary; hangers & support Owner's Engineering.
- 4.06.08 Final revision of all documents including preparation and compilation of Instruction Manuals for installation, commissioning, operation and maintenance for all equipment and systems. Refer clause 5.00.00 for the specific requirement in this regard.
- 4.06.09 Certification and submission of final as-built drawings for all areas.
- 4.06.10 Preparation and compilation of all drawings, schedules and instructions which may be required at site, whether separately mentioned or not.
- 4.06.11 All erection and assembly drawings which may be required at site.
- 5.00.00 **INSTRUCTION MANUALS**
- 5.01.00 The Bidder shall provide all necessary instruction manuals for the Owner's review, comment, and final acceptance as required in the contract. The instruction manual shall contain full details required for erection, commissioning, operation and maintenance of each equipment. The instruction manual shall be submitted in the form of one (1) soft copy in CD and 15 hard copies.



## 5.02.00 Erection Manuals

5.05.01 The erection manuals shall be submitted at least three (3) months prior to commencement of erection activities of particular equipment/system. The manuals shall contain the following as a minimum:

- a) Erection strategy.
- b) Sequence of erection.
- c) List of tools, tackles, heavy equipments like cranes, dozers etc required for erection.
- d) Bill of Materials.
- e) Safety precautions to be followed during erection.
- f) Erection instructions.
- g) Critical checks and permissible deviation/tolerances.
- h) Check-list for pre-commissioning activities
- i) Check-list for commissioning of the system.
- j) Procedure for initial checking, testing and acceptance norms.

## 5.03.00 Operation & Maintenance Manuals

5.03.01 The operating and maintenance instructions together with drawings of the equipment, as completed, shall be in sufficient detail to enable the Owner to operate, maintain, dismantle, reassemble, and adjust all parts of the equipment. They shall outline a step-by-step procedure for all operations likely to be carried out during the life of the plant/ equipment. Each manual shall include a complete set of drawings together with performance/ rating curves of the equipment and test certificates wherever applicable.

5.03.02 If after commissioning and initial operation of the plant, the manuals require any modification/ additions in the view of the Owner or Bidder, the same shall be incorporated and the updated final manuals shall be submitted to the Owner.

5.03.03 The manuals shall include the following:

- a) List of spare parts along with their drawing and catalogue and Pro-forma for ordering spares.
- b) Location and identification guide for bearings of various equipments and lubrication schedule including charts showing lubrication checking, testing and replacement procedure.





- c) Wherever applicable, fault location charts shall be included to facilitate fault detection.
- d) Detailed specification for all consumables (including lubricating oils, greases, chemicals etc.) required for each equipment.

#### 6.00.00 **PLANT HANDBOOK**

The Bidder shall provide the plant handbook to the Owner as per provision of the contract.

The Plant Handbook shall contain the following as a minimum:

- a) Design and performance data
- b) Process & instrumentation diagrams
- c) Single line diagrams
- d) Sequence & Protection interlock schemes
- e) Alarm and trip values
- f) Performance curves
- g) General layout plan and layout of Balance of Plant building and auxiliary buildings
- h) Important Do's and Don'ts.

#### 7.00.00 **TENDER STAGE DOCUMENT SUBMISSION**

7.01.00 The Bidder shall submit along with his bid all documents/drawings as specified in RFP and respective sections of the Technical Specifications in Vol-II and Vol-III. The documents shall include but not be limited to the following:

- a) All Bid proposal sheets duly filled up.
- b) Detailed experience list and financial resources of the Prime Bidder his collaborators/associates in this bid as well as the sub-vendors proposed.
- c) Scheme drawings indicating scope of supply and service as offered by the Bidder indicating clearly exclusions, if any.
- d) List of terminal points of the package offered together with quality and quantity of various input (i.e. water, air, electricity etc.) as required from the Owner at such interfaces.
- e) Equipment GA, Layout, Design Calculations, interlock and other write-up, catalogues/literature etc. as required for clear understanding of the bid submitted.



- f) High level project schedule network indicating target dates for intermediate milestones and final commissioning of plant systems; This network shall be supplemented by a detailed write-up on proposed sequence and method of execution for project implementation, deployment schedule for Key personnel with their bio-data, schedule of construction machinery etc.

#### 8.00.00 **CONTRACT STAGE DOCUMENT SUBMISSION AND APPROVAL PROCEDURE**

- 8.01.00 Owner's Engineering schedule shall be submitted by the Bidder as indicated in the RFP. Owner's Engineering schedule shall be developed in format as desired by the Owner/consultant.

The documents shall be divided into two categories: a) for approval and b) for information/further Owner's Engineering and co-ordination by the Consultant.

In preparing this schedule, the Bidder shall allow one (1) week from date of receipt for review and comments by the Consultant for each submission of a document.

This document submission schedule shall require acceptance by the Owner/Consultant.

Bidder shall also develop and submit a Master drawing list to the Owner/consultant.

- 8.02.00 All contract documents shall be marked with the name of the Owner, the Project, the specification title and number and the unit designation.

All dimensions shall be in metric units.

All notes, markings etc. shall be in English.

- 8.03.00 Documents/Drawings, submitted during tender stage, shall be revalidated or revised as required and submitted as certified contract document for approval/information of the Owner/Consultant.

- 8.04.00 Unless specified otherwise, the following categories of documents/drawings would require approval of the Owner/Consultant:

- a) System scheme and Process & instrumentation Diagrams (P & IDs).
- b) Design basis documents / memoranda / calculations justifying sizing and selection of equipment, vessels, tanks, piping, valves & specialities as well as the process parameters.
- c) Equipment data sheets and general arrangement drawings.
- d) Materials of construction.



- e) General Arrangement and Layout drawings.
- f) Typical control schemes, circuit diagrams, drive/ feeder-wise control scheme showing all external interfaces.
- g) Control System Configuration
- g) Shop Inspection and Testing Procedures, Test Set-up & Instrumentation, Acceptance Criteria and Codes / Standards followed, correction curves / charts, etc.
- h) Performance Test Procedures, Instrumentation, Acceptance Criteria and Codes / Standards followed, correction curves / charts, etc.
- i) Schedules covering equipment delivery schedules, erection, testing and commissioning schedules at L1 and L2 levels.

8.05.00 Unless specified otherwise, the following categories of documents / drawings would be treated for information/further Owner's Engineering by the Owner/Consultant. The Bidder shall, however, incorporate all additional information and clarifications in these documents/ drawings as and when desired by the Owner/ Consultant.

- a) Equipment foundation drawings.
- b) Equipment cross-section drawings, product literature etc. which are of proprietary nature.
- c) Predicted performance curves of equipment.
- d) Various bills of quantity, schedules etc.
- e) Piping fabrication drawings, isometrics etc.
- f) Panel wiring diagrams.
- g) Instruction/Operation manuals.
- h) Service manuals and trouble shooting guide for C & I system including field instruments.
- i) Operation logic diagrams.
- j) Cable schedule and interconnection chart.

In essence, the Bidder is solely responsible for corrections and adequacy of design & Owner's Engineering for documents under this category.

8.06.00 Upon review, the Consultant shall put his remarks and one of the following action stamps on the drawing / document:

- a) Approved.







- b) Approved except as noted, forward final drawing
- c) Approved except as noted, resubmission required.
- d) Disapproved.
- e) For information/reference only.

For action stamps in category (c) & (d), documents must be resubmitted for review by the Owner/Consultant. For action stamp in category (b), further review by Owner/Consultant would not be necessary provided the Bidder agrees & incorporates the minor comments made on the document.

Except for action stamp under category (c) & (d), the Bidder can proceed with manufacturing and other sequential activities for those areas of a drawing/document which do not have any review comment by the Owner/Consultant.

The Consultant may accord approval in category (c) or (d) in more than one submission of a document till he is satisfied that the intent of the specification has been fully complied with. The Bidder shall be responsible for delay in such cases and no extension of time shall ordinarily be allowed on such grounds.

The Bidder's work shall be in strict accordance with the finally approved drawings and no deviation shall be permitted without written approval of the Consultant.

- 8.07.00 Except key plan/general yard plan, any layout drawing requiring scrutiny shall not be drawn to a scale less than 1:50.
- 8.08.00 For review by the Consultant, the Bidder shall furnish three (3) prints of each drawing (only for first submission). There upon all transaction of drawings including reviewed comments and stamping shall be done in soft. All transaction of drawings shall be accompanied by a reference letter mentioning the date, revision no. and document status. Only on receiving the Approval Stamping, bidder shall distribute 6 sets of drawings (2 at WBPDCCL corporate office and 4 sets at WBPDCCL site office).. The Bidder shall furnish three (3) CDs of all as built/final drawings for Owner/Consultant site.
- 8.09.00 In case of contradiction between the stipulations above and those stated elsewhere in the specification, the stipulations herein shall prevail.



## SECTION-VIII

### QUALITY ASSURANCE REQUIREMENTS





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## SECTION-VIII

### QUALITY ASSURANCE REQUIREMENTS

#### 1.00.00 QUALITY ASSURANCE PROGRAMME

1.01.00 To ensure that the equipment and services under the scope of Contract whether manufactured or performed within the Successful Bidder's works or at his Sub-Vendor's premises or at the Owner's site or at any other place or work are in accordance with the specifications, the Successful Bidder shall adopt suitable quality assurance programme to control such activities at all points, as necessary. Such programmes shall be outlined by the Successful Bidder and shall be finally accepted by the Owner/Authorised representative after discussions before the award of contract. A quality assurance programme of the Successful Bidder shall generally cover the following :

- a) His organisation structure for the management and implementation of the proposed quality assurance programme.
- b) Documentation control system.
- c) Qualification data for Bidder's key personnel.
- d) The procedure for purchase of materials, parts, components and selection of Sub-Vendor's services including vendor analysis, source inspection, incoming raw-material inspection, verification of materials purchased etc.
- e) System for shop manufacturing and site erection control including process controls and fabrication and assembly controls.
- f) Control of non-conforming items and system for corrective actions.
- g) Inspection and test procedure both for manufacture and all site related works.
- h) Control of calibration and testing of measuring and testing equipments.
- i) System for quality audit.
- j) System for indication and appraisal of inspection status.
- k) System for authorising release of manufactured product to the Owner.
- l) System for handling storage and delivery.
- m) System for maintenance of records.





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- n) Furnishing of quality plans for manufacturing and field activities detailing out the specific quality control procedure adopted for controlling the quality characteristics relevant to each item of equipment/component as per format enclosed at Annexure-A to this section.

## 2.00.00 GENERAL REQUIREMENTS - QUALITY ASSURANCE

- 2.01.00 All materials, components and equipment covered under this specification shall be procured, manufactured and tested at all the stages, as well as Services provided for erection, commissioning and testing shall be as per a comprehensive Quality Assurance Programme. An indicative programme of inspection/tests to be carried out by the Bidder for some of the major items is given in the respective technical specification. This is however, not intended to form a comprehensive programme as it is the Bidder's responsibility to draw up and implement such programme and reviewed by by the Owner/Consultant. The detailed Quality Plans for manufacturing and field activities should be drawn up by the Bidder, separately in the format attached at Annexure-I and will be submitted to Owner/Owner's representative for review. Schedule of finalisation of such quality plans will be finalised before award.
- 2.02.00 Manufacturing Quality Plan will detail out for all the components and equipment, various tests/inspection, to be carried out as per the requirements of this specification and standards mentioned therein and quality practices and procedures followed by Bidder's Quality Control organisation, the relevant reference documents and standards, acceptance norms, inspection documents raised etc., during all stages of materials procurement, manufacture, assembly and final testing/performance testing.
- 2.03.00 Field Quality Plans will detail out for all the equipment, the quality practices and procedures etc. to be followed by the Bidder's site Quality Control organisation, during various stages of site activities from receipt of materials/equipment at site.
- 2.04.00 The Bidder shall also furnish copies of the reference documents/plant standards/acceptance norms/tests and inspection procedure etc., as referred in Quality Plans along with Quality Plans. These Quality plans and reference documents/standards etc. will be subject to Consultant's approval without which manufacture shall not proceed. In these approved quality plans, Owner/Authorised representative/Consultant shall identify Customer Hold Points (CHP), test/checks which shall be carried out in presence of the Owner/Consultant/Owners Owner's Engineer or his Authorised Representative and beyond which the work will not proceed without consent of Owner/Authorised representative/Consultant in writing. All deviations to this specification, approved quality plans and applicable standards must be documented and referred to Owner/Authorised Representative/Consultant for acceptance and dispositioning.
- 2.05.00 The Bidder shall provide adequate notice to the Owner for inspection before the material is dispatched as per the provisions of the Contract. No material shall be despatched from the manufacturer's works before the same is accepted subsequent to pre-despatch final inspection including verification of records of





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all previous tests/inspections by Owner's Owner's Engineer/Authorised representative, and duly authorised for despatch issuance of Material Despatch Clearance Certificate (MDCC).

2.06.00 All materials used or supplied shall be accompanied by valid and approved materials certificates and tests and inspection report. These certificates and reports shall indicate the sheet numbers or other such acceptable identification numbers of the material. The material certified shall also have the identification details stamped on it.

2.07.00 All the individual and assembled rotating parts shall be statically and dynamically balanced in the works.

Where accurate alignment is necessary for component parts of machinery normally assembled on site, the Bidder shall allow for trial assembly prior to despatch from place of manufacture.

2.08.00 Castings and forgings used for construction shall be of tested quality. Details of results of chemical analysis, heat treatment record, mechanical property test results shall be furnished.

2.09.00 All welding and brazing shall be carried out as per procedure drawn and qualified in accordance with requirements of ASME Section-IX/BS-4870 or other International equivalent standard acceptable to the Owner.

All brazers, welders etc. employed on any part of the contract at Bidder's/Sub-Vendor's works or at site shall be qualified as per ASME Section-IX or BS-4871 or equivalent international standard approved by the Owner. Such qualification tests shall be conducted in presence of Owner/his authorised representative.

For welding of pressure parts and high pressure piping the requirements of IBR shall also be complied with.

Under no circumstances any repair or welding of castings be carried out without the consent of the Owner. Proof of the effectiveness of each repair by radiographic and/or other non-destructive testing technique, shall be provided to the Owner.

All pressure parts shall be subjected to hydraulic testing as per the requirements of IBR. Other parts shall be tested for one and half times the maximum operating pressure, for a period not less than thirty (30) minutes.

2.10.00 All non-destructive examination (NDT) shall be carried out in accordance with approved international standard. The NDT operator shall be qualified as per SNT-TC-1A (of American Society of non- destructive examination). Results of NDT shall be properly recorded and submitted for acceptance.

All welding procedures adopted for performing welding work shall be qualified in accordance with the requirements of Section-IX of ASME code or IBR as applicable. All welded joints for pressure parts shall be tested by liquid







penetrant examination according to the method outlined in ASME Boiler and Pressure Vessel code. Radiography, magnetic particle examination and ultrasonic testing shall be employed wherever necessary/ recommended by the applicable code. At least 10% of all major butt welding joints shall be radiographed. Statutory payments in respect of IBR approvals including inspection shall be made by Bidder. Bidder's scope and responsibility shall also include preparation and submission of all necessary documents in the specific formats and manner stipulated by the statutory bodies, coordination and follow up for above approvals.

2.11.00 All the Sub-Vendors proposed by the Bidder for procurement of major bought out items including castings, forgings, semi-finished and finished components/equipment list of which shall be drawn up by the Bidder and finalised with the Owner shall be subject to Owner's review. Quality Plans of the successful Sub-Vendors shall be discussed, finalised and accepted by the Owner/Authorised representative and form part of the Purchase Order between the Bidder and the Sub-Vendor.

2.12.00 All the purchase specifications for the major bought-out items, list of which shall be drawn up by the Bidder and finalised with the Owner shall be furnished to the Owner for comments and subsequent acceptance before orders are placed.

Owner reserves the right to carry out quality audit and quality surveillance of the systems and procedures of the Bidder's or their Sub-Vendor's quality management and control activities. The Bidder shall provide all necessary assistance to enable the Owner carry out such audit and surveillance.

Quality audit/acceptance of the results of tests and inspection will not prejudice the right of the Owner to reject equipment not giving the desired performance after erection and shall not in no way limit the liabilities and responsibilities of the Bidder in earning satisfactory performance of equipment as per specification.

2.13.00 Quality requirements for main equipment shall equally apply for spares and replacement items.

2.14.00 Repair/rectification procedures to be adopted to make any job acceptable shall be subject to the acceptance of the Owner.

2.15.00 For quality assurance of all civil works refer to the specifications for civil works.

### 3.00.00 **QUALITY ASSURANCE DOCUMENTS**

3.01.00 The Bidder shall be required to submit two (2) copies and two (2) sets of microfilms of the following Quality Assurance documents within three (3) weeks after despatch of the equipment:

- a) Material mill test reports on components as specified by the specification.





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- b) The inspection plan with verification, inspection plan check points, verification sketches, if used and methods used to verify that the inspection and testing points in the inspection plan were performed satisfactorily.
- c) Non-destructive examination results /reports including radiography interpretation reports.
- d) Factory tests results for testing required as per applicable codes and standards referred in the specification.
- e) Welder identification list listing welder's and welding operator's qualification procedure and welding identification symbols.
- f) Sketches and drawings used for indicating the method of traceability of the radiographs to the location on the equipment.
- g) Stress relief time temperature charts.
- h) Inspection reports duly signed by QA personnel of the Owner and Bidder for the agreed inspection hold points. During the course of inspection, the following will also be recorded :
  - i) When some important repair work is involved to make the job acceptable.
  - ii) The repair work remains part of the accepted product quality.
- i) Letter of conformity certifying that the requirement is in compliance with finalised specification requirements.

#### 4.00.00 **INSPECTION, TESTING AND INSPECTION CERTIFICATES**

4.01.00 The Successful Bidder shall give the Owner's Engineer/Inspector fifteen (15) days written notice of any material being ready for testing. Such tests shall be to the Successful Bidder's account except for the expenses of the Inspector. The Owner's Engineer/Inspector, unless the witnessing of the tests is virtually waived, will attend such tests within fifteen (15) days of the date on which the equipment is notified as being ready for test/inspection failing which the Successful Bidder may proceed with test which shall be deemed to have been made in the Inspector's presence and he shall forthwith forward to the Inspector duly certified copies of test reports in six (6) copies.

4.02.00 The Owner's Engineer or Inspector shall within fifteen (15) days from the date of Inspection as defined herein give notice in writing to the Successful Bidder, or any objection to any drawings and all or any equipment and workmanship which is in his opinion not in accordance with the contract. The Successful Bidder shall give due consideration to such objections and shall either make modifications that may be necessary to meet the said objections or shall confirm in writing to the Owner's Engineer/Inspector giving reasons therein, that no modifications are necessary to comply with the contract.





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- 4.03.00 When the factory tests have been completed at the Bidder's or sub-Vendor's works, the Owner/Inspector shall issue a certificate to this effect fifteen (15) days after completion of tests but if the tests are not witnessed by the Owner/Inspectors, the certificate shall be issued within fifteen (15) days of the receipt of the Bidder's test certificate by the Owner/Inspector. Failure of the Owner/Inspector to issue such a certificate shall not prevent the Bidder from proceeding with the works. The completion of these tests, or the issue of the certificates shall not bind the Owner to accept the equipment should it, on further tests after erection be found not to comply with the contract.
- 4.04.00 The Bidder shall furnish quarterly inspection programme indicating schedule dates of inspection at customer hold point and final inspection stages. Updated quarterly inspection plans will be made for each three consecutive months and shall be furnished before beginning of each calendar month.





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### FORMAT OF QUALITY ASSURANCE PROGRAMME

Name of Company / Successful Bidder	NAME OF CONTRACT PACKAGE			QUALITY PLAN FOR						
	Package No. : _____			QP No. : _____ Date _____						
	Contractor : _____			Rev.No.: _____ Date _____						
Sl. No.	Component & Operation	Characteristics	Class	Type of Check	Quantum of Check	Reference Document	Acceptance Norm	Format of Record	Agency	Remarks



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### FIELD WELDING SCHEDULE

PROJECT : FWS NO :  
CONTRACTOR : REV NO. :  
PACKAGE : FIELD WELDING CODE :  
SYSTEM : PAGE NO. :

Sl No.	Drawing No. for Weld Locations & Identification mark	Description of parts to be welded	Material specification	Dimensions	Process of Welding	Type of Weld	Electrode Filler Specification	WPS No.	Minimum Pre-heat Temperature	Heat Treatment Temperature [Holding Time in secs]	NDT Method	Quantum	NDT Specification Number	Acceptance Norm Ref.	Remarks
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The Field Welding Schedule should be submitted for :

- o Pressure Parts
- o Tanks/Vessels
- o Piping
- o Heavy/Important Structural Steel
- o Heat Exchangers
- o Bus Ducts



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## SECTION-IX

### PERFORMANCE GUARANTEES AND TESTS







## CONTENT

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## SECTION-IX

### PERFORMANCE GUARANTEES AND TESTS

#### 1.00.00 PERFORMANCE GUARANTEES, PERFORMANCE/ACCEPTANCE TESTS & LIQUIDATED DAMAGES FOR SHORTFALL IN PERFORMANCE

1.01.00 The Bidder shall guarantee that the equipment offered shall meet the ratings and performance requirements stipulated for various equipment covered in this specification. The guarantees are categorised as:

- a) Those, which attract liquidated damages, as listed below (Category-"A"). The Bidder shall furnish signed declarations in the manner prescribed in the bid proposal schedules for these guarantees.
- b) Those, which do not attract liquidated damages, as listed below (Category-"B"). This guarantee list indicated in this section is not exhaustive and the Owner reserves the right to call upon the Bidder to demonstrate any parameter, operation, etc. of any equipment as specified and as required to meet the duty conditions.

1.02.00 The Bidder shall demonstrate all the guarantees as specified in this section. In case during tests it is found that the equipment/system has failed to meet the guarantees, the Contractor shall carry out all necessary modifications to make the equipment/systems comply with guaranteed requirements. However, if the Contractor is not able to demonstrate the guarantees, even after the modifications within ninety (90) days of notification by the Owner, the Owner will at his discretion:

- i) reject the equipment and recover the payment already made or engage other agencies for making good all the deficiencies, the cost to be borne & recovered from the contractor or accept the equipment only after levying liquidated damages upto a ceiling 10% of contract price as identified in this section for those guarantees which are covered under category "A".
- ii) reject the equipment and recover the payment already made or engage other agencies for making good all the deficiencies, the cost to be borne & recovered from the contractor or accept the equipment only after assessing and deducting from the contract price an amount equivalent to the deficiency of the equipment/system as assessed by the Owner, for those guarantees which are covered under Category-B.

For equipment/systems not covered under this section Bidder shall demonstrate the functionality and the rated performance for such equipment/systems before handover to the owner.

1.03.00 All guaranteed parameters shall necessarily be quoted by the Bidder based on the established proven results obtained from similar units in successful operation. Evidence for this shall necessarily include the test codes used, acceptance test results, and accuracies of various instruments used for the





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performance test, details of tolerances, if allowed, etc. While quoting the guaranteed parameters, the Bidder shall keep in view the requirements specified in the specification especially regarding the reliability, operability and maintainability of the equipment proposed. The Owner reserves the right to evaluate the parameters quoted by the Bidder based on his experience and published material available.

- 1.04.00 The liquidated damages shall be calculated prorata for the fractional parts of the unit unless stated otherwise.
- 1.05.00 The turbine generator, boiler, auxiliaries, and all other plant equipment and system shall perform continuously without the noise level (individual or collectively) exceeding the values specified in respective equipment specification over the entire range of output and operating frequencies.
- 1.06.00 **Performance/Acceptance Tests**
- 1.06.01 The performance/acceptance tests for various equipment and systems shall be carried out as specified under the respective equipment specifications and those specified below shall be specifically applicable. All the guarantees shall be tested together as far as practicable.
- 1.06.02 In case of systems with stand-by equipment the liquidated damages for non-performance will be levied for normal operating number of equipment only. However, for this purpose all the equipment including standby equipment shall be tested and average values arrived at.
- 1.06.03 For instrument in-accuracies during PG Test, refer subsequent clauses of this section.
- 1.06.04 For Total Auxiliary Power Consumption of BTG island, Off site BOP facilities and the transformers listed under the respective clauses, shall be taken together for purposes of guarantee and not individually.
- 2.00.00 **START-UP, INITIAL OPERATION, TRIAL OPERATION AND PERFORMANCE TESTS**
- 2.01.00 The Contractor shall provide commissioning & start-up supervisory engineering staff specially identified for the period commencing with start-up and extending through initial & trial operation and all performance tests. During this period, the Contractor shall furnish the calibration devices, special test instruments, etc. required to prepare for and conduct the performance tests. The Owner will associate his operating personnel and necessary supporting staff and shall make available fuel, and the system electrical load. Contractor's commissioning, & start-up supervisory engineering personnel shall conduct training for the Owner's personnel prior to and during this period and shall train them so that they will be able to operate and maintain the new equipment satisfactorily after acceptance by the Owner.
- 2.02.00 The Owner proposes to carry out in association with the Contractor, the following field inspections and tests in the sequence detailed below, and the







successful performance and completion of all the tests taken together shall constitute the Owner acceptance tests. The Contractor shall provide supervisory services during field inspection and tests.

## 2.02.01 Inspection and Checking of the Unit

After completion of erection and/or installation, and before being put into operation, the unit and all its appurtenances shall be thoroughly cleaned and then inspected, for correctness and completeness of installation and acceptability for placing in operation. All piping system shall be flushed, chemically cleaned; steam blown, air blown as required and cleanliness demonstrated using acceptable industry standards. Procedures to accomplish this work shall be subject to Owner's approval.

The checkouts during the pre-commissioning period should be programmed to follow the construction completion schedule. Each system, as it is completed by construction and turned over to the commissioning (start-up) engineer(s), should be checked out and cleaned. The checking and inspection of individual systems should then follow a prescribed schedule. Also refer specification clause on commissioning management specified elsewhere.

On completion of inspection, checking and after the pre-commissioning tests are satisfactorily over, the complete equipment shall be placed on Initial Operation during which period the complete equipment shall be operated integral with sub-systems and supporting equipment as a complete plant.

When the equipment is operating properly, its characteristics shall be recorded on the start-up report sheets. Copies of typical start-up report shall be given to the Owner. Start-up reports for all equipment shall be completed before the start of the trial operation period.

## 2.02.02 Initial Operation, Reliability Run/Trial Run

The plant shall be on Trial Operation during which period all necessary adjustments shall be made while operating over the full load range enabling the plant to be made ready for performance and guarantee tests.

The duration of Trial Operation of the complete equipment, systems, sub-systems and their control system shall be in Automatic mode for fourteen (14) days out of which at least seventy two (72) hours shall be in continuous operation on full load or any other duration as may be agreed to between the Engineer, and the Contractor. The Trial Operation shall be considered successful, provided such item of the equipment can be operated, continuously at the specified operating characteristics for the period of Trial Operation.

For the period of Trial Operation, the time of operation with any load shall be counted; minor interruptions not exceeding four (4) hours at a time caused during the continuous operation shall not affect the total duration of trial operation. However, if in the opinion of the Owner, the interruption is long, the Trial Operation shall be prolonged for the period equivalent to the duration of interruption.



A trial Operation report comprising observations and recordings of various parameters to be measured, in respect of the above Trial Operation shall be prepared by the Contractor. This report besides recording the details of the various observations during trial run shall also include the dates of start and finish of the Trial Operation and shall be signed by the representatives of both the parties. The report shall have sheets, recording and print out of all the details of interruption occurred, adjustments made, any minor repairs done during the Trial Operation. Based on the observations, necessary modifications/ repairs to the plant shall be carried out to the full satisfaction of the Engineer to enable the later to accord permission to carry out Performance and Guarantee Tests on the plant. However, it is the prerogative of the Owner to grant permission for aforesaid test with minor defects, which do not endanger the safe operation of the equipments. .

Should any major failure or interruption occur in any portion of the plant due to or arising from faulty design, materials, workmanship or omissions or incorrect erection, sufficient to prevent safe and full commercial use of the plant, the reliability run shall be considered void and the reliability test period of 14 days shall recommence after the Contractor has remedied the cause of defect to the satisfaction of the owner

### 2.02.03

### Performance and Guarantee Test

- a) The final tests as to the performance and guarantees shall be conducted at site, by the Contractor with full involvement of the Owner. The necessary operating inputs shall be provided by the Owner. The Contractor's engineering staff for commissioning and start-up shall ensure that the equipment are ready for such tests. The Owner shall associate his necessary supporting staff with the Contractor to carry out the various activities related to P-G tests.

The necessary labour/supporting staff etc. shall be provided by the Contractor. Such tests will be conducted within a period of three (3) months after the successful completion of Trial Operation. Any extension of time beyond the above three (3) months shall be mutually agreed upon.

- b) These tests shall be binding on both the parties of the Contract to determine compliance of the equipment with the performance guarantees.

The Contractor shall submit the test procedure for Owner's approval within thirty six (36) months from the date of letter of award of the contract. The test shall be carried out by the test grade instruments as stipulated in the applicable test code. These instruments shall be calibrated by the Contractor in a laboratory duly approved by Owner. Batch calibration will not be acceptable. The available instrumentation and control equipment in the plant if found suitable could also be used with the prior approval of the Owner after calibrations in the plant/outside laboratory. The tests will be conducted at the specified load points, and as near the specified cycle conditions as practicable. Proper corrections in calculations to take into account the conditions



which do not correspond to the specified conditions will be applied in the test report as brought out under the respective sections of the specification.

- c) All special test grade instruments, equipment, tools and tackles, required for the successful completion of the Performance and Guarantee Tests shall be brought for the purpose of test, free of cost by the Contractor.
- d) The guaranteed performance figures of the equipment shall be proved by the Contractor during these Performance and Guarantee Tests. The Contractor shall submit a detailed test report in the manner, already agreed to within one (1) month time of completion of the test, for Owner's approval. Should the Owner's assessment of these tests show any deterioration from the guaranteed values the Contractor/Owner shall modify the equipment as required to enable it to meet the guarantees to the satisfaction of the Owner. In such case, the Performance and Guarantee Tests shall be repeated within one (1) month, from the date the equipment is ready for retest and all costs for modifications including labour, materials and the cost of additional testing to prove that the equipment meets the guarantees, shall be borne by the Contractor.
- e) The specific tests to be conducted on equipment have been brought out in the technical specifications. The procedure to be submitted by the Contractor should include the detailed methodology to conduct these tests/verify the guarantees offered by the Contractor notwithstanding whether these attract liquidated damages or not.
- f) Instrument accuracies shall be in accordance with the relevant test codes. All instrument in-accuracies if applicable shall be computed as per the code and values will be corrected to the advantage of the Owner. No negative tolerance will be allowed. For example, if the inaccuracy of instrumentation has been worked out to be 1%, the measured values will be assessed to be 1% inferior for purpose of LD.
- g) The Bidder shall establish the following modes of operation to the satisfaction of the Owner before acceptance test :
  - i) Operation of each system by remote manual control.
  - ii) Operation of the entire system in integrated manner on auto control.
  - iii) Operation of the entire plant with auto-control loops fully implemented including different modes of load control with the help of control system.
- h) Ten (10) copies of the test reports are to be furnished by the Contractor to the Owner backed up with jointly signed data sheets.





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3.00.00

**SCHEDULE OF GUARANTEES WHICH ATTRACT LIQUIDATED DAMAGES [CATEGORY-A]**

Sl. No.	Package System	Parameter for Performance Guarantee	Liquidated Damages
<del>3.01.00</del>	<del>Steam Generator</del>		
<del>3.01.01</del>	<del>Capacity</del>	<del>Capacity in T/HR of steam at rated steam parameters at superheater outlet with combination of mills working as per Owner's choice and the coal being fired within range specified.</del>	<del>For deficiency in Steam Generator capacity for every 1T/hr. Rs. 32,580,000/-</del>
<del>3.01.02</del>	<del>Efficiency</del>	<del>Efficiency in percentage corresponding to 100% and 80% turbine loads under rated steam parameters at Superheater &amp; reheater outlet, under rated Condenser Vacuum and zero make-up with combination of mills working as per Owner's choice.</del>	<del>For every 0.1% decrease in weighted average efficiency – Rs. 206,980,000/-</del>
<del>3.02.00</del>	<del>Turbine Generator</del>		
<del>3.02.01</del>	<del>Heat Rate</del>	<del>Heat rate in kCal/ kWh corresponding to 100% and 80% turbine loads under rated steam parameters, design condenser vacuum with zero percent make up.</del>	<del>Rs. 110,520,000/- for every kCal/ kWh increase in weighted average heat rate over guaranteed value.</del>
<del>3.02.00</del>	<del>Output</del>	<del>Output in kW under rated steam conditions and CW temp. of 33°C with 1% make up and all heaters in service.</del>	<del>Rs. 270,000/- for every one (1) kW shortfall in output from guaranteed value.</del>
3.03.00	Total Auxiliary Power Consumption	Total Auxiliary power consumption (in kW) of the unit under rated steam conditions at 100% Turbine loads with zero make-up.	Rs. 462,000/- for every one (1) kW excess weighted average auxiliary power consumption over guaranteed value on the basis of Figures declared by the bidder in Attachment-8 and shall be submitted in the Guaranteed Data Declaration Sheet against Sl. No. 9.00.00, Sch-III A/4:4 of Vol-III A.



~~The test for TG test capacity shall be carried out along with the heat rate test. Instrumentation and other details shall comply as above.~~

#### 6.04.06 **Condenser**

~~Performance test for the condenser shall be conducted in accordance with the latest edition of ASME PTC 12.2. The condenser pressure shall be measured at 300 mm above the top row of tubes under VWO condition, estimated make-up and design CW flow and CW inlet temperature of 33 Deg. C. The cleanliness factor shall be determined in accordance with the latest edition of ASME PTC 12.2.~~

#### 6.04.07 **Feed Water Heaters and Drain Cooler**

~~Performance test for feed water heaters shall be conducted in accordance with the latest edition of ASME PTC 12.1.~~

#### 6.04.08 **Deaerator**

~~Performance test for deaerator shall be conducted in accordance with the latest edition of ASME PTC 12.3.~~

~~The dissolved oxygen content in feed water at outlet of deaerator shall be determined by ASME D 888. Reference Method A and any recognised modification thereof.~~

~~Free carbon dioxide content of deaerator effluent shall be measured by APHA method.~~

#### 6.05.00 **Remaining Plant and Equipment**

For other equipment, plants and systems, the performance test shall be carried out as per the respective equipment specification and the applicable codes.



## SECTION-X

### REQUIREMENTS OF SPARES, TOOLS & TACKLES







## CONTENTS

CLAUSE NO.	DESCRIPTION	PAGE NO.
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2.00.00	SPARES	1

## ATTACHMENT

ANNEXURE-I	MANDATORY SPARES LIST
ANNEXURE-II	LIST OF TOOLS & TACKLES





## SECTION-X

### REQUIREMENTS OF SPARES, TOOLS & TACKLE

#### 1.00.00 TOOLS & TACKLE

The Bidder shall supply with the equipment one complete set of special tools and tackles required for the erection, assembly, dis-assembly & proper maintenance of the plant and equipments and systems (including software). These special tools shall also include special material handing equipment, jigs & fixtures for maintenance and calibration/ re-adjustment, checking & measurement aids etc. A list of such tools & tackles shall be submitted by the Bidder along with the offer. Detailed description of each tool/tackles, its function along with the equipment/part for which it is meant for, shall also be indicated in the offer. These tools & tackles shall be separately packed and sent to site before the first unit commissioning. The Bidder shall also ensure that these tools are not used for erection, commissioning and initial operation. For this period, the Bidder shall bring his own tools and tackles. All the tools and tackles shall be of reputed make acceptable to Owner.

#### 2.00.00 SPARES

##### 2.01.00 General

The Bidder shall indicate and include in his scope of supply all the necessary start-up, commissioning and recommended spares in addition to mandatory spares as specified elsewhere in the specification. The Bidder shall also state for each item of spares both mandatory and recommended, the normal expected service life.

2.01.01 All spares supplied under this contract shall be strictly interchangeable with the parts for which they are intended to replace. 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 bags with dessicator packs as necessary.

2.01.02 Each spare part shall be clearly marked or labelled on the outside of the packing with the description. When more than one spare part is packed in a single case, a general description of the contents shall be shown on the outside and a detailed list enclosed. All cases, containers and other packages must be suitably marked and numbered for the purposes of identification.

2.01.03 All cases, containers or other packages are liable to be opened for examination as may be considered necessary by the Owner.

2.01.04 The Bidder shall also guarantee supply of spare parts, which shall be made, based on manufacturer's drawings on special order from the Owner for 30 years after commissioning of the plant.

2.01.05 Warranty period for all kinds of spares shall be six thousand (6000) hours of operation.





- 2.01.06 Design & Engineering details of all spares (make, model, rating, drawing, data sheet etc.) shall be submitted to the Owner prior to dispatch from manufacturers' works.
- 2.02.00 **Recommended Spares**
- 2.02.01 The Bidder shall provide a list of recommended spares for 3 years of normal operation of the plant for spares of indigenous origin, and for 5 years of normal operation for spares of non-indigenous origin. This list shall take into consideration the mandatory spares specified elsewhere in the specification and should be a separate list.
- 2.03.00 **Start-up Commissioning Spares**
- 2.03.01 Start-up commissioning spares are those spares which may be required during the start-up and commissioning of the equipment/system. The list of commissioning spares to be brought by the Bidder to ensure smooth commissioning of the plant shall be subject to the Owner's approval. All spares used until the plant is handed over to the Owner shall come under this category. Said spares, properly marked, shall be supplied together with the main equipment and shall be used by the Bidder, if needed, during erection & commissioning stage. All such spares which remain unused till issuance of Taking Over Certificate by the Owner, along with an equipment-wise quantitative consumption report shall be returned to the Owner during time of handover.
- 2.04.00 **Mandatory Spare Parts**
- 2.04.01 The Owner considers some of the spares are essential for running the equipment irrespective of whether they are included in the list of recommended spares by the Bidder as mentioned above.
- Since the components involved can not be foreseen at the bidding stage, only broad requirements of the Owner in this respect are outlined hereinafter. The bidder shall include his proposal, on the basis of these guidelines, an item-wise list of all components recommended as mandatory spares with the quantity. This list shall be separate from the list of recommended spares and shall be used for bid evaluation purposes. Any clarification in this respect may be obtained by the Bidder at the pre-bidding stage. During finalization of detailed engineering if some component, equipment, system, sub-system found to undergo change, then the Owner/Consultant shall revise the list for compliance by the Bidder without any implication to the Owner.
- 2.04.02 For Mandatory Spares refer Annexure-I of this section.



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Annexure-I

Sl. No.	Equipment/Package Name	Quantity to be supplied for the Package
1.31.05	Other Electrical Spares as applicable as per the Electrical List	Applicable Item & Quantity same as indicated in Electrical list Sl. No. 7.08.00, 7.21.00.
1.31.06	MMI Spares	Applicable Item & Quantity same as indicated in C&I list Sl. No.8.03.00
1.32.00	Mill Reject Handling System	
1.32.01	Pneumatic Conveying System	
(i)	Pneumatic Main Valves	4Sets of each type
(ii)	Pneumatic/Solenoid Two/ Three Position Control Valve	4Sets of each type
(iii)	Plate/Dome (including seals) Valve with Actuator	4Nos.
(iv)	Plate/Dome valve seals	6Sets
1.32.02	Compressor	Applicable Spares as Sl. No. 6.05.00
1.32.03	Other Electrical Spares as applicable as per the Electrical List	Applicable Item & Quantity same as indicated in Electrical list Sl. No. 7.08.00, 7.13.00 & 7.21.00.
1.32.04	PLC System	Applicable Item & Quantity same as indicated in C&I list Sl. No.8.03.00
1.32.05	Other C&I Spares as applicable as per the C&I List	Applicable Item & Quantity same as indicated in C&I list Sl No.8.04.00 & 8.07. Refer Section IC
1.33.00	Flue Gas Desulphurization System	
1.33.01	Gates/dampers in Flue Gas System	
(i)	Seals	1 set of each type gates and actuator (Set means complete replacement required)
(ii)	Actuator 1 no. of each type	1 no. of each type of gates and actuator
1.33.02	Air Pre Heaters	
(i)	Radial seals	1 set
(ii)	Axial Seals	1 set
(iii)	Circumferential or bypass seals	1 set
(iv)	Rotor post seals	1 set
(v)	Heating Element	1 set
(vi)	Air Motor	1 no.
(vii)	clutch assembly	1 no. of each type
(a)	Support Bearing	1 no.
(b)	Guide Bearing	1 no.
(vii)	Complete Speed reducer	
(a)	Speed reducer Gears, pinions & shaft	1 set
(b)	Speed reducer Bearings	1 set
(c)	Speed reducer Seals & gaskets	1 set
(d)	Speed reducer Clutch assembly	1 no
(e)	Couplings with inserts & fasteners	1 no.
(f)	Solenoid valves	1 no of each type and rating
(viii)	GGH Cleaning Device	
(a)	Lance and Nozzle	1 no.
(b)	Drive assembly including Gearbox and motor	1 no.
(c)	Valve assembly with actuator	1 no.
(d)	Pump assembly (if applicable)	1 no.
(ix)	GGH Electric Motor	1 no.
(x)	Lubricating system of support & Guide Brg.	







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Annexure-I

Sl. No.	Equipment/Package Name	Quantity to be supplied for the Package
6.04.05	Electrical Spares as applicable as per the Electrical List	Applicable Item & Quantity same as indicated in Electrical list Sl. No.7.08.00,7.12.00 & 7.21.00
6.04.06	C&I Field Instruments & PLC as applicable as per the C&I List	Applicable Item & Quantity same as indicated in C&I list Sl. No. 8.03.00, 8.04.00 & 8.10.00
6.05.00	<b>Compressed Air System</b>	
6.05.01	Dry Air Intake Filter	5Nos.
6.05.02	Complete set of Loading- unloading valve assembly	2Sets (one set means complete replacement for one compressor)
6.05.03	Low Pressure Compressor element (Screw) with Drive end & Non-drive end Bearings for Male & Female Elements	2Sets (one set means complete replacement for one compressor)
6.05.04	High Pressure Compressor element (Screw) with Drive end & Non-drive end Bearings for Male & Female Elements	2Sets (one set means complete replacement for one compressor)
6.05.05	Plug for Inter cooler Tube Bunch	15Nos
6.05.06	Plug for After Cooler Tube Bunch	15Nos
6.05.07	Automatic Purge Drain Valve for Inter cooler and After cooler	2Sets (one set means complete replacement for one compressor)
6.05.08	Air Outlet Check Valve	2Nos.
6.05.09	Air Outlet Compensator	1Set (one set means complete replacement for one compressor)
6.05.10	Lub oil filter	5Nos.
6.05.11	Lub oil Pressure Regulating valve	1No.
6.05.12	Different oil seals/O-ring for Lub oil system	4Sets (one set means complete replacement for one compressor)
6.05.13	Cooling water Inlet and Outlet connection bellows	2Sets (one set means complete replacement for one compressor)
6.05.14	Gear Box Unit Complete	1Set (one set means complete replacement for one compressor)
6.05.15	Gear Box Component	
(i)	Different Oil Seals/O-ring	2Sets (one set means complete replacement for one compressor)
(ii)	Set Of Bearings	1Set (one set means complete replacement for one compressor)
(iii)	Breathing Unit	2Nos
6.05.16	Component of L.P Cylinder	
(i)	Gear sets	1Set (one set means complete replacement for one compressor)
(ii)	Set of bearings	1Set (one set means complete replacement for one compressor)
(iii)	Mechanical Seal & O-ring	1Set (one set means complete replacement for one compressor)
6.05.17	Component of HP Cylinder	
(i)	Gear sets	1Set (one set means complete replacement for one compressor)
(ii)	Set of bearings	1Set (one set means complete replacement for one compressor)
(iii)	Mechanical Seal & O-ring	1Set (one set means complete replacement for one compressor)
(iv)	Different Safety Valves	1Set (one set means complete replacement for one compressor)





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Sl. No.	Equipment/Package Name	Quantity to be supplied for the Package
(v)	Coupling	
(a)	Complete Set of Coupling (Motor to Compressor)	1Set (one set means complete replacement for one compressor)
(b)	Flexible Rubber for Coupling	4Nos.
6.05.18	Drain Moisture Trap	2Sets (one set means complete replacement for one compressor)
6.05.19	Safety Valve's Springs & Gasket for LP Stage	1Set (one set means complete replacement for one safety valve)
6.05.20	Safety Valve's Springs & Gasket for HP Stage	1Set (one set means complete replacement for one safety valve)
6.05.21	Oil Pump & Motor Complete Assembly	1Set
6.05.22	Drive Motor	1No.
6.05.23	Other Spares as applicable as per the Electrical List	Applicable Item & Quantity same as indicated in Electrical list Sl. No.7.08.00, 7.12.00 & 7.21.00
6.05.24	Compressed Air Line Valves	As applicable as per Sl. No.5.05.02
6.05.25	C&I Items	
(i)	PLC with MMI System	Applicable Item & Quantity same as indicated in C&I list Sl. No. 8.03.00
(ii)	Field Instruments & Others as applicable as per the C&I List	Applicable Item & Quantity same as indicated in C&I list Sl. No. 8.04.00, 8.07.00 & 8.10.00
6.05.26	Air Drying Plant (HOC Type)	
(i)	Pre-filter Elements	2Sets (one set means complete replacement for one drier filter)
(ii)	After-filter Elements	2Sets (one set means complete replacement for one drier filter)
<del>6.06.00</del>	<del>Ventilation System</del>	
<del>6.06.01</del>	<del>Centrifugal Fans</del>	
<del>(i)</del>	<del>Set of Bearings for Air Washer Fans</del>	<del>1Set for each Type of Fan</del>
<del>(ii)</del>	<del>Set of Bearings for U.A.F. Fans</del>	<del>1Set for each Type of Fan</del>
<del>(iii)</del>	<del>Impeller for the Fan</del>	<del>1Set for each Type of Fan</del>
<del>(iv)</del>	<del>Drive Motor</del>	<del>1No. for each Type of Fan</del>
<del>(v)</del>	<del>Electrical Spares as applicable as per the Electrical List</del>	<del>Applicable Item &amp; Quantity same as indicated in Electrical list Sl. No. 7.21.00</del>
<del>6.06.02</del>	<del>Centrifugal Pumps</del>	
<del>(i)</del>	<del>Set of Bearings for Air Washer Pumps</del>	<del>1Set for each Type and rating of Pump</del>
<del>(ii)</del>	<del>Set of Bearings for U.A.F. Pumps</del>	<del>1Set for each Type and rating of Pump</del>
<del>(iii)</del>	<del>Gland Packing, Shaft Sleeve &amp; Casing Wearing Ring</del>	<del>1Set for each Type and rating of Pump</del>
<del>(iv)</del>	<del>Impeller for the Pump</del>	<del>1Set for each Type and rating of Pump</del>
<del>(v)</del>	<del>Electrical Spares as applicable as per the Electrical List</del>	<del>Applicable Item &amp; Quantity same as indicated in Electrical list Sl. No. 7.21.00</del>
<del>6.06.03</del>	<del>Spray Nozzles</del>	
<del>(i)</del>	<del>Spray nozzles for air washer unit</del>	<del>1Set (one set means complete replacement for one air washer)</del>
<del>(ii)</del>	<del>Spray nozzles for U.A.F. unit</del>	<del>1Set (one set means complete replacement for one UAF)</del>
<del>6.06.04</del>	<del>SS Filters</del>	
<del>(i)</del>	<del>SS Filters for Air washer</del>	<del>1Sets (one set means complete replacement for one air washer)</del>
<del>(ii)</del>	<del>SS Filter for Unitary air filtration unit</del>	<del>1Sets (one set means complete replacement for one UAF)</del>





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Sl. No.	Equipment/Package Name	Quantity to be supplied for the Package
(d)	<del>Voltmeter Selector Switch</del>	<del>3 nos. of each type.</del>
(xvii)	<del>Isolation switch for the control supply (AC Supply On / Off Switch, DC Supply On / Off Switch, Motor Heater On / Off Switch etc.)</del>	<del>3 nos. of each type.</del>
(xviii)	<del>Operating mechanism rod for each rating</del>	<del>3 nos</del>
(xix)	<del>Set of gaskets of each rating</del>	<del>2 sets</del>
(xx)	<del>Ammeter of each type &amp; range</del>	<del>2 no. of each type &amp; range</del>
(xxi)	<del>Voltmeter of each type &amp; range</del>	<del>1 no. of each type &amp; range</del>
(xxii)	<del>Circuit breaker aux. contact assembly:-</del>	<del>10% (rounded off to the next higher integer) of total nos. or minimum 5 nos. whichever is higher for each type and rating used in each switchgear</del>
(a)	<del>52 a &amp; b</del>	
(b)	<del>52 c &amp; d</del>	
(xxiii)	<del>Indicating Lamps</del>	
(a)	<del>Indicating lamps (Red, amber, green, white, blue)</del>	<del>5% (rounded off to the next higher integer) of total nos. for each type</del>
(b)	<del>Indicating lamp covers of all colours, lamp resistors &amp; holders</del>	<del>5% (rounded off to the next higher integer) of total nos. for each type and rating used in each switchgear</del>
(xxiv)	<del>Fuse base and holder of each type &amp; rating</del>	<del>6 nos. of each type.</del>
(xxv)	<del>MCB &amp; Fuse of each type &amp; rating</del>	<del>12 nos. of each.</del>
(xxvi)	<del>Maintenance tools and accessories for maintenance (bidder to list)</del>	<del>1 set.</del>
(xxvii)	<del>Carbon brushes for spring charging motor (if applicable)</del>	<del>20 sets</del>
(xxviii)	<del>Breaker jaw contact (Bus end &amp; breaker end) assembly</del>	<del>2 sets (1 set consists of 3 nos.) of each rating</del>
(xxix)	<del>Terminal blocks</del>	<del>12 nos. of each type and rating</del>
(xxx)	<del>Arc chute (if applicable for each rating)</del>	<del>3 nos.</del>
(xxxi)	<del>DC Supply Source Selector Switch (3 position)</del>	<del>3 nos.</del>
(xxxii)	<del>Bearings for spring charging motor</del>	<del>6 sets</del>
(xxxiii)	<del>Multiple pin plug contact assy. with cables (male &amp; female)</del>	<del>6 sets</del>
(xxxiv)	<del>Guide for moving contact set</del>	<del>6 sets (complete)</del>
(xxxv)	<del>Interphase barrier</del>	<del>3 nos. for each type</del>
(xxxvi)	<del>Contactors with HRC fuses</del>	<del>10 % (rounded off to the next higher integer) of each type and rating</del>
(xxxvii)	<del>Aux. contactors</del>	<del>10 % (rounded off to the next higher integer) of each type and rating</del>
(xxxviii)	<del>Control supply transformers (If applicable)</del>	<del>1 no. of each type.</del>
(xxxix)	<del>Dash pot complete assembly</del>	<del>1 no. with each type</del>
(XL)	<del>Surge Arrester</del>	<del>5 nos. of each type and rating</del>
(XLI)	<del>Transducer</del>	<del>2 nos. for each type and Rating</del>
(XLII)	<del>Energy Meter</del>	<del>1 no. of each type and rating</del>
(XLIII)	<del>HT fuse of PT</del>	<del>3 nos. of each type and rating</del>
7.08.00	415V System	
7.08.01	11/0.415KV Transformer ( for Each make, type and rating of Transformer)	
(i)	Door Limit Switch complete set	1 set (1 set means total requirement for one





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Sl. No.	Equipment/Package Name	Quantity to be supplied for the Package
		Transformer)
(ii)	Neutral CT	1 no of each type and rating
(iii)	Temperature scanner	1 no.
(iv)	bhy	3 No
(v)	LV Bushing with metal parts, connectors and gaskets	3 No
(vi)	LV neutral Bushing with metal parts, connectors and gaskets	1 No
(vii)	Post Insulator	1 set (1 set means total requirement for one Transformer)
(viii)	Limb of complete LT & HT of temperature sensing devices	1 Set (1 set means total requirement for one Transformer)
7.08.02	415V Air Circuit Breaker (for Each make, type and rating of ACB)	
(i)	Trip Coil	20% of total nos. or minimum 5 nos whichever is higher for each type and rating used in each switchgear (PCC/PMCC/MCC/ACDB)
(ii)	Closing Coil	20% of total nos. or minimum 5 nos whichever is higher for each type and rating used in each switchgear (PCC/PMCC/MCC/ACDB)
(iii)	Spring Charging Motor	2 nos.
(iv)	Spring Charging Motor with complete Mechanism	2 nos.
(v)	Spring Charged Limit Switch	5 nos.
(vi)	Thermal Overload for Spring Charging Motor	2 nos.
(vii)	Main Contact (Fixed and moving) assembly	5 sets (1 set consists of 3 nos.) for each type and rating
(viii)	Arcing Contact (Fixed and moving) assembly	5 sets (1 set consists of 3 nos.) for each type and rating
(ix)	Breaker Jaw Contact ( Bus-end & Breaker- end) assembly	5 sets (1 set consists of 3 nos.) for each type and rating
(x)	Sliding Contact (Fixed & Moving)	3 sets.
(xi)	Breaker Auxiliary Contact Block	5 nos.
(xii)	Arcing Chute	2 sets (1 set consists of 3 nos.) for each type and rating
(xiii)	Plug Socket with Prefab cable	3 nos
(xiv)	Position Limit Switch	5 sets
7.08.03	415V PCC, PMCC, MCC, ACDB, DCDB, Elect. Control Panel (For each PCC, PMCC, MCC, ACDB, DCDB and Elect. Control Panel ) ( applicable items of PCC, PMCC, MCC, ACDB, DCDB and Elect. Control Panel shall be considered)	
(i)	Indicating Lamps complete assembly	
(a)	Red	3 nos of each make and type.
(b)	Blue	3 nos of each make and type.
(c)	Green	3 nos of each make and type.
(d)	White	3 nos of each make and type.
(e)	Amber	3 nos of each make and type.
(ii)	CT	2 nos. for each make, type and Rating







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Sl. No.	Equipment/Package Name	Quantity to be supplied for the Package
(iii)	Transducer	2 no for each make, type and Rating
(iv)	Trip / Neutral / close Control Switch	2 nos. for each make, type and Rating
(v)	Switch gear or MCC / Trial / Normal selector switch	2 nos. for each make, type and Rating
(vi)	Local/Remote selector switch	2 nos. for each make, type and Rating
(vii)	AC Supply On / Off Switch	1 no. for each make, type and Rating
(viii)	DC Supply On / Off Switch	1 no. for each make, type and Rating
(ix)	Motor Heater On /Off Switch	1 no. for each make, type and Rating
(x)	DC Supply Source Selector Switch (3-position)	1 no. for each make, type and Rating
(xi)	Ammeter Selector Switch	1 no. for each make, type and Rating
(xii)	Voltmeter Selector Switch	1 no. for each make, type and Rating
(xiii)	Voltmeter	2 no. for each make, type and Rating
(xiv)	Ammeter	2 no. for each make, type and Rating
(xv)	Auxiliary Control Contactor	
(a)	Auxiliary Control Contactor complete assembly	10% of total nos for each make, type and Rating.
(b)	Auxiliary Control Contactor spare kits	10% of total nos. for each make, type and Rating.
(c)	Auxiliary Control Contactor Coils	10% of total nos for each make, type and Rating.
(xvi)	Power Contactor	
(a)	Power Contactor Complete Assembly	10% of total nos for each make, type and rating
(b)	Power Contactor spare kits	10% of total nos for each make, type and Rating.
(c)	Power Contactor Coils	10% of total nos for each make, type and Rating.
(xvii)	MCCB	5% of total nos. for each make, type and rating.
(xviii)	MCB	5% of total nos. for each make, type and rating.
(xix)	Switch Fuse Unit (DC)	10% of total nos. for each make, type and rating.
(xx)	Power Fuse	5% of total nos. for each make, type and rating.
(xxi)	Control Fuse	5% of total nos. for each make, type and rating.
(xxii)	Thermal Overload Relay	5% of total nos. for each make, type and rating.
(xxii)	Sliding contact (Fixed and moving) Complete assembly	2 sets of each make, type and rating
(xxiii)	Busbar to module Lira Contact assembly	2 sets of each make, type and rating (1 set means all 3 ph+ neutral)
(xxiv)	Control and Aux. Transformer	1 no of each make, type and rating
(xxv)	Delay Timer	2 no of each make, type and rating
(xxvi)	Power Terminal Block	2 sets for each make, type and rating
(xxvii)	Control Terminal Block	2 sets for each make, type and rating
(xxviii)	End plate for Power and Control terminal block	2 sets for each make, type and rating
(xxix)	Energy meter	1 no for each make, type and rating
(xxx)	Relays (Other than numerical relay):	
(a)	Conventional (Electromagnetic/Static type) Relay	2 no for each make, type and rating
(b)	Aux. relays & Lock out relays & TIMERS	2 nos for each make, type and rating
(xxxi)	MCCB Status (On/off) Monitoring Switch/Contact	2 nos for each make, type and rating
(xxxii)	Push Button (On/Off) Complete Assembly	2 nos for each make, type and rating
(xxxiii)	Annunciation Facia with lamps complete	1 set for each make, type and rating





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Sl. No.	Equipment/Package Name	Quantity to be supplied for the Package
<del>7.11.06</del>	<del>UPS Battery (Ni-Cad Type)</del>	
(i)	<del>Battery Cell (Uncharged, Dry)</del>	<del>10Nos. each type</del>
(ii)	<del>Inter-connecting cell strips</del>	<del>10Nos. each type</del>
(iii)	<del>Vent cap</del>	<del>10Nos. each type</del>
(iv)	<del>Hydrometer</del>	<del>1No.</del>
(v)	<del>Rubber gloves</del>	<del>1Pair</del>
(vi)	<del>Voltmeter for measuring cell voltage (Center zero type)</del>	<del>1No.</del>
(vii)	<del>Funnel</del>	<del>1No.</del>
(viii)	<del>Jug</del>	<del>1No.</del>
(ix)	<del>Apron &amp; Goggles</del>	<del>1Set</del>
(x)	<del>Cell lifting puller</del>	<del>1No.</del>
(xi)	<del>Insulated socket spanner with handle</del>	<del>1No.</del>
(xii)	<del>Terminal screw with Belleville washer</del>	<del>5% of total quantity used</del>
(xiii)	<del>Plastic filling bottle</del>	<del>1No.</del>
(xiv)	<del>Thermometer</del>	<del>1No.</del>
<del>7.11.06</del>	<del>Other Electrical Items</del>	<del>For other applicable items SI No. 7.12.00 &amp; 7.08.00 of this document shall be followed.</del>
7.12.00	Control Panel/Desk Mounted Items	
7.12.01	Push Button Complete assembly	10Nos. for each colour
7.12.02	Push Button Contact Element (1NO + 1NC) Block	20Nos.
7.12.03	Selector Switch	10Nos. for each type and rating
7.12.04	Meter (Analog and Digital)	
(i)	Ammeter	2Nos. for each type and range
(ii)	Voltmeter	2Nos. for each type and range
(iii)	Frequency	2Nos. for each type and range
(iv)	MW	2Nos. for each type and range
(v)	MVAR	2Nos. for each type and range
(vi)	Power Factor	2Nos. for each type and range
(vii)	Synchroscope	1No. for each type and range
(viii)	Synchrocheck Relay complete set	1No. for each type and range
(ix)	Transducer	1No. for each type and range
7.12.05	Indicating Lamps complete assembly	20Nos. for each Colour and type
7.12.06	Mimic Lamps	10Nos. for each Colour and type
7.12.07	MCB	5Nos. for each type and rating
7.12.08	Door Limit Switch	5Nos.
7.12.09	Annunciation system	
(i)	Lamp Box with Facia & Lamps (LED type)	25Nos.
(ii)	Hooter	1No.
(iii)	Each type of PCB (for non-PLC driven system)	1(one) no.
7.13.00	Actuator	
7.13.01	Complete set of Actuator	2Nos. for each type, make and rating, 1 no. for H2 cooler Temperature controller and 1 no. for stator water temperature controller
7.13.02	Power Unit for Modulating Actuator	4Nos. of each type





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Sl. No.	Equipment/Package Name	Quantity to be supplied for the Package
7.13.03	DC-DC Power Pack Unit	4Nos. of each type
7.13.04	Electronic cards	4Nos. of each type
7.13.05	Position Feed Back Transmitters	4Nos. of each type
7.13.06	Control Unit	4Nos. of each type
7.13.07	Limit Switch Assembly	2 Nos each type and rating
7.13.08	Torque Switch Assembly	2 Nos each type and rating
7.13.09	Power Contactor	5Nos. for each type and rating
7.13.10	Auxiliary Contactor	5Nos. for each type and rating
7.13.11	Thermal Over Load Relay	2Nos. for each type and rating
7.13.12	Motor	1No. each type and rating
7.13.13	Complete Seal kit	2Sets for each type and rating
7.13.14	Complete O-Ring Set	2Sets for each type and rating
7.14.00	Illumination	
7.14.01	Lighting fixtures without light	20 Sets for each make, type and rating
7.14.02	MCCB	5 Nos for each make, type and rating.
7.14.03	MCB	20 Nos for each make, type and rating.
7.14.04	Power and Control Contactor	5 Nos for each make, type and rating
7.14.05	Switches	5 Nos for each make, type and rating.
7.14.06	Receptacles with plug	5 Nos for each make, type and rating
7.14.07	Rotary switches	2 Nos for each make, type and rating.
7.14.08	LED light	50 nos for each make, type and rating.
7.14.09	Clock switch type Time Switch	2 nos for each make, type and rating.
7.14.10	Lighting Transformer	1 no for each make, type and rating.
7.15.00	Cable	
7.15.01	11KV Grade HT Power Cable	2 (Two) Kms. of each type, size & rating of Cables
7.15.02	3.3KV Grade HT Power Cable	2 (Two) Kms. of each type, size & rating of Cables
7.15.03	LT Power Cable	2(Two)Kms. of each type, size & rating of Cables
7.15.04	Control Cable	2(Two)Kms. of each type, size & rating of Cables
7.15.05	Fire Survival Cable	1(One)Km of each type, size & rating of Cables
7.16.00	Neutral Grounding Register	
7.16.01	NGR complete with all accessories	1 set of each make, type and rating
7.16.02	Insulator	2 nos for each make, type, rating and size
7.16.03	Neutral CT( if applicable)	1 no of each type and rating
7.17.00	DG Set	
7.17.01	Diesel Engine	
(i)	Element Corrosion Resistor	8Nos.
(ii)	Element lub oil Filter	8Nos.
(iii)	Element lub oil by pass Filter	8Nos.
(iv)	Element Fuel Filter	16Nos.
(v)	Plate corrosion Resistor	16Nos.
(vi)	Element Air cleaner outer	2Nos.
(vii)	Element Air cleaner Inner	2Nos.
(viii)	Fuel Oil Pump	1No.





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Annexure-I

Sl. No.	Equipment/Package Name	Quantity to be supplied for the Package
(viii)	Voltmeter for measuring cell voltage (Center zero type)	1No.
7.18.02	Float cum Boost Charger (For each make, Type and Rating)	
(i)	Electronic Module, PCB, Cards of each type and rating (with all components mounted)	2 Set
(ii)	Fuses of each type and rating	100% of total quantity.
(iii)	SCR of each type and rating	2 Nos.
(iv)	Blocking Diode of each type and rating	5 Nos. of each type
(v)	Potentiometer of each type and rating	1 Set
(vi)	Pulse transformer	1 Set of each type
(vii)	Main and Aux. transformer	1 no of each type and rating
(viii)	Capacitor	2 no of each type and rating
(ix)	Meters	1 No of each type
(x)	Transducer	1 No of each type
(xi)	Selector Switch	1 no of each type
(xii)	Control Switch	1 no of each type
(xiii)	Current transformer(if applicable)	1 no of each type and rating
(xiv)	Push button complete set	1 no of each type
(xv)	Annunciation window	1No.
(xvi)	Indicating Lamps complete assembly	2 Nos of each type.
7.19.00	24V-DC System	
7.19.01	Battery	
(i)	Battery Cell (Uncharged, Dry)	10Nos
(ii)	Inter-connecting cell strips	10Nos
(iii)	Vent plug	5Nos
(iv)	Teak wood cable clamps with hardware	2Nos
(v)	Hydrometer	1No.
(vi)	Rubber gloves	1pair
(vii)	Voltmeter for measuring cell voltage (Center zero type)	1No.
(viii)	Insulated socket spanner with handle	1No.
(ix)	Thermometer	1No.
7.20.02	Float cum Boost Charger	
(i)	Fuses & fuse links	100% of total quantity for each type, rating of fuses used in the system
(ii)	SCR	100% Used in the System
(iii)	Diode	100% Used in the System
(iv)	Indicating lamps	100% Used in the System
(v)	All types of Electronic Module/ PCB/Card	2Nos. each type used in the system
(vi)	pulse transformer	1 set
7.20.03	Other DCDB Spares items as applicable as per the Electrical List	Item & Quantity same as indicated in Electrical list Sl. No.7.09.00
7.20.04	Other Electrical Spares as applicable as per the Electrical List	Item & Quantity same as indicated in Electrical list Sl. No.7.08.00 & 7.12.00
7.21.00	Motor	
7.21.01	11 KV & 3.3 KV Motor	
(i)	Motor of each type and rating (Note :	10% of the installed quantity or minimum 1







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Sl. No.	Equipment/Package Name	Quantity to be supplied for the Package
	<del>motors covered in mechanical spare items need not to be included here again)</del>	<del>number whichever be higher</del>
(ii)	<del>Neutral End Terminal Bushing with Fasteners</del>	<del>1 no. for each type and rating of Motor</del>
(iii)	<del>Bearing Temperature Gauge Driving &amp; Non-Driving End</del>	<del>1 set for each type and rating of Motor</del>
(iv)	<del>Phase segregated terminal boxes</del>	<del>2 Nos. for each type and rating of Motor</del>
(v)	<del>Heaters</del>	<del>2 sets for each type and rating of Motor</del>
(vi)	<del>Complete Set of Coupling</del>	<del>1 set for each type and rating of Motor</del>
(vii)	<del>Bearings (DE) for each type and rating of motors</del>	<del>2 sets for each type and rating of Motor</del>
(viii)	<del>Bearings (NDE) for each type and rating of motors</del>	<del>2 sets for each type and rating of Motor</del>
(ix)	<del>Cooling Fan Internal &amp; External</del>	<del>1 set for each type and rating of Motor</del>
(x)	<del>Neutral CT for differential protection (For motor rating &gt;1000 KW)</del>	<del>2 no of each type and rating.</del>
(xi)	<del>End Termination kits</del>	<del>2 Nos. of each type and rating</del>
(xii)	<del>Indicating Instruments/gauges other than Bearing temperature gauge (as applicable)</del>	<del>1 set for each type and rating of Motor</del>
(xiii)	<del>Phase side Bushing and Insulator</del>	<del>1Set for each type and rating of Motor</del>
(xiv)	<del>Oil Seal Ring (as applicable)</del>	<del>1Set for each type and rating of Motor</del>
7.21.02	415 Volt Motor	
(i)	Motor of each type and rating (Note : motors covered in mechanical spare items need not to be included here again) 10% of the installed quantity or minimum 1 number whichever be higher	10% of the installed quantity or minimum 1 number whichever be higher
(ii)	End Shield Cover Driving & Non-Driving End	1 set for each type and rating of Motor
(iii)	Heaters	2 sets for each type and rating of motor
(iv)	Bearings (DE and NDE) for each type and rating of motor	2 sets
(v)	Cooling Fan for all type and rating of LT motors	One (1) set
(vi)	Dust seals and gaskets for each type of motors	1 Set
(vii)	Motor Terminal Block	1 no. for each type and rating of Motor
(viii)	Complete Set of Coupling	1 set for each type and rating
7.21.04	DC Motor	
(i)	Motor of each type and rating (Note : motors covered in mechanical spare items need not to be included here again)	10% of the installed quantity or minimum 1 number whichever be higher
(ii)	Carbon brushes	2 sets for each type and rating of Motor
(iii)	Brush assemblies	2 sets for each type and rating of Motor
(iv)	Terminal blocks	1 set for each type and rating of Motor
(v)	Heaters	1 set for each type and rating of Motor
(vi)	Complete Set of Coupling	1 set for each type and rating of Motor
(vii)	Bearings (DE and NDE) for each type and rating of motor	1 set for each type and rating of Motor
(viii)	Cooling Fan	1 set for each type and rating of Motor
7.22.00	Local Control Station	





## LIST OF TOOLS &amp; TACKLES

## 1. Steam Generator &amp; Auxiliaries

Sl. No.	Description	Quantity Required
<b>A.</b>	<b>PULVERISER</b>	
1.	Box wrench trunion shaft end cap	3 Nos.
2.	Drive cap for journal shaft	2 Nos.
3.	Sampling device assembly	1 no.
4.	Oil dip stick	3 Nos.
5.	Spring pre-load fixture/ JOURNAL ROLL SPRING PRE-LOAD FIXTURE	2 Nos.
6.	Grinding roll removal fixture/ JOURNAL GRINDING ROLL LIFTING LUG	2 Nos.
7.	Grinding roll wear measurement gauge	1No.
8.	Spanner wrench grind roll lock nut	3 Nos.
9.	Single open end jaw spanner	3 Nos.
10.	Trip torque arrangement	1 no.
11.	BOWL & BOWL HUB HOISTING FIXTURE	1 No.
12.	GEARBOX WITHDRAWAL FIXTURE	1 No.
13.	MULTI POINT ROTARY PROBE	1 No.
14.	PLANETARY GEARBOX ALIGNMENT ADJUSTING BLOCKS	1 Set
15.	JOURNAL TILT OUT APPLICATION & FIXTURE	1 No.
16.	JOURNAL STOP BOLT WRENCH	1 No.
17.	HYDRAULIC TORQUE WRENCH	1 No.
18.	HYDRAULIC STUD TENSIONER	1 No.
19.	DIRTY AIR PITOT	4 No.s
20.	ANCHOR BOLT TEMPLATE	1 No.
21.	TRUNNION SHAFT ECCENTRIC ADJUSTMENT TOOL	1 No.
22.	ELECTRICAL OPERATED MILL HANDLING EQUIPMENT	1 Set.
<b>B.</b>	<b>GRAVIMETRIC FEEDERS</b>	
1.	Checking bar	2 Nos.
2.	Pulley lift bar assembly	1 no.
3.	Pulley removal tool	1 no.
4.	Feeder calibrating instrument kit	2 Nos.
5.	Rail extension (LG & RH)	1 set
6.	Digital tachometer	1 no.
7.	Shims for calibration	2 Nos.
<b>C.</b>	<b>GRAVIMETRIC FEEDER CONTROLS (MICROPROCESSOR BASED)</b>	
1.	Calibration probe and cables	2 sets
2.	Digital tachometer	1 no.
<b>D.</b>	<b>FANS</b>	



1.	Bearing cum coupling puller assembly	2 Nos.
2.	Mounting and dismounting tool for impeller	1 no.
3.	Torque wrench 20 – 200 NM	1 no.
4.	Torque wrench 75 – 400 NM	1 no.
<b>E.</b>	<b>AIR HEATERS</b>	
1.	Hydraulic lifting cylinder set (Pump with Hoses etc.)	4 Nos.
<b>F.</b>	<b>ELECTROSTATIC PRECIPITATOR</b>	
1.	Stretching device for mounting emitting electrode	2 Nos.
2.	Alignment jig for support insulator replacement	2 Nos.
3.	Lifting tool for support insulator replacement	4 Nos.
4.	Form tool for correcting collecting electrode profile	1 no.
5.	Shaft insulation removal tool	1 no.
<b>G.</b>	<b>LAPPING TOOLS FOR VALVES</b>	
1.	Lapping tools for safety valve	1 set
2.	Lapping tools for other IBR valve	1 set
3.	Ring caps	1 set
4.	Grinding stones	1 set
<b>H.</b>	<b>SOOT BLOWERS</b>	
1.	Soot blower valve lapping tool	1 no.
2.	Soot blower valve spring tool	1 no.
3.	Soot blower special key	1 no.
4.	Nozzle setting fixture	1 no.
5.	Pressure sealing tool	1 no.
6.	Packing tampering tool	1 no.
<b>I.</b>	<b>OIL SYSTEM</b>	
1.	Burner vice assembly	3 sets
2.	Maintenance trolley	2 sets
<b>J.</b>	<b>LIFTING TACKLES</b>	
<b>a)</b>	Hoist for Fans and air heaters – electrically operated	
	i) FD fan – rotor	2 Nos.
	ii) FD fan – motor	2 Nos.
	iii) PA fan – rotor	2 Nos.
	iv) PA fan – motor	2 Nos.
	v) ID fan motor and impeller	1 No.
<b>b)</b>	Air heater (for basket removal from operating floor to ground level)	1 No.



	Air heater (from AH top to operating floor)	2 Nos. (manually operated)
c)	Electricity Operated Cranes for Mill Motor and Mill component handling	2 Nos. (one no. of each side of boiler)
	Electricity Operated Cranes for Mill component handling (in between mills)	10 Nos. (arranged on both sides)
d)	Electrical hoist for ESP components handling	2 Nos.
<b>K.</b>	<b>BOILER FEED PUMP SET</b>	
1.	Cartridge Assembly and Disassembly Tools	1 No.
2.	Cartridge Withdrawal Gear Arrangement	1 No.
3.	Mounting bracket Assy.	1 No.
4.	Mounting Wheel Assy. (MDBFP)	1 No.
5.	Mounting Wheel Assy. (TDBFP)	1 No.
6.	Extension sleeve Assy. (1 <sup>st</sup> stage)	1 No.
7.	Extension sleeve Assy. (Inter stage)	4Nos.
8.	Support jack Assy.	1 No.
9.	Support column (Motor driven)	2 Nos.
10.	Support column (Turbine driven)	2 Nos.
11.	Withdrawal Plate Thrust Collar	1 No.
12.	Withdrawal Plate DE Gland Sleeve	1 No.
13.	Withdrawal Plate Balancing Drum Assembly	1 No.
14.	Withdrawal Plate Gland Sleeve Assembly	1 No.
15.	Tube Spanner (Balancing Drum Nut) Assembly	1 No.
16.	Tube Spanner (Shaft Nut Thrower) Assembly	1 No.
17.	Tube Spanner (Shaft Lock Nut NDE) Assembly	1 No.
18.	Tube Spanner (Coupling Nut) Assembly	1 No.
19.	Tube Spanner (Shaft Lock Nut DE) Assembly	1 No.
20.	Hook Spanner	3 Nos.
21.	Hydraulic Stud Tensioner	1 No.
22.	Support Frame	1 No.
23.	LEVER ASSY, INNER CASING WITHDRWL	2 Nos
24.	PULL OUT ATTCH ASSY ,WTHDRWL	2 Nos
25.	BOLT INNR CASNG M30x3.5 ,WITHDRWL	2 Nos
26.	PR.PLATE M16 ,INNR CASNG WITHDRWL	2 Nos
27.	PIN 16 RND HD ,INNR CASNG WTHDRWL	2 Nos
28.	CASING STUD EXTN M56x4 ,WITHDRWL	2 Nos
29.	CAP NUT M115x3 / M56X4	2 Nos
30.	SUPPORT JACK ASSY, COUP. SIDE	1 No.
31.	SHAFT,SUPPORT JACK ASSY	1 No.
32.	SPACER NO.1,SUPPORT JACK ASSY	1 No.
33.	SPACER NO.2,SUPPORT JACK ASSY	1 No.
34.	SPACER NO.3,SUPPORT JACK ASSY	3 Nos





35.	SPACER NO.4,SUPPORT JACK ASSY	1 No.
36.	SPACER NO.5,SUPPORT JACK ASSY	3 Nos
37.	SPANNER, COUPLING NUT	1 No.
38.	THRUST DISC TOOL	1 No.
39.	THRUST DISC PULL OUT TOOL	1 No.
40.	TORQUE WRENCH ADPTR,TH.NUT	1 No.
41.	S.ROW DEEP GR BALL BRG 6305-2Z,VAR.20	2 Nos
42.	BOLT HEATER,BFP CSG BOLTS	4 Nos
43.	HEX SOC HD CAP SCR U HTS M36x80,VAR.NO.07	2 Nos
44.	BOLT HEX M20X80 P8.8 ELEGAL	1 No.
45.	BOLT HEX M20X180 ELEGAL	1 No.
46.	NUT HEX P M20-8	1 No.
<b>L.</b>	<b>CONDENSATE EXTRACTION PUMP</b>	
1.	Thrust Bearing Withdrawal and Assembly Tools	1 No.
2.	Impeller withdrawal and fitting Assembly	1 No.
3.	Set of 'C' Spanners set	1 No.
4.	Hook Spanner	1 No.
5.	Tie rods	3 Nos.
6.	TIE ROD ASSY-EN6J40/500 TB WTHDWL TOOLS	1 No.
7.	TIE ROD M16X500-EN6J40/500 TB WTHDWL	2 Nos
8.	STRONG BACK-EN6J40/500 TB WTHDWL	1 No.
9.	STRONG BACK-EN6J40/500 1ST IMP WTHDWL	1 No.
10.	SCR U ROD M12X330-EN6J40/500 1ST IMP TOOL	2 Nos
11.	NUT HEX P M12 -8	2 Nos
12.	NUT HEX P M16-8	4 Nos
13.	WASHER MCD 17-ST	2 Nos
14.	WASHER (M24 BOLT)	1 No.
15.	C SPANNER VAR NO 12	1 No.
16.	C SPANNER VAR.NO.13 ASSLY	1 No.
17.	NUT HEX P M24-8	1 No.
<b>M.</b>	<b>Boiler Feed Pump Drive Turbine</b>	
1.	Spanner for Stop Valve Assembly	1 No.
2.	Pin Spanner for Over –speed Governor	1 No.
3.	Ring Spanner for Turbine Casing	1 No.
4.	Single Ended Open Jaw Spanner for Stop Valve	1 No.
5.	Double Ended Open Jaw Spanner for Stop Valve	1 No.
6.	Single Ended Box Spanner for Bearing Housing	1 set
7.	Eye Bolts for Bearing Hosing	1 set
8.	Lifting Equipment for Rotor	1 No.
9.	Transport Equipment for Turbine Casing	1 set
10.	Hook Spanner for Governing Valves	1 No.
11.	Press for Governing Valves Spindle Packing Assembly	1 set
12.	Circlip Pliers for Governing Assemblies	1 set
13.	Blowing Down Fixture for Steam Blowing	1 No.



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Annexure-II

	Bolt Heating Equipment (Electrical)	1 No.
<b>For Blowing Down Equipment</b>		
	Flange and Pipe Assembly	1 No.
	Plate	1 No.
	Spindle	1 No.
	Washer	1 No.
	Packing Dia 600 X Dia 400 X 2	1 No.
	Plate 5 IS 2062 GRE250(FE410W)QLTY-A	1 No.
<b>Special Tools for Governing System</b>		
	Pin Spanner Assembly	1 No.
	PRESS ASSEMBLY	1 No.
	HOOK SPANNER 69	1 No.
	PRESS ASSEMBLY (PRESS FOR PACK)	1 No.
	GUIDE BUSH (PRESS FOR PACKING)	1 No.
	CLAMPING DEVICE	1 No.
	ASSLY.FIXTURE FOR ESV SEAT N250	1 No.
	EXT.CIRCLIP PLIER ST.NOSE 8MM	1 No.
	CIRCLIP PLIER INTERNAL STRAIGHT 8MM	1 No.
	INT.CIRCLIP PLIER ST.NOSE 19MM	1 No.
	EXT.CIRCLIP PLIER ST.NOSE 19MM	1 No.
	EXT.CIRCLIP PLIER ST.NOSE 10MM	1 No.
	PULLER FOR F.P.BUSH	1 No.
	MOUNTING FIXTURE	1 No.
	GUIDE BUSH	1 No.
<b>Special Tools for Drive Turbine</b>		
	RING SPANNER AF 90	2 No.
	SPECIAL RING SPANNER AF 105	2 No.
	ROD DIA 12X250 for spanner	4 No.
	FORCING OFF SCREW M30	1 No.
	HEX SCREW WITH DOG POINT M36	1 No.
	SHORTEND S.E.RING SPANNER AF 75MM	1 No.
	SHORTEND S.E.RING SPANNER AF 85MM	1 No.
	SHORTEND S.E.RING SPANNER AF 90MM	1 No.
	SHORTEND S.E.RING SPANNER AF 95MM	1 No.
	SHORTEND S.E.RING SPANNER AF 105MM	1 No.
	S.E.O.J.SPANNER AF 85MM	1 No.
	S.E.O.J.SPANNER AF 90MM	1 No.
	S.E.O.J.SPANNER AF 95MM	1 No.
	S.E.O.J.SPANNER AF 105MM	1 No.
	S.E.O.J.SPANNER AF 115MM	1 No.
	EYE BOLT CS M24 COL DIA 48 EYE ID 48 CP	2 No.
	EYE BOLT CS M30 COL DIA 56 EYE ID 56 CP	2 No.



	EYE BOLT CS M36 COL DIA 67 EYE ID 67 CP	2 No.
	EYE BOLT CS M42 COL DIA 80 EYE ID 80 CP	2 No.
	SCREW DRIVER FOR RECESS HEAD	1 No.
	ENGINEER'S SCREW DRIVER 100MM	1 No.
	ENGINEER'S SCREW DRIVER 150MM	1 No.
	ENGINEER'S SCREW DRIVER 250MM	1 No.
	S.E.SOLID BOX SPANNER AF 46MM	1 No.
	S.E.SOLID BOX SPANNER AF 55MM	1 No.
	INT.CIRCLIP PLIER ST.NOSE 19MM	1 No.
	CIRCLIP PLIER INTERNAL STRAIGHT 8MM	1 No.
	EXT.CIRCLIP PLIER ST.NOSE 8MM	1 No.
	CARRIER FOR BEARINGS	1 No.
	DEE SHACKLES GR:30 CS SWL 1TON EYE&COLLR	1 No.
<b>Lifting Equipment of Rotor</b>		
	LIFTING EQUIPMENT OF ROTOR	1 No.
	WIRE ROPE SLING GALV ROPEDIA20 SLING 5M	2 No.
	WIRE ROPE SLING GALV ROPEDIA20 SLING 2M	2 No.
<b>SPECIAL TOOL FOR TDBFP</b>		
	SUPPORT JACK ASSY,COUP SIDE	1 No.
	SHAFT	1 No.
	SPACER NO.1	1 No.
	SPACER NO.2	1 No.
	SPACER NO.3	2 Nos
	LEVER ASSY,INNER CASING WITHDRWL	1 No.
	PULL OUT ATTCH ASSY ,WITHDRWL	1 No.
	BOLT INNR CASNG M30x3.5 ,WITHDRWL	1 No.
	PR.PLATE M16 ,INNR CASNG WITHDRWL	1 No.
	PIN 16 RND HD ,INNR CASNG WITHDRWL	1 No.
	CAP NUT M110x3 / M56x4 ,WITHDRWL	1 No.
	CASING STUD EXTN M56x4 ,WITHDRWL	1 No.
	THRUST DISC PULL OUT TOOL	1 No.
	SPANNER, COUPLING NUT	1 No.
	TORQUE WRENCH ADAPTER,THR NUT	1 No.
	THRUST DISC TOOL	1 No.
	S.ROW DEEP GR BALL BRG 6305-2Z,VAR.20	2 Nos
	BOLT HEATER,BFP CSG BOLTS	4 Nos
	HEX BOLT M42X4.5X90, VAR.NO.16	1 No.
	BOLT HEX M20X80 P8.8 ELEGAL	1 No.
	BOLT HEX M20X180 ELEGAL	1 No.
	NUT HEX P M20-8	2 Nos

## 2. Steam Turbine Generator & Auxiliaries





## A. List of Tools &amp; Tackles for Turbo Generator

Sl. No.	For Equipment	Description	Quantity Required
1.	Mounting of shaft seal	Wrench	1 No.
2.	Mounting of shaft seal	Extension 8.5 inch.	1 No.
3.	Mounting of shaft seal	Extension 17 inch.	1 No.
4.	Mounting of shaft seal	Cross handle 20 inch	1 No.
5.	Mounting of shaft seal	Eye bolt M24	2 No.
6.	Mounting of bearing shell	Wrench B41 x 46	1 No.
7.	Mounting of bearing shell	Eye bolt M20	2 No.
8.	Tightening seal ring bolts	Pin Spanner	1 No.
9.	Bracket for seal ring holder	Bracket	1 No.
10.	Bracket for oil catcher/inner	Bracket	1 No.
11.	Bracket for compressor, seal body, seal ring & bearing.	Mounting Bracket	1 No.
12.	Assy. Of baffle ring, baffle ring carrier for compressor	Bracket	2 No.
13.	Assy. Device for HV terminal bushing	Mounting Device	1 No.
14.	Assy. of seal body	Half Ring	2 No.
15.	Rotor insertion	Skid Plate	1 No.
16.	Rotor insertion	Assy. fixture	1 Set
17.	Rotor insertion	Guide pulley	1 No.
18.	Rotor insertion	Skid shoe	2 No.
19.	Rotor insertion	Slide pedestal	1 No.
20.	Rotor insertion	Cross beam for rotor Insertion TE	1 No.
21.	Rotor insertion	Cross beam for rotor Insertion EE	1 No.
22.	Rotor insertion	Grates for rotor lifting	2 No.
23.	Rotor slinging	Wire rope dia 42x18 M	2 No.
24.	Rotor insertion	Copper sheet	1 No.
25.	Rotor insertion	Press board 3x450x500	1 No.
26.	Rotor insertion	Pulling device TU 32	1 No.
27.	Rotor insertion	Wire rope dia 16x20 M	1 No.
28.	Rotor insertion	Hand level for pulling device (suitable for d16x20)	1 No.
29.	Rotor insertion	Socket head cap screw M36x120	2 No.
31.	Rotor insertion	Eye nut M36	2 No.
32.	Rotor insertion	Dee shackle C4	1 No.
33.	Rotor insertion	Press board 3x770 x 1150	3 No.
34.	Mounting of shaft seal	Eye nut M24	1 No.





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Annexure-II

Sl. No.	For Equipment	Description	Quantity Required
35.	Mounting of shaft seal	Dee shackle	1 No.
36.	Mounting of shaft seal	Cross beam for bearing shell	1 No.
37.	For use during stand still	Dry air blower	1 No.
38.	Stator alignment	Hydraulic equipment	1 Set
39.	Bearing Oil Flushing (Prior to commissioning)	Oil purging system	1 Set
40.	Stator alignment	Aligning bracket (left)	2 No.
41.	Stator alignment	Aligning bracket (right)	2 No.
42.	Coupling bolt assembly (Exciter)	Guide bolt	2 No.
43.	Coupling bolt assembly (Exciter)	Round bar	1 No.
44.	Coupling bolt assembly (Exciter)	Hexagonal set screw	2 No.
45.	Exciter stator assembly	Top bolt	2 No.
46.	Diode wheel assembly	Torque spanner	1 Set
47.	Coupling bolt assembly	Wrench 58	1 No.
48.	Diode wheel assembly	Wrench	1 No.
49.	Diode wheel assembly	Wrench	1 No.
50.	Diode wheel assembly	Screwed pin M 5x8	2 No.

#### B. List of Tools & Tackles offered for Steam Turbine

Sl. No.	Assembly where used	Description	Quantity Required
1.	IP Casing	Dummy shaft for IPC (Alignment Shaft for IP Turbine)	1no.
2.	IP Rotor, LP Rotor	Shaft lifting device for IP(F), LP(F&R)	1 Set
3.	HPT & IPT	Stud heating & measuring device	1no.
4.	IP Rotor	IP Shaft support	1no.
5.	LP Rotor	LP Shaft support	1no.
6.	LP Shaft sealing	Lifting device for LP shaft seal casing	1no.
7.	IP & LP rotors, LP outer Casing(U/H)	Lifting beam	1no.
8.	LP Turbine	LP joint covering	1no.
9.	Lifting of IP & LP rotors,	Grommet sling	1pair





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Annexure-II

Sl. No.	Assembly where used	Description	Quantity Required
	LPC outer casing		
10.	HPT Assembly	Assembly fixture for HPT	1set
11.	HP inlet Assembly	Breech nut heating device	1no.
12.	LP Turbine	Device for shaft sealing compensators	1no.
13.	LP Rotor	Device for axial adjustment	1no.
14.	HPT Assembly	Turning over device for HPT	1no.
15.	HPT Assembly	Casing support	1no.
16.	IP Rear Bearing	Mounting frame for bearing shell	1no.
17.	HP rear bearing, IP rear bearing & LP rear bearing	Assy. Device for bearing shell D 250/D 380/D 500,	1 set
18.	HPT overhaul	Valve support	1no.
19.	Emergency Governor, ESV&CV, IV&CV	Pin spanner set	1no.
20.	ESV, IV & LP Bypass Valve	Steam blowing device set	1set
21.	Valve	Packing device for valves	1set
22.	Valve	Assy. device for valves	1set
23.	Governing Rack	Transport device for Governing Rack	1no.
24.	Rack	Transport device for Protection Rack	1no.
25.	ESV, IV	Hydraulic Test device (MS pipe/HRH pipe),	1 set
26.	Hydraulic Accumulator	Falling & Gauging device (as required)	1 Set
27.	Throttle Valve	Flush part for oil throttle valve	1no.
28.	Control Fluid system	Control Fluid piping flush & pressure testing device	1no.
29.	ESV & CV, IV, IPCV	Pipe spanner set	1no.
30.	IV	Spacer	4no.
31.	ESV&CV,IV,IPCV,ESV&IV Servo, Gen.	Eye bolt, Eye bolt collard/non-collard,	1 set
32.	Frame for suspension	Lifting lug	3set
33.	MOP, suspension of IV, General	Spanner set	1set
35.	General	Hook spanner	1no.
		Engineer's, set	1set
		SGL Ended open Jaw SPNR-	1 Set
		DBL Ended open Jaw SPNR-	1 Set
		Single ended ring spanner,	1 set
		Double ended ring spanner,	1 set
		Double ended tubular box spanner,	1 set
		Torque wrench	1 set
		Impact ring	1no.
		Guide column I = 750	2no.
		Pin	2no.
		Threaded bolt	1no.





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## Annexure-II

Sl. No.	Assembly where used	Description	Quantity Required
		Hex key set	1no.
		Screw set hex.	1 Set
		Off set screw driver	1 set
		Hydraulic Cylinder (Sl. – 50, 100)	1 set
		Rod m5 x 250, m8x500,	1 set
		Screw CAP SOC P 12-9 M5-65	4no.
		Mounting tool,	1 set
		Mounting ring	1no.
		Packing puller with cover	2no.
		Bushing,	1 set
		Draw bar	2no.
		Screw grub slt m20 x 310	2no.
		Tubular Soc. Pipe Spanner 470 x 1040x65	1no.
60.	General Governing System	Bolt Press out BM Set	1set
		Stret. Device for Breech Block	1 No.
		Forced Cooling Device for IPV	2 No.
		Forced Cooling Device for HPV	2 No.
		Tools for Governing System	1 No.
		Steam Blowing Device O/L Valve	1 No.
		HP Steam Pipes Hyd. Test Device	2 No.
		IP Steam Pipes Hyd. Test Device	2 No.
		Lifting slings for HP Turbine	1 No.
		Lifting slings for IP Turbine	1 No.
		Lifting slings for LP Turbine	1 No.
		Lifting Slings for HP Turbine	1 No.
		Lifting Slings for IP Turbine	1 No.
		Lifting Slings for LP Turbine	1 No.
		Lifting Device C-Hook	1 No.
		Dev. Axial Holding of LP Shaft	1 No.
		Grating Covering for LP	1 Set
		Assembly Device for HP SV & CV	1 No.
		Assembly Device for IPCV	1 No.
		Turning Over Device for HPT	1 No.

**Note :** The List is tentative & the bidder shall include in the offer any additional items that shall be required for the system in offer as well any item description that may undergo specific technical changes.



## SECTION-XI

### PROTECTIVE COATING AND PAINTING







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## SECTION-XI

### PROTECTIVE COATING AND PAINTING

#### 1.00.00 INTENT OF SPECIFICATION

1.01.00 This specification addresses the requirements of all labour, material, and appliances necessary with reference to preparations for lining / painting, application as well as finishing of all lining / painting for all mechanical and electrical equipment, piping and valves, structures etc. included under the scope of this Package.

1.02.00 The Bidder shall furnish and apply all lining, primers including wash primers if required, under-coats, finish coats and colour bands as described hereinafter or necessary to complete the work in all respects.

#### 2.00.00 CODES & STANDARDS

2.01.00 The Bidder shall follow relevant Indian and International Standards wherever applicable in cleaning of surface, selection of lining material / paints and their application. The entire work shall conform to the following standards / specifications (latest revision or as specified).

- |    |                            |   |  |
|----|----------------------------|---|--|
| a) | SSPC SP 10 / NACE 2 / Sa2½ | : | Near White Blast Cleaning  |
| b) | SSPC PA 2                  | : | Measurement of dry film coating thickness with magnetic gauges.                      |
| c) | ASTM D 45                  | : | Method for pull off strength using portable Adhesion Tester.                         |
| d) | NACE RP 0274 – 2004        | : | High-Voltage Electrical Inspection of Pipeline Coatings.                             |
| e) | NACE SP 0188 – 2006        | : | Discontinuity (Holiday) Testing of New Protective Coatings on Conductive Substrates. |
| f) | NACE RP 0169 – 2002        | : | Control of External Corrosion of Underground or Submerged Metallic Piping Systems.   |
| g) | AWWA C 210 – 2007          | : | Liquid-Epoxy Coating Systems for the Interior and Exterior of Steel Water Pipelines. |
| h) | IS 3589:2001 Annexure-B    | : | Steel Pipes for Water and Sewage Specification.                                      |
| i) | AWWA C222-2000             | : | Polyurethane Coating for the Interior and Exterior of Steel Water Pipe and Fittings. |



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- j) IS 13213 : 2000 : Polyurethane Full Gloss Enamel (Two pack)
- k) ISC HD 20 (11902) : Polyurethane coating for Interior and Exterior of steel pipe and fittings.
- l) ISC HD 20 (11055) : Solvent less Liquid epoxy system by application of Interior and Exterior surface of steel pipeline.

### 3.00.00 GENERAL REQUIREMENTS

- 3.01.00 The steel surface preparation prior to actual commencement of coating shall conform to SSPC SP 10 / NACE 2 / Sa2½ (near white metal) with sand blasting.
- 3.02.00 The contractor shall submit a detailed written description in the form of a manual covering coating equipment, procedures, materials inspection test, and repair etc. to Owner/Consultant for approval.
- 3.03.00 The contractor shall also provide copies of test reports from NABL approved laboratory (like National Test House, Kolkata) in support of the paint/primer materials to be used shall conform to the specification requirement.
- 3.04.00 The contractor shall also provide certificates from paint/primer manufacturer mentioning the batch numbers, date of manufacture and shelf life etc. of the materials to be used. In addition to that Manufacturing Quality Plan (MQP) and Field Quality Plan (FQP) shall also be submitted prior to commencement of supply of material and field application.
- 3.05.00 Paint/coating application work at site shall be done either by paint manufacturer or by their authorized applicator. The authorized applicator shall have proper training & certification from manufacturer. Applicator shall possess all the necessary specialized equipment and manpower experienced in similar job.
- 3.06.00 Applied coating shall be tested for dry film thickness, holiday (electrical inspection for continuity) and adhesion as per relevant standard such as SSPC PA 2, NACE RP 0274 and ASTM D 4541.
- 3.07.00 If necessary, the material may be heated and applied by airless spray / plural component spray system.
- 3.08.00 Manufacturer's specific recommendation, if any, shall be followed during application of lining / paints.
- 3.09.00 In areas where there is danger of spotting automobiles or other finally finished equipment or building by wind borne particles from paint spraying, a Purchaser approved method shall be adopted.





- 3.10.00 The colour scheme of the entire Plant, covered under this specification shall be approved by the Purchaser in advance before application.
- 3.11.00 All indoor and outdoor piping, insulated as well as uninsulated will have approved colour bands painted on the pipes at conspicuous places throughout the system, as approved by Purchaser.
- 3.12.00 Inside surfaces of vessels / tanks shall be protected by anticorrosive paints or rubber lining as required / specified elsewhere in the specification. External surfaces of all vessels / tanks shall be protected by anti-corrosive painting.
- 3.13.00 For vessels / tanks requiring lining and epoxy painting all inside surface shall be blast cleaned using non-siliceous abrasive after usual wire brushing.
- 3.14.00 Natural rubber lining shall be provided on the inside of vessels / tanks as required / specified elsewhere in the specification, in three layers resulting in a total thickness not less than 4.5 mm.
- 3.15.00 Surface hardness of rubber lining shall be 65 +/- 5 deg. A (shore).
- 3.16.00 After the lining is completed, the vessels / tanks shall not be subjected to any prolonged exposure to direct sunlight in course of its transportation, erection etc. They shall not be stored in direct sunlight. No further lining or burning shall be carried out on the vessel, after application of the lining.
- 3.17.00 All lining projecting outside of the vessel shall be protected adequately from mechanical damages during shipment, handling storage etc.
- 3.18.00 Suitable warnings, indicating the special care that must be taken with respect to these lined vessels shall be stenciled on their outside surface with the letters at least 12 mm high.
- 3.19.00 All insulated piping shall have aluminium sheet jacketing.
- 4.00.00 **EQUIPMENT, MATERIAL AND SERVICES TO BE FURNISHED BY THE BIDDER**
- 4.01.00 After erection at site, the outside surfaces of all equipment having a shop coat shall be given further priming coat and finished coats of paint as detailed in following clauses. However, if the painting system is such that the shop coat and primer coat to be applied at site are not compatible, then shop coat has to be removed from the surface of equipment before application of primer coat with prior blasting.

All factory finished paints shall be touched up at site as required.

All uninsulated piping shall be finished with final paintings after use of proper wash primer and primer. Aluminium sheet jacketed piping need not be painted. Colour bands of Purchaser's approved shade shall however be





applied on jacketed piping near walls or partitions, at all junctions, near valves and all other places as instructed by the Purchaser. All structures shall be painted with approved paint.

#### 4.02.00 **Surface Preparation**

4.02.01 Unless mentioned otherwise, all rust and mill scale shall be removed by blasting up to SSPC SP10/NACE2/Sa2½ level to get “near white metal” surface before applying the primer.

4.02.02 Special care shall be taken to remove grease and oil by means of suitable solvents like Trichloroethylene or Carbon Tetrachloride.

#### 4.03.00 **Painting**

4.03.01 Specification for application of paints for external surfaces protection of vessels / tanks / equipment / piping / fittings / valves shall be as follows :

- a) Surface preparation shall be done by means of sand blasting, which shall conform to SSPC SP10/NACE 2/Sa2½ Standard.
- b) Primer Coat shall consist of one coat (minimum DFT of 100 microns) of epoxy resin based zinc phosphate primer.
- c) Intermediate Coat (or Under Coat) shall consist of one coat (minimum DFT of 100 microns) epoxy resin based paint pigmented with Titanium Dioxide.
- d) Top Coat shall consist of one coat (minimum DFT of 75 microns) of epoxy paint of approved shade and colour with glossy finish. Additional one coat (minimum DFT of 25 microns) of Finish Coat of polyurethane shall be provided.
- e) Total DFT of paint system shall not be less than 300 microns.

4.03.02 Specification for application of paints for external surfaces protection of steel pipes and fittings which are buried underground / laid inside a Hume Pipe & or submerged Under Water and laid under Pipe Trenches (in road/rail/pipe or trench crossings) shall be as follows :

- a) Surface preparation by means of sand blasting and shall conforms to SSPC SP10/NACE2/ Sa2½.
- b) External surface of the pipe, fittings, specialties etc. handling raw water/ clarified water/filter water shall be painted with one coat of two part chemically cured polyurethane primer of min 50 micron dry film thickness followed by three or maximum four coats of two part solvent less polyurethane to build up coating of dry film thickness of 1500 micron including primer coat.



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- 4.03.03 Specification for application of paints for internal surface protection of large diameter pipes, if any, shall be as follows :
- Surface preparation by means of sand blasting which shall conforms to SSPC SP10/NACE2/Sa2½ standard.
  - All Internal surfaces of steel pipes, fittings, specialties etc. buried underground or located within pipe trenches shall be given epoxy coating to protect them from (except for drinking water service, where the compatible painting shall be so selected to meet relevant quality standards) corrosion.
  - Internal surface of the pipe should be coated with one coat of two part epoxy primer with not less than 50 micron DFT (dry film thickness) followed by two part polyamide cured solvent less epoxy.
  - The minimum dry film thickness (DFT) of internal lining shall be 500 micron.
- 4.03.04 Specification for application of paints for protection of internal surfaces of DM Water Storage Tank(s) shall be as follows :
- Primer - One coat of epoxy primer containing high level of Zinc Phosphate anticorrosive pigment. Total Dry Film Thickness (DFT) of primer shall not be less than 125 microns.
  - Finish Paint - Three (3) coats Polyamine HB Epoxy Paint. Total Dry Film Thickness (DFT) of finish paint shall not be less than 125 microns per coat.
  - Total thickness of primer and paint should not be less than 500 microns.
- 4.03.05 All motors, local push button stations, cable racks, structures used for supports etc. are to be painted with acid proof paint.
- 4.03.06 The following surfaces shall not be painted - stainless steel, galvanized steel, aluminum, copper, brass, bronze and other nonferrous materials.
- 4.03.07 No painting or filler shall be applied until all repairs, hydrostatic tests and final shop inspection are completed.
- 4.03.08 All machined surfaces shall have two (2) coats of water repellant grease after thorough cleaning.

## 5.00.00 COATING PROCEDURE AND APPLICATION

### 5.01.00 Surface preparation :

Pipe shall be blast cleaned by sand. The cleanliness achieved prior to application shall be in accordance with the requirement of SSPC SP 10 /





NACE 2 / Sa2½ of ISO 8501 (near white metal)

- a) The blast pattern or profile depth shall be 40 to 100 micron and shall be measured by dial micrometer.
- b) Before sand blasting is started or during blasting or coating, temperature of the pipe surface should be more than 3°C above dew point temperature. Blast cleaned surface should be primed within 4 hours and shall be protected from rainfall or surface moisture and shall not be allowed to flash rust. If the rust occurs, the surface again to be prepared by sand blasting or wire brushing.

5.02.00

### Application of Epoxy Coating

- a) Coating shall be applied when
  - i) When the pipe surface temperature shall be at least 3°C above dew point temperature.
  - ii) The temperature of mixed coating material and the pipe at the time of application shall not be lower than 10°C or greater than 50°C.
- b) Material preparation shall be in accordance with manufacturer's recommendations.
- c) Application of epoxy coating system :

The epoxy coating system shall be applied as per recommendation of the manufacturer and shall be applied by airless spray / plural component spray machine. For more than one coat, the second shall be applied with the time limits as recommended by the manufacturer.

5.03.00

### Application of PU Coating

- a) PU coating shall be applied when the pipe surface temperature at least 3°C above dew point temperature (when R.H is more than 85%).
- b) Material preparation and application shall be done as per manufacturer recommendation.

6.00.00

## TEST REQUIREMENTS

6.01.00

### Measurement of dry film thickness

Measurement of dry film thickness of coating: Coating thickness shall be in the range of ±20% and as per SSPC PA 2.





#### 6.01.01 Apparatus / Instrument

The instrument used for dry film thickness may be Type 1 pull of gauges or Type 2 electronic gauges.

#### 6.01.02 Procedures

##### a) Number of measurements

For 100 square feet (9.29 square meters), five (5) spots per test area (each spot is 3.8 cm) in diameter. Three gauge readings per spot (average becomes the spot measurement).

b) If the structure is less than 300 square feet, each 100 square feet should be measured.

c) If the structure is between 300 and 1000 sq ft, select 3 random 100 square feet test areas and measure.

d) For structure exceeding 1000 square feet, select 3 random 100 square feet testing areas for the first 1000 sq ft and select 1 random 100 square feet testing area for each additional 1000 square feet

e) Coating thickness Tolerance: Individual reading taken to get a representative measurement for the spot are unrestricted (usually low or high readings are discarded). Spot measurements (the average of 3 gauge readings) must be within 80% of the minimum thickness and 120% of the maximum thickness.

Area measurement must be within specified range.

#### 6.02.00 Electrical Inspection (Holiday) Test

6.02.01 All the coated / lined pipes shall be tested with an approved high voltage holiday detector preferably equipped with an audio visual signaling device to indicate any faults, holes, breaks or conductive particles in the protective coating.

6.02.02 The applied output voltage of holiday detector shall have a spark discharge of thickness equal to at least twice the thickness of the coating to assure adequate inspection voltage and compensate for any variation in coating thickness. The electrode shall be passed over the coated surface at approximately half the spark discharge distance from the coated surface only one time at the rate of approximately 10 to 20m/min. The edge effect shall be ignored. Excessive voltage shall be avoided as it tends to induce holiday in the coated surface thereby giving erroneous readings.

6.02.03 While selecting test voltages, consideration should be given to the tolerance on coating thickness and voltage should be selected on the basis of maximum coating thickness likely to be encountered during testing of a particular pipe.







The testing voltage shall be calculated by using following formula. (as per NACE 0274 : 2004)

Testing Voltage  $V = 7900 \sqrt{T} \pm 10$  percent where T is the average coating thickness in mm.

6.02.04 Any audio visual sound or spark leads to indicate pinhole, break or conductive particle.

#### 6.03.00 **Adhesion Pull off Test**

After holiday the coated surface is subjected to adhesion pull off test as per ASTM D 4541.

6.03.01 Apparatus / Instrument: Adhesion tester consists of three basic components:

A hand wheel, a black column containing a dragging indicator pin and scale in the middle and a base containing three legs and a pulling "Jaw" at the bottom and also dollies.

#### 6.03.02 **Prepare the test surface**

Once test area is selected, test area shall be free of grease, oil, dirt, water. The area should be flat surfaces and large enough to accommodate the specified number of replicate test.

#### 6.03.03 **Prepare Dolly (Test Pull Stub)**

The dolly is a round, two sided aluminium fixture. Both sides of the dolly looks same, however, one side sloped on top surface while flat on bottom surface. As the surface of the dolly is polished aluminium, roughen the same using a coarse sand paper.

#### 6.03.04 **Select an adhesive**

Use araldite, a 100% solid epoxy adhesive. This adhesive requires at least 24 hours at room temperature to cure.

#### 6.03.05 **Attach the dolly to the surface**

- a) Using a wooden stick, apply an even layer of adhesive to the entire contact surface area of the dolly.
- b) Carefully remove the excessive adhesive by using a cotton swab. Allow the adhesive to fully cure before performing the adhesion test.
- c) Attach the dolly to the coated surface and gently push downward to displace any excessive adhesive.
- d) Push the dolly inward against the surface, then apply tape across the head of the dolly.



## 6.03.06

**Adhesion Test Procedure**

- a) Attach the adhesion tester to the dolly by rotating the hand wheel counter clockwise to lower the jaw of the device.
- b) Slide the jaw completely under the head of the dolly. Position the three legs of the instruments so that they are sitting flat on the coated surface.
- c) Slide the dragging indicator pin on the black column to zero by pushing it downward.
- d) Firmly hold the base of the instrument in one hand and rotate the hand wheel clockwise to raise the jaw of the device that is attached to the head of the dolly. The dragging indicator pin will move upward on the black column as the force is increased and will hold the reading. Apply the tension using a moderate speed. Continue to increase the tension on the head of the dolly until (a) the minimum PSI/MPa/Kg/cm<sup>2</sup> required by project specification is exceeded and the test is discontinued, (b) the maximum PSI/MPa/Kg/cm<sup>2</sup> of adhesion tester has been achieved and dolly is still attached, (c) The force applied by the adhesion tester causes the dolly to dislodge.
- e) Read the scale and record the adhesion value.

## 6.04.00

**Coating Repair**

Defective Coating shall be repaired in accordance with the following subsections.

## 6.04.01

**Surface Preparation**

Accessible areas of pipe requiring coating repairs shall be cleaned to remove debris and damaged coating using surface grinders or other means. The adjacent coating shall be feathered by sanding, grinding or other method. Accumulated debris shall be removed by blowing with contaminant free air or wiping with clean rags.

## 6.04.02

Areas not accessible for coating repair such as interior surfaces of small diameter pipe shall be reprocessed and recoated.

## 6.04.03

**Coating Application**

The coating system shall be applied to the prepared areas in accordance with procedure.

## 6.04.04

**Repair Inspection:**

Repaired portion shall be electrically inspected using a holiday detector.

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**6.05.00 Welded Field Joints**

**6.05.01 Preparation**

The weld joints shall be cleaned so as to be free from mud, oil, grease, welding flux, weld spatter and other foreign contaminants. The cleaned metal surfaces of the weld joint shall then be blasted or abraded using rotary abrading pads. The adjacent liquid Epoxy / PU coating shall be feathered by abrading the coating surface for a distance of 25 mm.

**6.05.02 Electrical Inspection**

After curing the coating system applied to the welding joints shall be holiday tested. Any holidays indicated by the detector shall be marked with chalk to identify the area of repair.

**7.00.00 INFORMATION/DATA REQUIRED**

The Bidder shall submit complete list of paints and primers proposed, giving detail information, such as, chemical composition, drying time etc. and also unit rates for application of each type of paint along with supply shall be furnished.



## SECTION-XII

### SALIENT DESIGN DATA

[TABLE-I TO TABLE-VIII]







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V.II/Amend-1/Analysis  
TABLE-I

<b>PROXIMATE ANALYSIS OF COAL (As received Basis)</b>					
Sl. No.	Description	Symbol	Design Coal	Worst Coal	Best Coal
1	Total Moisture	TM%	15.00	18.00	12.00
2	Ash	A%	40.00	46.00	36.00
3	Volatile Matter	VM%	19.00	18.00	22.00
4	Fixed Carbon	FC%	26.00	18.00	30.00
<b>ULTIMATE ANALYSIS (As Received Basis)</b>					
1	Carbon	C%	29.73	23.08	37.32
2	Hydrogen	H <sub>2</sub> %	3.70	3.54	3.92
3	Nitrogen	N <sub>2</sub> %	1.80	1.45	1.60
4	Oxygen (by difference)	O <sub>2</sub> %	8.66	6.70	8.32
5	Sulphur.	S%	0.50	0.60	0.40
6	Carbonates	CO <sub>3</sub> %	0.58	0.60	0.40
7	Phosphorous	P <sub>2</sub> %	0.03	0.03	0.04
8	Total Moisture	TM%	15	18	12
9	Ash	A%	40	46	36
10	Total	%	100	100	100
11	Gross Caloric Value (as received basis)	GCV Kcal/Kg	3300	2800	4000
12	Hard grove index	HGI	55	50	60
13	YGP index	mg/Kg	95	110	80



## DESIGN RAW WATER ANALYSIS

SL.NO.	Different Characteristic	Results
1.	Calcium ( $\text{Ca}^{++}$ ) as $\text{CaCO}_3$	86
2.	Magnesium ( $\text{Mg}^{++}$ ) as $\text{CaCO}_3$	52
3.	Sodium & Potassium ( $\text{Na}^+$ & $\text{K}^+$ ) as $\text{CaCO}_3$	138
	<b>Total Cations</b>	<b>276</b>
4.	Bicarbonates ( $\text{HCO}_3$ ) as $\text{CaCO}_3$	200
5.	Carbonates ( $\text{CO}_3$ ) as $\text{CaCO}_3$	-
6.	Hydroxyde ( $\text{OH}$ ) as $\text{CaCO}_3$	-
7.	Sulphate ( $\text{SO}_4$ ) as $\text{CaCO}_3$	35
8.	Chloride ( $\text{Cl}$ ) as $\text{CaCO}_3$	41
9.	Nitrate ( $\text{NO}_3$ ) as $\text{CaCO}_3$	-
10.	Phosphate ( $\text{PO}_4$ ) as $\text{CaCO}_3$	-
	<b>Total Anions</b>	<b>276</b>
11.	Total Hardness (as $\text{CaCO}_3$ )	138
12.	Permanent Hardness (as $\text{CaCO}_3$ )	-
13.	Temporary Hardness (as $\text{CaCO}_3$ )	138
14.	Methyl Orange Alkalinity (as $\text{CaCO}_3$ )	200
15.	Phenolphthalein Alkalinity (as $\text{CaCO}_3$ )	-
16.	Iron (Original) (as Fe)	-
17.	Iron (in solution) (as Fe)	1.0
18.	Manganese (as Mn)	-
19.	Ammonia, free (as $\text{NH}_3$ )	-
20.	Carbon Dioxide free (as $\text{CO}_2$ )	-
21.	Silica (in solution (as $\text{SiO}_2$ ))	20.0
22.	Dissolved Oxygen ( $\text{O}_2$ )	-
23.	Suspended Solids	-
24.	Dissolved Solids	438
25.	pH at 25 °C	7.5 – 8.0
26.	Organic Matter (in terms of Oxygen absorbed from acid permanganate solution in 4 hours)	2.0
27.	Appearance	Turbid
28.	Odour	Nil
29.	Turbidity	500 NTU



## DESIGN CLARIFIED WATER ANALYSIS

CONSTITUENTS	As	CONTENT
Calcium	CaCO <sub>3</sub>	105 ppm
Magnesium	CaCO <sub>3</sub>	52 ppm
Sodium and Potassium	CaCO <sub>3</sub>	138 ppm
Hydrogen (FMA)	CaCO <sub>3</sub>	--
TOTAL CATIONS	CaCO <sub>3</sub>	295 ppm
Bicarbonate	CaCO <sub>3</sub>	196.5 ppm
Carbonate	CaCO <sub>3</sub>	-
Chloride	CaCO <sub>3</sub>	41 ppm
Sulphate	CaCO <sub>3</sub>	57.5 ppm
Nitrate	CaCO <sub>3</sub>	-
TOTAL ANIONS	CaCO <sub>3</sub>	295 ppm
M.O. Alkalinity	CaCO <sub>3</sub>	196.5 ppm
P. Alkalinity	CaCO <sub>3</sub>	
Total Hardness	CaCO <sub>3</sub>	157 ppm
Carbon-di-oxide	CO <sub>2</sub>	3.5
Dissolved Silica	SiO <sub>2</sub>	20 ppm
Total Iron	Fe	1 ppm
pH Value	-	7.9 – 8.0
Turbidity, NTU	-	20
Organic Matter Content in terms of Oxygen in absorbed from (KMnO <sub>4</sub> (4 Hrs.))		5 ppm





### DESIGN DM WATER ANALYSIS

Sl. No.	Description	Max. Limit
1.00	Total Electrolyte	0.1 ppm, max.
2.00	Total SiO <sub>2</sub>	0.01 ppm, max.
3.00	Iron as Fe	Nil
4.00	Free CO <sub>2</sub> ppm as CO <sub>2</sub>	Nil
5.00	Total Hardness	Nil
6.00	pH value at 25 Deg.C	6.8 – 7.2
7.00	Conductivity, micro mho/cm	Less than 0.1 at 25 Deg. C

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EPC Bid Document  
Sagardighi Thermal Power Project  
1x660 MW Unit No. 5, Phase - III

**VOLUME: II-H2**

**SECTION-II**

**MILL REJECT SYSTEM**



Development Consultants Pvt. Ltd.

Volume : II-H2  
Section : II  
Mill Reject System



## CONTENT

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## SECTION-II

### MILL REJECT SYSTEM

#### 1.00.00 INTENT OF SPECIFICATION

This section presents design, constructional features, operation philosophy, inspection and testing of Mill Reject Handling System to be used for handling of coal rejects from coal mills of 1 x 660 MW of Sagardighi Thermal Power Station (Phase-III).

#### 2.00.00 SYSTEM DESCRIPTION

Pneumatic conveying system will be employed for handling of the mill rejects. Each mill will be provided with collection and transportation equipment consisting of one no pyrite hopper with water spray arrangement, knife gate valves at inlet & outlet and a conveying vessel. The conveying vessel will operate on level probe control with timer back up.

Each conveying vessel will be connected to a storage bunker via conveying pipeline and a terminal box installed on top of storage bunker. Bag filters of adequate capacity will be provided on top of bunker for separating dust from air. The bunker will be provided with pneumatic operated discharge gate with manual operation (operated manually from local push button station) at its outlet to discharge mill rejects into a truck for onward disposal.

Screw type compressor will be used for supplying compressed air for conveying.

#### 3.00.00 SCOPE OF SUPPLY

##### 3.01.00 Conveying Air System

3.01.01 Two (2) nos. oil free water cooled screw compressors (01 working + 01 standby) with drive shall be provided in a separate building to supply compressed air for conveying of mill rejects from Unit-5 only.

3.01.02 One (1) no. compressor of Phase-III will act as stand-by for Phase-III Unit i.e two (2) nos. oil free water-cooled screw compressors (1 working + 1 standby) shall be provided for mill rejects conveying.

3.01.03 The rating of proposed compressor of Phase-III will be in such a way that the equipment capacity shall meet the requirements of Unit-5 only.

3.01.04 DELETED.

3.01.05 The compressed air system shall have air receivers (one no per mill bay), necessary pipe work and each air receiver will be equipped with isolation





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valves, pressure gauge, pressure switch, solenoid operated auto drain trap (timer operated), pressure relief valve, etc.

3.02.00 Pyrite hoppers & accessories, conveying vessels, mill reject storage bunker with terminal box, vent filter, discharge gate, interconnected distribution piping system with valves, controls, instruments and all other accessories.

3.03.00 Instrument Air System

Instrument air shall be provided from the plant instrument air distribution pipe network of Phase-III for supplying instrument air / purging air to actuate pneumatic cylinder operated plate valves, conveying vessel local pneumatic panel and bag filter, etc.

3.04.00 Cooling & Spray Water System

3.04.01 DMCW cooling water for MRS compressors of Phase-III shall be solely catered from Phase-III DMCW system.

3.04.02 Cooling water requirement for water cooled valve and spray water for mill reject shall be sourced from plant service water network of Phase-III.

3.05.00 The pipes in mill bay area will be supported from mill bay columns wherever possible and pipes from / to compressors shall be taken on pipe rack.

3.06.00 Rain water and floor water will be collected in drain sump through common drain trench provided in each mill bay. One (1) no (1W) submersible fixed type sump pumps of adequate capacity for each drain trench, will be provided to evacuate the stored drain water from drain sump to nearest plant drain.

#### **4.00.00 PERFORMANCE REQUIREMENT**

4.01.00 Performance requirement for the plant and equipment shall be guided by 'Design and Construction' clause.

4.02.00 The performance requirement for the mill reject handling plant shall be defined by the rate (TPH.) of handling as specified within guaranteed power and water consumption of the system operation within stipulated time.

#### **5.00.00 DESIGN AND CONSTRUCTION**

5.01.00 Mill Reject Handling System of pneumatic type meeting the following requirement shall be provided:

Number of mills

REFER ANNEXURE I : EQUIPMENT DESIGN/  
SELECTION CRITERIA





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Percentage of mill reject generation (Design)	1% of the maximum coal consumption rate per mill (A margin of min. 5% over & above the reject generated to be considered.)
Guaranteed conveying rate (overall continuous basis)	Bidder to consider maximum mill loading at 100% BMCR with design / worst coal vis-à-vis number of mills operating in corresponding condition.
Bulk density of mill rejects	
(For volumetric flow, bunker volume sizing and conveying)	1600 kg/ m <sup>3</sup>
(For structural load calculation)	2400 Kg/m <sup>3</sup>
Max. particle size of mill rejects	50 mm (5% of total reject) max size, 25 mm (normal size).
Average conveying velocity	To be indicated by Bidder as per proven practice
Temperature (Normal / Maximum)	Max. 180 / 200 Deg.C
Discharge from each mill	As per mill manufacture's data (Minimum 3.5 meter headroom shall be provided below mill outlet.)
General margin on selection of equipment and compressor.	10% margin on selection of equipment and compressor capacity.

#### 5.02.00 Velocities

Service	Pipe sizes		
	Less than 50 NB	50 NB to 150 NB	200 NB & Above
Water pump suction	0.6-0.9	1.2-1.5	1.2-1.5
Water pump discharge	0.9-1.8	1.5-2.4	1.5-2.5
Compressed Air below 2 Kg/cm <sup>2</sup> (g)	15 - 20	20 - 30	25 - 35
Compressed Air at 2 Kg/cm <sup>2</sup> (g) & above	20 - 30	25 - 40	35 - 45

5.03.00 The maximum expected pressure in the system should be computed by considering 10% over-pressure above the rated discharge pressure of the air compressor.





5.04.00 Conveying vessels would be conveying one after another in a predefined sequence. If system of one mill goes out of order or is in line block condition, the system will shift on to the next mill automatically.

5.05.00 Tie In points

Sl. No.	System	Description	Location
1	Conveying Air	<del>Interconnection arrangement between common discharge headers of Phase-II &amp; III shall be provided so, that any two compressors of Phase-II &amp; III can be operated to meet conveying air requirement of Phase-II &amp; III.</del>	<del>Existing plant air compressor house (Common for Phase-II &amp; III)</del>
2	DM Water	DMCW cooling water for MRS compressors of Phase-III shall be solely catered from Phase-III DMCW system.	80NB tapping at inlet and outlet header at 5 m distance from MRS compressor house.

5.06.00 Technical Data Sheet

1	<b>Pyrite Hopper</b>		
a	No. of Pyrite Hopper	One (1) no. per mill	
b	Capacity	Effective capacity will be more than three times of conveying capacity / 2-3 cycles to act as buffer holding capacity.	
c	Material of construction		
	Pyrite hopper body	MS-IS: 2062, Gr. A	Min. 8 MM thickness
	Grid	MS-IS: 2062, Gr. A	
	Supports, Platform	MS-IS: 2062, Gr. A	
d	Accessories		
	Rupture disc	One (1) no. per hopper	
	Flexible joint	One (1) no. per hopper	
	Oversize reject chute	One (1) no. per hopper	
	Bypass Chute	One (1) no. per hopper	
	Sizing Grid	One (1) no. per hopper	MS:2062 Bars and flats with opening suitable to allow 50 MM (max) particle
	Spray nozzles	One (1) no. per hopper	Water Spray quenching system with solenoid operated spray nozzle



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	Hopper movement	As per mill manufacture's data	
	Flange details	As per mill manufacture's data	
	Elevation	As per mill manufacture's data	Min. 3.5 meter headroom shall be provided below mill outlet.
	Temperature Switch	One (1) no. per hopper	
	RF (radio frequency) type level switch	Two (2) nos. per hopper	For high level and high-high level
2	<b>Conveying Vessel</b>		
a	Design Code	As per ASME (unfired pressure vessels) or IS2825	The conveying vessel will be supported independently on steel columns.
b	Quantity	One (1) no. per hopper	
c	Location	Below Pyrite hopper	
d	Material	Mild Steel as per IS 2062 Gr. A	
e	Outlet bend	Alloy CI (Min. 450BHN)	
f	Pneumatic Panel	One (1) no. per conveying vessel	Pneumatic panel shall consist of vessel high & low pressure switch
3	<b>Storage Bunker</b>		
a	Quantity	One (1) no. per mill bay	
b	Effective Capacity	24 hrs storage volume for the mill reject based on worst coal firing at 100% BMCR.	
c	Free board	Minimum 300 MM	
d	<b>Material of Construction</b>		
	Bunker Plates	MS plate	Min. 10 MM thick.
	Liners	SS 304	Min. 6 MM thick. for conical portion
e	<b>Accessories</b>		
	Number of outlet	One (1) no. per storage bunker	
	Pneumatic operated twin sector discharge with provision for manual operation	One (1) no. per storage bunker	CI as per IS 210 FG 260 / MS as per IS 2062 with TISCRA / SAIL HARD liner
	Pressure Relief Valve	One (1) no. per storage bunker	
	RF Type Level Switch	One (1) no. per storage bunker	For high level in bunker
	Terminal Box	One (1) set per	Mild Steel as per IS 2062





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		storage bunker	Gr. A
4	<b>Bag Filter</b>		
a	Type	Reverse pulse jet type	
b	Quantity	One (1) no. per storage bunker	
c	Air to cloth ratio	1.5 with isolation of 10% bags	
d	Material of Construction		
	Filter cloth	Polyester needle felt	
	Filter bag cage	MS, IS 2062, Gr.A	Minimum 3 mm thick, Galvanized
	Filter housing	MS	
e	SMP level of vent air from bag filter	Less than 30 mg/NM3	
f	Differential pressure switch		One (1) no. across each bag filter
5	<b>Plate Valve</b>		
a	Quantity	As per flow diagram for mill reject handling system	
b	Material of construction		
	Body	Cast Iron (IS 210 Gr. FG 260)	
	Knife Gate	ASTM A 240 type 304 (Edge hardened to 400 BHN)	Minimum 10 MM thickness
6	<b>Inlet Valve</b>		
a	Quantity	As per flow diagram for mill reject handling system	
b	Material of construction		
	Body	Cast Iron (IS 210 Gr. FG 260)	
	Dome	Alloy CI (Min. 350 BHN)	
	Seat	Alloy CI or SS smooth finished with Min. 250 BHN hardness	Replaceable type
c	Method of operation	Solenoid operated pneumatically actuated with provision for manual override facility.	
7	<b>Conveying Pipe</b>		
a	Pipe Size	As per system requirement	To be decided by system supplier. However, pressure drop sizing calculation shall be provided by Bidder during detail engineering



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			stage.
b	Design Pressure	110% of discharge pressure of rated compressor	
c	Quantity	As per layout requirement	
d	Material	Mild Steel ERW as per IS 1239 (Heavy Gr.) upto 150NB and Min. 6.35 MM Thick. (>150 NB)	
e	Type of joint	Flanged	
f	Bends & Fittings	Alloy CI (Min. 450BHN)	The radius of bends shall not be less than 3D.
8	<b>Conveying Air Compressor</b>		
a	General		
	Quantity	Two (2) nos	
	Type	Single stage, water cooled, oil free rotary screw type	
	Design parameters	50 DegC & 100 % RH	
	Fluid to be compressed	Air	
	Location	Indoor	
b	Material of construction		
	Compressor casing	Cast Iron	
	Rotor	EN8 \ EN8M \ EN8D	
	Rotor housing	Cast Iron	
	Gears	Low Alloy Steel	
	Drive shaft	EN8 \ EN8M \ EN8D	
	Oil cooler	Plate type – SS 304	
	Cooler casing	CI / MS	
	Inlet throttle valve & housing	Aluminum / SS	
c	Air intake filter		
	Quantity	Two (2) nos	Two stage centrifugal type
	Filtering media	Cellulose based Paper	
	Particle size of Intake Filter	10 Micron	
	Particle removing efficiency	99.9%	
d	Note:	The materials of construction, suggested above are the minimum requirement and for general reference only. MOC as provided by OEM shall be final.	



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9	<b>Air Receiver</b>		
a	Quantity	One (1) no. per mill bay	
b	Design Code	IS 2825	
c	Capacity	As per IS 7938	Min. capacity 15 CMH
d	Material	MS: IS 2062 Gr. A	Head thickness = 2 mm higher than shell thickness.
e	Accessories		
	Safety valve	One (1) no per air receiver	
	Pressure switch	One (1) no per air receiver	
	Pressure gauge	One (1) no per air receiver	
	Auto drain & Y type Strainer	One (1) no per air receiver	Timer based solenoid operated Auto Drain Type
10	<b>Service Water Pipes</b>		
a	Up to & including 150 NB	MS, ERW pipes to IS:1239 Heavy grade	Thickness - Heavy grade.
b	200 NB to 450 NB	MS ERW to IS 3589. FE 410 grade.	Min 6.35 MM thick for 200 NB to 400 NB, Min. 7.14 mm thick for 450 NB
11	<b>Instrument Air and DMCW Pipes</b>		
a	Material	ASTM-A-312 Gr. 304	As per ASME-B-36.19

## 6.00.00 OPERATION AND CONTROL SYSTEM

For Control & Instrumentation refer VOLL-E, SEC-V.

## 7.00.00 INSPECTION AND TESTING

Inspection and testing will be carried out as per relevant standard and as per good engineering practice including the following.

- 7.01.00 Rotating components shall be statically and dynamically balanced. Dynamic balancing tests shall be carried out. Test procedure and acceptance limit shall be guided by the relevant testing standard and shall be enclosed in the QAP. The Owner shall have to be intimated prior to the test for witnessing the test at works.

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**VOLUME: II-J1**

**SECTION: VI**

**TECHNICAL SPECIFICATION  
FOR  
LOW PRESSURE PIPING, VALVES AND SPECIALTIES**



**Development Consultants Pvt. Ltd.**

**Volume: II-J1  
Section: VI  
Low Pressure Piping, Valves**



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## SECTION-VI

### LOW PRESSURE PIPING, VALVES AND SPECIALTIES

#### 1.00.00 GENERAL INFORMATION

This section covers all the low-pressure piping up to 400mm NB size, associated valves and specialties that include but is not limited to the following systems.

- 1.01.00 Service Air System - shall consist of distributions terminated at hose valves for general house-keeping on the different floors of Power House Building, boiler floors, mill reject system and other auxiliary buildings of Main Plant. Distribution scheme shall also include some continuous and intermittent requirement of boiler and Turbine-generator islands and other BOP area buildings such as CW-ACW pump house, Vacuum pump house, CW treatment building, FGD & SCR areas. Both service air and instrument air will be supplied from the existing compressor house, where new compressors of Phase-III shall be installed.
- 1.02.00 Instrument Air System - shall comprise of distribution of instrument quality air to pneumatically operated instruments/ valves/dampers of the Main Power House Building, boiler, mill reject system and other auxiliary buildings inside plant area.
- 1.03.00 Demineralised Water -supply system including hot well make-up water piping from condensate storage tank, suction to different pumps and distribution to different consumption points.
- 1.04.00 Demineralised Water closed cycle cooling system.
- 1.05.00 Service water (clarified quality) - including supply to overhead Service Water (SW) tank in Power house from Tie-in-Point near unit#4 power house building and from tank to different distribution points of the Main Power house and other auxiliary buildings.
- 1.06.00 Potable water system (filtered & chlorinated water) including supply to overhead potable tank of Power House building, from Tie-in-Point near unit#4 power house building and from tank to different distribution points of the Power House Building and other auxiliary buildings.
- 1.07.00 Air Preheater wash water system including supply of Clarified water from Tie-in-Point near unit #4 to APH wash point of Unit #5, Phase-III and one pipe line (250 NB) from existing APH wash pump discharge header in clarified water pump house in PT area of Phase-I to enable operation of both existing APH wash pumps. This pipe shall be run on existing pipe rack.



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1.08.00 Any other low pressure piping as found necessary during detail engineering shall also be included.

2.00.00 **CODES AND STANDARDS**

2.01.00 In addition to the requirements spelt out in Volume IIA, the design, manufacture, inspection and testing of the piping, fittings, valves and specialties covered under this specification shall conform, in general, to the standards and codes (latest edition) mentioned below:

2.01.01	IS-1239 [Part-I & II]	:	Mild steel tubes, tubular and other wrought steel fittings.
2.01.02	IS-3589	:	Electrically welded steel pipes for water, gas and sewage (150 to 2000 mm nominal diameter)
2.01.03	IS-554	:	Dimensions for pipe threads where pressure tight joints are required on the threads.
2.01.04	IS-1363 [Part-I & II]	:	Hexagonal head bolts, screws and nuts (size range M5 M36)
2.01.05	IS-1364	:	Precision and Semi-precision hexagon bolts, screws, nuts and lock nuts (diameter range 6 to 39 mm)
2.01.06	IS-3138	:	Hexagon bolts & nuts (M42 to M150)
2.01.07	IS-5312	:	Swing check type reflux (non-return) valves.
2.01.08	IS-2379	:	Colour code for the identification of pipelines.
2.01.09	IS-2016	:	Plain washers
2.01.10	IS-2712	:	Compressed asbestos fibre jointing
2.01.11	ANSI B-16.5	:	Steel pipe flanges and flanged fittings
2.01.12	ANSI B-16.9	:	Wrought steel Butt welding flanged
2.01.13	ANSI B-16.11 : ANSI B-36.10 :	:	Forged steel fittings, Socket-welding and Threaded. Steel pipes thickness
2.01.14	API-600	:	Steel gate valves
2.01.15	BS-2633	:	Class I Arc welding of ferrite steel pipe work for carrying fluids.
2.01.16	BS-534	:	Specification for steel pipes and specials for water and sewage.
2.01.17	BS-5351	:	Specification for Ball valves.





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- 2.01.18 AWWA-C-504 : Specification for Butterfly valves.
- 2.01.19 AWWA-C-208 : Dimension for fabricated steel water pipe fittings.
- 2.02.00 Other international codes and standards may also be offered by bidder. However, same may be subject to acceptance by the Purchaser.
- 3.00.00 **SCOPE OF WORK**
- 3.01.00 The equipment and materials to be supplied shall include but not be limited to the following:
- a) Supply of all low pressure piping including bends, elbows, tees, branches, laterals, crosses, reducing union, couplings, caps, saddles, shoes, flanges, blank flanges, Y-pieces etc. as required for the piping system under the scope of this section.
  - b) Matching pipes, matching pieces like reducers/enlargers etc., counter flanges with bolts, nuts, washers, temporary and permanent gaskets, threaded union etc.
  - c) Supply and machining work of flanges, pipe spools and matching pipes to connect flow measuring orifices/nozzles with the main pipe work.
  - d) All isolating and regulating valves, non-return valves, steam/air traps, relief/safety valves (wherever applicable), strainers, pressure reducing orifices etc. complete with the counter flanges and matching connecting pieces as required within the entire low pressure piping system.
  - e) Anchors, hangers and supports, etc. as required. Any platform necessary for maintenance and operation of valve and equipment located 1.5 m above any permanent floor or platform including access ladders, supporting structures etc.
  - f) All secondary structural steel members required for pipe supports from building steel structures and from embedded steel wherever provided including pipe supports in trenches. However, trench piping should be avoided to the extent possible.
  - g) Funnels, tundishes for drips and drains including all miscellaneous drain piping and drain piping from tundish outlet up to drain points. All drain and vent lines shall be conveniently terminated to floor drain points/permanent drain trenches.
  - h) Flanges, counter flanges, blank flanges, bolts, nuts, washers, temporary and permanent gaskets, fasteners caps etc. as required for interconnecting piping, valves & fittings.







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- i) Cleaning and Painting of all piping, valves & specialties at manufacturer's shop.

3.02.00 Following general requirements shall however be provided:

- a) Instrument Connections including instruments, root valves, sensing lines etc.
- b) Pipe stubs and blanking plates etc. required for chemical cleaning and hydro testing.

For conducting acceptance test, the required pressure, temperature, flow measurement points shall be provided.

3.03.00 All miscellaneous instruments as per approved P &ID during detail engineering stage.

3.04.00 **Tie-in Points with Phase-II**

Tie-in points for different systems will be as indicated below:

**i) DM Water Transfer System**

DM Water Transfer pump discharge line, capable of feeding both Phase-II & Phase-III is extended upto Condensate Storage tanks (CST) of unit #3 & #4 of Phase-II. The discharge line is terminated with an isolation valve. Suitable extension of piping from this tie-in point to inlet of CST of Phase-III will be done.

**ii) Potable Water System**

Potable water pump discharge line, capable of feeding both Phase-II & Phase-III is extended upto Potable water storage tanks on power house of unit #4 of Phase-II. The discharge line is terminated with an isolation valve. Suitable extension of piping from this tie-in point to the inlet of potable water storage tank of Phase-III will be done.

**iii) Service Water System**

Service water pump discharge line, capable of feeding both Phase-II & Phase-III is extended upto Service water storage tanks on power house of unit #4 of Phase-II. The discharge line is terminated with an isolation valve. Suitable extension of piping from this tie-in point to the inlet of service water storage tank of Phase-III will be done.

**iv) APH wash System**

APH Wash pump discharge line, is extended upto Air pre-heater of unit #4. The discharge line is terminated with an isolation valve. Suitable extension of piping from this tie-in point to be done upto APH of Phase-III. Another extension pipe line (250 NB) from existing APH



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wash pump discharge header in clarified water pump house in PT area of Phase-I to APH of Phase-III to be implemented.

**v) Instrument Air System**

Instrument air line of Phase-III shall be interconnected with instrument air header of Phase-II near existing plant air compressor house. Further, IA ring header of Phase-III power house shall have interconnection with that of power house Phase-II.

**vi) Service Air System**

Service air line of Phase-III shall be interconnected with service air header of Phase-II near existing plant air compressor house. Further, SA ring header of Phase-III power house shall have interconnection with that of power house Phase-II.

**vii) Cooling water supply & return lines**

DMCCW supply and return header of Phase-II inside compressor house shall be extended to cater the cooling water requirement of IA & SA compressors and dryers of phase-III.

**4.00.00 GENERAL DESIGN AND CONSTRUCTION**

**4.01.00 General Considerations**

- 4.01.01 The piping systems included in this section shall be designed to operate continuously without replacement during the plant service life of 30 years.
- 4.01.02 The piping system shall be complete in every respect and in accordance with the highest standard of workmanship. Any item of the section on which the bidder is in doubt shall be referred to the Owner for clarification.
- 4.01.03 All design and fabrication shall be in accordance with codes/standards specified.
- 4.01.04 No pipe work shall be run in trenches carrying electrical cables.
- 4.01.05 Pipe size above 50 NB shall be shop fabricated and of size 50 NB and below shall be field run.
- 4.01.06 All piping shall be identified by means of colour strips and by adequate lettering, conveniently spaced and located. Identification colours and lettering shall be as approved.
- 4.01.07 Air release and drain branches shall be provided wherever necessary depending upon the layout and arrangement so that the drains and air release valves are located for easy operation.



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- 4.01.08 Unless otherwise specified, all pipe work shall be suitable for a minimum pressure of 10.0 kg/sq. cm(g) at 80 deg. C or as required by the design of the different piping system, if higher.
- 4.01.09 **Drain Pipe Work**
- a) Low pressure drains shall have an isolating valve at the point of take-off from the pipe or vessel to be drained, or as near as possible for conventional operation.
  - b) Unless otherwise stated, all drain piping shall be of 25 mm NB minimum and all vent pipings shall be of 15 mm NB size minimum. For pipes up to 50mm NB, pipe wall thickness shall be as per schedule 80 of ANSI B36.10.
  - c) Unless otherwise stated, wherever a main or branch of any pipeline is terminated with a valve, such terminal valve shall be provided with a blank flange/blanking cap at the free end.
- 4.01.10 Specification of pipes used in different services included in the L.P piping section has been detailed in Annexure-I.
- 4.02.00 **Material Specification**
- 4.02.01 Materials for pipes and fittings shall be as stipulated in Annexure-I. In case bidder wants to offer alternative piping material, same may be accepted by the Purchaser depending on the merits of alternative material.
- 4.02.02 Pipe attachments for supports, anchors and restraints, which are coming in direct contact with pipes, shall have similar materials as the piping concerned. All other materials of supports, anchors and restraints shall be of tested quality and as per manufacturer's standards.
- 4.03.00 **Fabrication**
- All pipes above 50 NB shall have butt-welded connections as per ANSI B 16.25 with a minimum of flanged joints necessary for maintenance. Piping of sizes 50 NB and below shall have socket welded connections as per ANSI B 16.11. Where flanges are adjacent to welded fittings, weld neck flanges shall be used.
- Branches shall, in general, be formed by welding. Standard fittings may be used in positions and for sizes where approval has been given in detail drawings. Pipe bends and tees shall be truly cylindrical and of uniform section. all welded branches shall be reinforced where needed as per the applicable codes/regulations.
- 4.03.01 Piping shall be fabricated in the shop in the largest transportable sections to minimize the number of field weld joints. The choice of field weld joints locations shall be based on the traverse of the pipe through walls, floors,



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sleeves or other restrictive areas. Support attachments for major piping shall be done at shop.

- 4.03.02 All pipes bends shall be made true to angle with no negative tolerance and shall have a smooth surface free of flat spots, crease and corrugations. A cross section through any bent portion of the pipe shall be true in diameter, within plus or minus 3% of the pipe diameter. Pipe bends shall be made from straight pipe pieces of sufficiently higher thickness so that after thinning, the minimum thickness of bends shall not be less than the minimum thickness required for the straight pipe. Thinning allowance shall be considered as per the relevant code.
- 4.03.03 For bends in pipes straight piece of pipes shall be bent by the bidder to required bend radius. However, forged bends (Bend radius = 1.5 x pipe diameter) wherever required shall be provided.
- 4.03.04 The ends of Pipe and welded fittings shall be bevelled according to details shown in the relevant piping code. All welding shall be made in such a manner that complete fusion and penetration are obtained without an excessive amount of filler metal beyond root area. The reinforcement shall be applied in such a manner that it shall have a smooth contour merging gradually with the surface of adjacent pipe and welded fittings. Backing rings shall not be used on any pipe welds, unless otherwise approved by the Engineer.
- 4.03.05 **Cutting and Beveling**
- a) Carbon steel piping - End preparation for butt welding shall be done by machining/flame cutting.
- 4.04.00 **Hangers, Supports, Anchors**
- Normally pipe supports and anchors shall be selected at those points in the buildings where provision has been made for the loads imposed. The cutting of floor/roof beams or the reinforcement in slabs will not be permitted. Piping attached to a plant item shall be supported in such a way that the weight of the piping is not taken by the plant item.
- 4.04.01 Support spacing shall be as per good engineering practice. However in no case it shall be less than support spacing stipulated in ANSI B31.1.
- 4.04.02 Accurate weight balance calculations shall be made to determine the required supporting force at each hanger location and the pipe weight load at each equipment connection.
- 4.04.03 All large pipes and all long pipes shall have at least two supports each arranged so that any length of pipe or valve may be removed without any additional supports being required.
- 4.04.04 Support steel shall be of structural quality. Perforated strap, wire or chain shall not be used. Support components shall be connected to support steel by





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welding, by bolting or by beam clamps. Bolt holes shall be drilled not burned. Support components may be bolted to concrete using approved concrete anchors.

#### 4.05.00 **Valves and Accessories**

##### 4.05.01 General Requirements

- a) All valves shall be of approved make and type and shall have cast/forged bodies with covers and glands of approved construction and materials as specified in Annexure II & III. The valves shall be provided with electric motors/solenoids and actuators as required.
- b) Valves and specialties to be supplied under this specification will be used for various air and water services and will be located indoor/outdoor and on horizontal/vertical runs of the pipelines. However, mounting of valves in vertical pipe runs should be avoided as far as possible.
- c) All valves shall, unless otherwise stated, have the internal diameter same/as the internal diameter of the pipes to be joined.
- d) All valves shall receive tests at manufacturer's or bidder's works in accordance with the specific requirements of the approved Codes of Practice. Valves shall be rising stem or otherwise as approved by the Purchaser.
- e) Gate valve and Ball valve have been specified with the intention of achieving isolation and tight shut-off. In full open condition, these valves should offer minimum of resistance to fluid flow.
- f) Globe valves have been specified with the intention of achieving good control of fluid passing. The plug and seat will have therefore suitable profiles for obtaining such controlling action.
- g) Check valves have been specified in order to prevent reverse flow through them.
- h) All valves shall function smoothly without sticking, rubbing or vibration on opening or closing and shall be suitable for most stringent service conditions i.e. flow, temperature and pressure under which they may be required to operate.
- i) Material, design, manufacture, testing etc. for all valves and specialties along with the accessories shall conform to the latest editions of codes.
- j) By pass valves shall be provided for larger size valves as per standards followed and as felt necessary for smooth and easy operation, even though not specifically mentioned in the specification.



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- k) All flanged valves and specialties to be supplied under this section shall be provided with two (2) counter flanges, bolts, nuts, washers, gaskets etc.
- l) All valves shall be of approved design and manufacture. Where valves are of similar size and type they shall be interchangeable with one another. Valves shall have welded or flanged connections subject to the Purchaser's approval.
- m) All valves shall have outside screwed spindles and screwed thread of spindle shall not pass through or into the stuffing box. Where valves are exposed to the weather, protective covers shall be provided for the spindles, which shall be subject to approval.
- n) Gate, Globe and Ball valves shall be provided with the following accessories in addition to other standard items:
  - i) Hand wheel with embossed open and shut directions.
  - ii) Local position indicator.
  - iii) Motorised operation as specified by Engineer.
- o) Gate valves, in addition shall be provided with following extra features
  - i) Bypass valve for valves of 300 mm size and above.
  - ii) Draining arrangement
  - iii) Enclosed Gear operators for valves 300 mm size and above for ease in operation.
  - iv) Motorised operation as specified by Engineer.
- p) All gate and globe valves shall be rising stem type.
- q) All valves shall be provided with hand-wheels, chain, operator, extended spindle and floor stand wherever required so that they can be operated manually by a single operator from the nearest operating floor either at a lower or higher elevation as the case may be. If such a valve is provided with integral bypass then similar arrangement shall be done for the bypass valve also.
- r) All valves and specialties shall be provided with brass Tag Discs indicating Tag numbers and nomenclature of the valve including duty or service intended and the function of the valves specialties.
- s) Stems shall preferably be arranged vertically with gland at the top, however, in no circumstances must the stem be inclined downward from horizontal or gland be at the bottom. Globe valves shall be installed with the pressure under the disc. Valves shall not be fitted in inverted position.





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- t) Where necessary, for accessibility, grease nipples shall be fitted at the end of extension piping and where possible these shall be grouped together and mounted on a common panel situated at a convenient position. A separate nipple shall be provided to lubricate each point. The Bidder shall supply the first fill of oil or grease for these parts. The Bidder shall supply a suitable manually operated grease gun for the standard type of nipple provided.
- u) The spindles for all valves for use outside the building shall have weatherproof protection covers of approved construction.
- v) All valves shall be fitted with indicators so that it may be readily seen whether the valves are open or shut. In the case of those valves fitted with extended spindles, indicators shall be fitted both to the extended spindles and to the valve spindles.
- w) Plastic or bakelite valve hand wheels will not be accepted.
- x) All valves shall be closed by rotating the hand wheel in a clockwise direction when looking at the faces of the hand wheel. The face of each hand wheel shall be clearly marked with the words 'Open' and 'Shut' with arrows adjacent to indicate the direction of rotation to which each refers.
- y) Wherever practicable heavy valves of total weight including actuator, drive motor, integral by-pass etc., equal to or greater than 500 kg. shall be provided with suitable lugs to permit direct suspension by hanger rod or direct resting on bottom support, as applicable.
- z) Special attention shall be given to the operating mechanism for large size valves in order that quick and easy operation is obtained and maintenance is kept to a minimum.
- aa) Eyebolts shall be provided where necessary to facilitate handling heavy valves or parts of valves.
- bb) The Bidder shall supply with his bid and in addition during the course of the Contract, comprehensive drawings showing the design of valves, test pressure and working pressure/temperatures. They should include a parts list referring to the various materials used in the valve construction.
- cc) All sampling and root valves shall be of integral body bonnet type.

4.05.02 For Design Requirements for different valves refer Annexure-II & III.

#### 4.06.00 **Safety/Relief Valves**

Safety/Relief valves shall be of direct spring loaded type and shall have a tight, positive and precision closing.



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All safety valves shall be provided with manual lifting lever.

Valves used for air and any other compressive fluid shall be of pop type.

Safety/Relief valves shall be constructed and adjusted to permit the fluid to escape without increasing the pressure beyond 10% above the set blow off pressure. Valve shall reset at a pressure not less than 2.5% and more than 5% of the set pressure.

Releasing capacity of the safety/relief valves shall be as per the applicable codes and standards and shall be subject to the approval of the Engineer.

The seat and disk of safety valves shall be of suitable material to resist erosion. The seat of valve shall be fastened to the body of the valve in such a way that there is no possibility of the seat lifting.

#### **4.07.00 Hosepipe and Accessories**

4.07.01 Hose valves for service water system shall be Gate valves and service air system shall be Globe valves.

4.07.02 Hose pipes with fittings for Service Water System:

- a) The water hose shall be as per IS-444 (Type-3).
- b) Length of each hose shall be 15 metres.
- c) For each hose, one end shall be fitted with M.S. female coupling with swiveling nuts and soft seating ring suitable for connection to male end of hose valve and other end shall be made threaded for joining with the swiveling nut of a second hose whereby two hose lengths may be joined.

4.07.03 Hose pipes with fittings for Compressed air System:

- a) The compressed air hose shall be as per IS-911 (Type 2).
- b) The length and type of each end shall be similar to as specified in above clause no. (4.07.02) above.

#### **5.00.00 BROAD GUIDELINES FOR ERECTION AND INSTALLATION OF LP PIPING**

5.01.00 All fittings like "T" pieces, flanges, reducers etc. shall be suitably matched with pipes for welding. The valves will have to be checked, cleaned or overhauled in full or in part before erection, after chemical cleaning and during commissioning.

5.02.00 Adjustments like removal of oval ties in pipes and opening or closing the fabricated bends of high pressure piping to suit the layout shall be considered part of work and is required to carry out such work as per instruction of Owner,





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which shall include specified heat-treatment procedures, etc. also wherever required.

- 5.03.00 Certain adjustments in length may be necessary while erecting high pressure pipelines and the bidder should remove the extra lengths to suit the final layout after preparing edges afresh and adopting specified heat treatment procedures.
- 5.04.00 Suspension for piping, pressure parts, etc., will be supplied in running lengths, which shall be cut to suitable sizes and adjusted as required.
- 5.05.00 All the valves, lifting equipments, actuators, power cylinders, etc., shall be serviced and lubricated to the satisfaction of Engineer before erecting the same and also during pre-commissioning. Even after commissioning, the equipments, if there are problems in the operation, they have to be attended to by the Bidder during the tenure of the contract. Welding or jointing of extension spindle for valves to suit the site conditions and operational facility shall be part of erection work.
- 5.06.00 All tubes and pipes shall be cleaned and blown with compressed air and shown to the engineer before lifting. Bigger size pipes should be cleaned with flexible wire brush, wherever necessary. After cleaning is over the end caps shall be put back in tube openings till such time they are welded to other tubes.
- 5.07.00 Fine fittings, drain piping, oil systems & other small bore piping have to be routed according to site conditions and hence shall be done only in position. As such, layout of small-bore piping shall be done as per site requirement. There is a possibility of slight change in routing the above pipelines even after completion of erection, which shall be carried out by the Bidder without any extra cost to the Purchaser. Work shall also include fabrication of small bends at site from straight lengths to suit the site conditions.
- 5.08.00 Welding of temporary supports, cleats, etc., on the building columns shall also be avoided. In case of absolute necessity, Erection bidder shall take prior approval from Bidder/Owner. Further, any cutting or alteration of member of the structure or platform or other equipments shall not be done without specific prior approval of Owner.
- 5.09.00 Wherever piping erected by the Erection Bidder is connected to piping or equipment erected by some other agencies the joint at the connecting point shall be considered under this specification.
- 5.10.00
  - a) All piping shall be grouped wherever practicable and shall be routed to present a neat appearance.
  - b) The piping shall be arranged to provide clearance for the removal of equipment for maintenance and for easy access to valves, instruments and other piping accessories required for operational maintenance.



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- c) Piping shall be routed above ground unless otherwise specifically indicated/ approved by the Owner. In such special case, the piping may be arranged in trenches, or buried and properly protected as per AWWA Standards.
- d) Overhead piping shall have a minimum overhead clearance of 4 meters above walkways and working areas and 6 meters above roadways unless otherwise approved by the Owner.
- e) Drains shall be provided at all low points and vents at high points as per actual layout regardless of whether some have been shown in respective Tenders drawings or not. The pipelines shall be sloped towards the drain points.

5.11.00 All drips and drains for piping and equipment whether shown in the Tender drawings or not shall terminate on the ground floor up to station drain unless otherwise specified. Leading such drains up to station drainage is also the responsibility of the Bidder.

#### 6.00.00 **DRAWINGS, DATA, INFORMATION & MANUALS**

6.01.00 Drawings, data, Information to be furnished by the Bidder besides those already mentioned in volume : IIA with the offer.

6.01.01 A complete list of all piping and fittings of various sizes with their quantities and details e.g. nominal size, O.D., I.D. (as applicable) thickness, design pressure, design temperature, material of construction/code/standards etc.

6.01.02 A complete list of all valves with their type, quantities & ratings.

6.01.03 Manufacturer's catalogue indicating complete range of available size and rating of pipes & fittings.

6.01.04 Descriptive literature on the manufacturing process and quality control procedures highlighting the manufacturing, fabricating and testing facilities available in the shop.

#### 6.02.00 **After Award of Contract**

Detail drawings including fabrication drawings of all shop fabricated piping system indicating design parameters and complete bill of material (Relevant Standards and grades to be indicated) and information/data pertaining to the hydrostatic and non-destructive test requirements to be submitted progressively.

6.02.01 Detail dimensioned drawing of each valve, specialties, indicating tag no., pressure rating, manufacturing standard, the bill of materials and hydrostatic test pressures. The drawing shall include the end preparation details and shall indicate the position of the hand wheel/operator. Technical particulars of motor operators wherever applicable shall also be indicated.



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- 6.02.02 General arrangement drawing for each hanger/support/anchor etc. indicating identification number, auxiliary supporting structural details, other details & information as required in the specification.
- 6.02.03 Wiring diagram for all limit switches of motor operated valves.
- 6.02.04 The loading data required for design of structures shall be furnished well in advance to suit Purchaser's time schedule.



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## ANNEXURE-I

## SPECIFICATION OF PIPES FOR DIFFERENT SERVICES

	A		B		C	D
<b>Services</b>	<b>1. Clarified Water piping</b>		<b>1. Drinking/ Potable Water Supply, piping (Clarified water, chlorinated)</b>		<b>1. Demineralised Water, DMCW piping, Service and Instrument Air Piping less than and equal to 50 NB</b>	<b>1. Demineralised Water, 2. DMCW piping, Service and Instrument air piping for sizes equal to greater than 65 NB</b>
1.00.00 Material of Pipe	Carbon Steel IS-1239 Heavy Grade upto 150 NB and IS-3589 for sizes above 150 NB with minimum pipe thickness of 6 mm.		Carbon Steel as per IS-1239 Heavy Grade for sizes upto 150 NB and IS-3589 for sizes above 150 NB with minimum pipe thickness of 6 mm. The pipes shall be galvanized as per IS-4736		Stainless Steel as per ASTM A-312 Gr. 304. Thickness- as per schedule 40S, ANSI B36.19	Stainless Steel as per ASTM A-312 Gr. 304. Thickness- as per schedule 10S, as per ANSI B36.19
2.00.00 Construction	ERW / Seamless		ERW / Seamless		Seamless	ERW
3.00.00 Joints	Slip-on Flange and butt weld for size 65 NB and above and Socket weld joint for size 50 NB and below.		Screwed flange for sizes 65 NB and above and screwed for size 50 NB and below. Pipe to pipe joint shall be with union as per IS:1239, Part-II.		Socket welded for size 50 NB and below	Slip-on flange and butt weld joint.
4.00.00 Fittings	Pipe Sizes > = 65 NB	Pipe Sizes < = 50 NB	Pipe Sizes > = 65 NB	Pipe Sizes < = 50 NB		



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	A		B		C	D
<b>Services</b>	<b>1. Clarified Water piping</b>		<b>1. Drinking/ Potable Water Supply, piping (Clarified water, chlorinated)</b>		<b>1. Demineralised Water, DMCW piping, Service and Instrument Air Piping less than and equal to 50 NB</b>	<b>1. Demineralised Water, 2. DMCW piping, Service and Instrument air piping for sizes equal to greater than 65 NB</b>
4.01.00 Materials	ASTM-A-234 Gr. WPB	ASTM-A-105	ASTM-A-234 Gr. WPB galvanized as per IS-4736	ASTM-A-105 galvanised as per IS-4736	ASTM-A-182 F304	ASTM-A-351-CF8 or ASTM-A-403 WP304
4.02.00 Construction	Welded/ Seamless	Forged	Welded/ Seamless	Forged	Forged	Welded/Seamless
4.03.00 Standard	ANSI-B-16.9 for Butt welding fittings and fabricated fitting AWWA-C- 208	ANSI-B-16.11 or IS:1239, Part-II	ANSI-B-16.9	ANSI-B-16.11 or IS:1239, Part-II	ANSI-B-16.11	ANSI-B-16.9
4.04.00 End details	Pipe size ≥65 NB Bevel ended as per ANSI-	Pipe size ≤50 NB Socket welded as per ANSI-B-	Pipe size ≥65 NB Screwed Flanged	Sizes ≤50 NB Screwed socketed as per ANSI-B-16.11.	Socket welded as per ANSI-B-16.11	Bevel ended as per ANSI- B-16.25



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	A		B		C	D
Services	1. Clarified Water piping		1. Drinking/ Potable Water Supply, piping (Clarified water, chlorinated)		1. Demineralised Water, DMCW piping, Service and Instrument Air Piping less than and equal to 50 NB	1. Demineralised Water, 2. DMCW piping, Service and Instrument air piping for sizes equal to greater than 65 NB
	B-16.25	16.11				
5.00.00  Flanges	150 lb (min) class as per ANSI-B-16.5 complete with nuts, bolts and gaskets		As per ANSI-B-16.5 pressure class 150lbs (min) - galvanised-complete with nuts, bolts and gaskets.		As per ANSI-B-16.5 pressure class 150lb (min) complete with nuts, bolts and gaskets. Material as per class 4.01.00.	150lb (min) class, flat face, as per ANSI-B-16.5 complete with nuts, bolts and gaskets.
Pipes which fall under IS:1239 shall be hydrostatically tested according to the said code, for others refer Vol.: II-A.						



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## ANNEXURE-II

## SERVICES OF VARIOUS CATEGORIES OF VALVES

Valve Classification		Service	
A.	Cast iron body Gate/Globe/Check Valve	i) Service Water ii) Clarified Water iii) Drinking/ Potable Water	For sizes 65 NB and above.
B.	Stainless steel body/ Gate/Globe /Check/Ball Valve	i) For Demineralised water ii) Service and Instrument Air iii) Inhibited Demineralised Water	For all sizes For all sizes. Ball valves to be used in air line. For all sizes
C.	Steel Body valves	i) Service Water ii) Clarified Water iii) Drinking/ Potable Water	For sizes less than and equal to 50 NB
D.	Cast Iron body butterfly valve	i) Service Water ii) Clarified Water iii) Filtered Water	For butterfly valve specification refer Annexure II, Sec.V of Vol. II-J1.



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## ANNEXURE-III

## SPECIFICATION OF VALVES

		A. Cast Iron Body Gate/ Globe/Check Valve	B. Stainless steel Body Gate/Globe/Check/Ball Valve	C. Steel Body Gate/ Globe/Check Valve/ Ball Valve
1.00.00	Valve Classification Code	CIGC	SSGC	STGC
2.00.00	Basic Design Code			
	a) Gate	a) i) IS 780 for 50 mm - 300 mm NB ii) IS2906 for 350 mm NB and above or as per MSS-SP-70	a, b, c) ANSI-B-16.34	i) API 600 for 50mm ii) API 602 for size
	b) Globe	b) MSS - SP - 85		b) BS-1873/ANSI-B-16.34
	c) Check	c) IS-5312/MSS - SP -71		c) BS-1868/ANSI B16.34
	d) Ball		d) BS-5351	
3.00.00	Pressure Class	To be suitably chosen considering the pressure requirement. Refer Clause No. 4.01.08 in this regard.		
4.00.00	Construction	Cast body and bonnet / cover	Forged body up to 50 NB	Forged body up to 50 NB and



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		A. Cast Iron Body Gate/ Globe/Check Valve	B. Stainless steel Body Gate/Globe/Check/Ball Valve	C. Steel Body Gate/ Globe/Check Valve/ Ball Valve
5.00.00	Material		and Cast body above that	Cast body above that
5.01.00	Body & Bonnet/ cover	IS 210 Gr. FG 260 or ASTM A216 Class B.	ASTM-A-182 F304 for Ball Valves: A351 CF8M for cast body, A 182 F304 for forged body.	ASTM-A-216 Gr. WCB for cast body & ASTM-A-105 for forged body
5.02.00	Trim / Disc.	IS-210 Gr. FG 260 or ASTM A216 Class B.	ASTM-A-182 F304 for Gate, Globe, Check valves and 351CF8M for Ball valves. For DKW system : ASTM-A-182 F6A (min. 250 HB)	13% Cr Steel as per ASTM-A-182 Gr. F6 heat treated and hardened (min 250 NB) for cast body and ASTM-A-105 Hard faced with Stellite (min 350 HB) for forged body
5.03.00	Seating surface	13% Cr steel as per IS 1570	For Ball valves PTFE seats and seals.	13% Cr. Steel as per ASTM-A-182 Gr. F6
6.00.00	End Preparation	Socket welded for size equal to and below 50 NB and flanged with counter flanges for 65 NB and above.		





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		A. Cast Iron Body Gate/ Globe/Check Valve	B. Stainless steel Body Gate/Globe/Check/Ball Valve	C. Steel Body Gate/ Globe/Check Valve/ Ball Valve
7.00.00	Testing			
	a) Gate	i) As per IS - 780 for 50 mm - 300 mm NB ii) IS-2906 for sizes equal to and above 350 mm NB	As per ANSI B-16.34	API-598
	b) Globe	Hydrostatic Test as per MSS-SP-85		BS-1873
	c) Check	IS-5312/MSS-SP-71		BS--1868



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**VOLUME II-K**

**TECHNICAL SPECIFICATIONS**  
**SUMP PUMPS, MISCELLANEOUS CRANES & HOISTS**  
**AND ELEVATORS**





## CONTENTS

**VOLUME: IIK : SPECIFICATIONS FOR SUMP PUMPS, MISCELLANEOUS CRANE & HOISTS AND ELEVATORS**

<b>SECTIONS</b>	<b>DESCRIPTION</b>
SECTION-I :	SUMP PUMPS, DRIVES AND ACCESSORIES
<del>SECTION-II :</del>	<del>MISCELLANEOUS CRANES</del>
SECTION-III :	MISCELLANEOUS HOISTS
<del>SECTION-IV :</del>	<del>ELEVATORS</del>





## **VOLUME : II-K**

### **SECTION-I**

## **SUMP PUMPS, DRIVES AND ACCESSORIES**





## CONTENT

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3.00.00	GENERAL PERFORMANCE REQUIREMENT	2
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## SECTION-I

### SUMP PUMPS, DRIVES AND ACCESSORIES

#### 1.00.00 GENERAL INFORMATION

1.01.00 Sump pumps specified hereinafter shall be used to dewater various sump pits within the plant area where gravity draining will not be envisaged and to ensure general housekeeping.

1.02.00 Pumps under this specification have been divided into following four (4) groups according to different duty envisaged and location of sumps/pits.

#### 1.02.01 Group - A

The Group - A pumps shall be electric motor driven permanently installed vertical wet pit bottom suction volute type and will handle drainage water, containing solid particles with sludges, polluted liquid etc. from the area where they are installed. These pumps will run continuously by the use of high and low level switches in the sump. Particle size in the water will not exceed 15 mm.

Group-A pumps shall also be provided to all indoor sumps of the plant and outdoor sumps of capacity 5 cu.m and above and underground cable vaults (if any) under the Scope of Bidder.

#### 1.02.02 Group - B

These pumps shall be horizontal centrifugal diesel engine driven portable type. Each pump set along with control panel etc. shall be mounted on a trolley for ease of transportation. These pumps shall be suitable for dewatering of pipelines of large diameter, if required and alike jobs and handling of liquids containing hard solid particles, sludge, polluted liquid, significant amount of fuel oil/LDO etc. and particle size will not exceed 20 mm. These types of pumps shall be used in different plant areas.

#### 1.02.03 Group - C

The Group - C pumps shall be vertical submersible portable type pump motor sets with suitable arrangement for carrying to any place and for lowering to and raising from various water reservoirs and pits. The pump motor set shall be suitable for handling water containing muds/sludge, solid particles, cotton waste, silica, ash particles, coal particles, polluted liquid etc. The particle size in water will not exceed 20 mm. These pumps will be utilised to dewater various deep sumps/pits in case of any eventuality.

#### 1.02.04 Group - D

These pumps shall be similar to Group - A pumps except that these pumps will be used to handle water containing solid particles, sludges, ash polluted liquids, etc. Particle size in the water will not exceed 25 mm. These pumps





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should be installed in the sumps/pits at the following locations:

- a) Ash Slurry Pump House
- b) Fly Ash Storage Silo area
- c) Other areas as envisaged by the successful bidder

NOTE : Total numbers and rating of all the groups of sump pumps are given in Annexure-II enclosed with this specification.

## 2.00.00 CODES AND STANDARDS

2.01.00 The design, manufacture and performance of the sump pumps and drives specified, hereinafter, shall comply with the requirements of all applicable codes, the latest applicable Indian/British/American/DIN Standards, in particular the following:

- 2.01.01 IS-1710 : Vertical Turbine Pumps for clear cold and fresh water.
- 2.01.02 IS-5120 : Technical Requirements – Roto-dynamic special purpose pumps.
- 2.01.03 IS-5600 : Sewage and drainage pumps.
- 2.01.04 Hydraulic Institute Standards of USA.

2.02.00 The materials of the various components shall conform to the applicable IS/BS/ASTM/DIN Standards.

## 3.00.00 GENERAL PERFORMANCE REQUIREMENT

3.01.00 The pumps shall be designed to have best efficiency at the specified duty point. The pump set shall be suitable for continuous operation at any point within the "Range of Operation" as stipulated by the manufacturer.

3.02.00 Pumps shall have a continuously rising head capacity characteristics from the specified duty point towards shut off point, the maximum head being at shut off.

3.03.00 Permanently installed vertical pumps shall be suitable for parallel operation. The head vs capacity, the bhp. vs capacity characteristics etc. shall match to ensure equal load sharing and trouble free operation throughout the range. Drive Motor shall not be overloaded when pump discharge is more than rated condition.

3.04.00 The static head requirement of portable submersible type sump pump may have a considerably wide range of variation depending upon the depth of pit being dewatered. While the pump shall have adequate capacity at the maximum head, the motor shall be sufficiently rated to cater for any





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overloading during the pump operation at its minimum possible head, i.e., maximum discharge.

3.05.00 Pump motor set shall run smooth without undue noise and vibration. Acceptable peak-to-peak vibration limits shall generally be guided by Hydraulic Institute Standards (latest edition).

#### **4.00.00 SCOPE OF WORK**

4.01.00 Pumps under groups A, B, C and D as listed in the Annexure-II along with drive units, couplings and other accessories mentioned below, as also those needed to make the pump-motor sets complete in all respect, for proper operation and maintenance. All motors in outdoor duty will be provided with IP-55 enclosure. The accessories shall include among other things of the following:

4.02.00 For the vertical Group - A sump pump motor sets

- a) Discharge piping of these sump pumps shall include a non-return valve and an isolating valve for each pump, necessary pipes, fittings, flange connections and counter flange with bolts, nuts and gaskets. Suction strainer will be provided of suitable size.
- b) A common base frame for the purpose of supporting the pump motor sets in each sump, utilising embedded curb angle around the top of the sump. The base frame shall also be used to support each discharge piping.
- c) Three (3) nos. electrode type capacitance level switches per sump; one for low level, the second for high level and the third for very high level, along with necessary junction box, local control panel, control cables etc. to achieve automatic starting/stopping of the sump pumps, and also ON/OFF indication for sump pump shall be monitored at DCS. The entire assembly being mounted on the same base frame as mentioned above (item "b"). The control panel shall also be equipped with start/stop push button for starting/stopping individual sump pumps manually. Local control panel and cable shall be as per Volume-II-F1 & F2 of the specification.

4.03.00 For each of the trolley mounted horizontal Group-B sump pump -Diesel Engine sets

- a) One (1) no. 7.5 meters long hose for the pump suction and one (1) no. 30 meters long hose for the pump discharge, either ends of each hose being provided with female hose coupling.
- b) One (1) no. 500 mm long straight pipe piece, with both ends flanged, one end matching with the pump suction nozzle.
- c) Two (2) nos. male type hose couplings, one of which is suitable for coupling with the above mentioned 500 mm pipe piece on one side



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and the 7.5 meters long suction hose on the other side, whereas the other is suitable for coupling with the pump discharge nozzle on one side and the 30 metres long hose on the other side. The pump suction pipe-piece and discharge nozzle shall be of flanged type. As such each coupling end that is to match with the pipe/pump nozzle shall also be flanged and shall be equipped with necessary bolts, nuts & gaskets.

- d) A foot valve (of Bidder's recommended size) with suction strainer, necessary coupling and matching piece/reducer (if necessary) to couple with the 7.5 meter long suction hose end.
- e) The pump diesel engine set with a base frame along with the suction & discharge hoses etc., as mentioned above, shall be mounted on a suitable trolley with swivelling front wheel and having adequate fixing arrangement for all equipment, for operation without any undue vibration and with facility for being handled by a single operator.

4.04.00 For each of the portable submersible Group-C sump pump motor sets.

- a) Two (2) nos. 30 metres long discharge hose, having female hose coupling at both ends.
- b) One (1) no. 500 mm long pipe piece with both ends flanged, one end connected by necessary bolts, nuts & gaskets with the flanged discharge nozzle of the sump pump.
- c) One (1) no. male type hose coupling, one end of which is suitable to couple with the discharge hose and the other end is flanged, matching with the above mentioned 500 mm long pipe end and connected therewith by necessary bolts, nuts & gaskets.
- d) Suitable attachment for temporary seat of the pump motor set on the floor at sump bottom. Suction strainer of suitable size will be provided.
- e) One (1) no. 25 metres long submersible type power cable having a power plug at one end and a hermetically sealed (waterproof) cable gland for connection with the pump drive- motor at the other end.
- f) Suitable lugs and other attachments on the pump motor assembly frame, for hoisting and lowering of the pump motor set from and to the sump.
- g) One starter panel, having a plug socket as receptacle of the above mentioned power plug (item "e"), a 25 metre long incoming power cable with switch/contacter and fuse, start- stop push buttons, red and green LED type indication lamps, over load relays, O/L reset push button, cable gland etc., and also a suitable arrangement for temporarily mounting the starter panel, near the sump, where the portable sump pump-motor set is to work. The incoming 25 metre long power cable shall also be provided with a suitable power plug at one end.



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- 4.05.00 For the vertical Group - D sump pump motor sets, the scope of supply should be similar to Group - A sump pump motor sets.
- 4.06.00 Other accessories to be supplied with the pump-motor sets are as follows:
- a) One discharge pressure gauge with 3 way SS isolating valve for each pump of Group-A and Group-D and all other instrumentation as required for safe and trouble free operation. Suction and discharge pressure gauge for Group-B pump.
  - b) All integral/internal piping, valves, fittings etc. for lubrication, cooling and sealing for each pump wherever required.
  - c) All equipment, accessories and consumable required for erection, testing and commissioning.
- 4.07.00 Lubrication of one (1) initial fill and one additional fill after commissioning.
- 4.08.00 Rust inhibitor paint at Manufacturer's works.
- 4.09.00 Any additional accessories not mentioned hereinabove but specified in enclosed technical specification for sump pumps, as applicable and those indicated in sump pump data specification sheets and electric motor specification should also be supplied.
- 5.00.00 DESIGN AND CONSTRUCTION**
- 5.01.00 The design, construction testing and other details of the sump pumps and related accessories shall be in line with the stipulations and data in this section and the lead specification (Vol. II A)
- 5.02.00 Each sump pump shall be equipped and coupled with a drive motor, with rating so selected as to have at least 15% margin over the maximum power required by the pump, throughout its range of operation. All other requirements of the drive motors shall be as stipulated in the Vol.II F1 & F2.
- The discharge rate of sump pump is uncontrolled. As such pump should be capable to operate even under a condition of as low as 25% of specified total head. Motors of group-B pumps should be designed to cater such eventuality.
- 5.03.00 All electrical items shall conform to the stipulations of Vol.II F1 & F2 as applicable.
- 5.04.00 All piping shall be as per IS-1239 of medium or heavy grade (as suited for the maximum operating pressure) and shall be either galvanised or painted with approved rust inhibiting paint.. Any matching piece/reducer required to match the pipe with pump nozzle, hose, etc. shall be provided.
- 5.05.00 All valves shall be steel body type as per applicable IS/BS/ANSI standard, with pressure class compatible with the maximum working pressure.
- 5.06.00 All hoses shall be of steel wire reinforced type. Pump suction hose shall be



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suitable for working under vacuum. Pump discharge hose shall be suitable to withstand the maximum pressure that it may be subjected to in all working conditions, including hydrostatic testing of the sump pump discharge line.

- 5.07.00 Pump suction strainer shall have openings large enough just to permit the entry of solids having maximum size as stipulated under clause no. 1.02.00.
- 5.08.00 Pressure gauges shall be of Bourdon type, with sealing diaphragm to prevent ingress of the working fluid. Selected range of pressure gauge shall be such that the entire range of working pressure covers about 1/3rd to 2/3rd to its range. Accuracy of measurement shall be within  $\pm 1\%$  of scale range. The suction pressure gauge shall be compound type. Pressure gauge dial size shall be 100 mm or more.
- 5.09.00 Pumps
- 5.09.01 Pumps under Group-A shall be wet pit type, vertical shaft, centrifugal, vertical submerged suction, non-clog volute type complete with enclosed shaft, discharge pipe, head assembly thrust bearing and drive assembly, cover plates etc.
- 5.09.02 Pumps under Group-B shall be of horizontal shaft, single stage, end suction, radially split casing, centrifugal, non-clog design complete with common base plate, drive assembly etc. These pumps shall be trolley mounted portable type.
- 5.09.03 Pumps under Group-C shall be submersible pump-motor type, single stage and non-clog design and shall be portable type.
- 5.09.04 Pumps under Group-D shall be similar to Group-A pumps.
- 5.09.05 Casing
- a) Casing shall be so designed to allow free passage of specified maximum size of solid.
  - b) Casing shall be designed to withstand the maximum shut-off pressure developed by the pump.
  - c) The casings shall be cast, free from blowholes, sand holes, other detrimental defects. The casing shall be complete with suction and discharge connections.
  - d) For pumps under Group-A, and Group-D adequate seal arrangement shall be made to keep leakage of liquid from casing to column assembly to minimum and adequate drain shall be provided in column assembly to permit escape of the leakage flow. The casing shall also include the bearing housing of the bottom pump shaft bearing.
  - e) Casing of pumps under Group-B shall be provided with vent connections and drain connections with valves. These pumps shall be manually primed.







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5.09.06

Impeller

- a) The impeller shall be open/semi-open non-clog type, cast in one piece and specially designed to pass large solids or unscreened liquids. The clearance between stationary and moving parts should be such as to allow sustained performance without exclusive maintenance.
- b) Impellers of pumps under Group-A and Group-D shall have provision for adjustment from an accessible location and for pumps under Group-C shall be capable of passing fibrous material like cotton waste, jutes, etc.

5.09.07

Pump Shaft

- a) Shaft size selected shall be such that critical speed is at least 20% away from the operating speed and the runaway speed.
- b) The shaft shall be ground and polished to final dimension and of ample size to withstand all stresses resulting from rotor weight, hydraulic loads and across the line starting. Shaft shall be provided with renewable sleeves particularly under stuffing boxes and other locations as recommended by pump manufacturers.
- c) The coupling between shafts shall be so designed that they become tight during pump operation.

5.09.08

Column Pipe (for pumps under Group-A and Group D)

The discharge pipe shaft assembly shall be flanged or screwed as per manufacturer's standard and standard length of each piece of column pipe shall be in conformity to the shaft piece lengths from consideration of easy handling.

5.09.09

Bearings

- a) Adequate nos. of properly designed bearings shall be furnished. Bearings for pumps shall be antifriction type and lubricated by grease. Line shaft bearings of vertical pumps shall also be grease lubricated. All necessary grease gun, grease cup and tubing shall be included.
- b) Thrust bearing of adequate design shall be furnished for taking the entire pump thrust arising from all probable conditions of continuous operation through out its "range of operation" and also the shut-off condition. The life of thrust bearing shall be 20,000 working hour minimum for the load corresponding to the duty point. The bearings shall be lubricated by grease from a location conveniently accessible. Design shall be such that the lubricant cannot contaminate the handling liquid.

5.09.10

Wearing Ring/Liner Plate

Renewable wearing rings/liner plates shall be provided either on impeller or



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on the casing or on both impeller and casing.

**5.09.11 Stuffing Box**

Stuffing Box of pumps under Group-A and Group-D shall be of mechanical packing type. For pumps under Group-B and Group-C mechanical seal of reliable design shall be provided.

**5.09.12 Coupling**

Pump and motor shall be connected with a suitable flexible coupling. Coupling shall be provided with coupling guard.

**5.09.13 Mounting Plate for Group-A and Group-D Pumps and Base Plate for pumps under Group-B.**

Each pump under Group-A and Group-D shall be provided with a suitable mounting plate. The mounting plate shall be adequately sized to accommodate the level switches, discharge pipe, grease cups etc. if any. Pumps and motor under Group-B shall be mounted in one base plate. Base plate shall be of rigid construction properly ribbed as needed. Suitable drain with valve and drain funnel shall be furnished by the Bidder.

The necessary supporting plate, mounting frame, base plate etc. as required shall be supplied under this specification, along with anchor bolts, foundation bolts, pipe, sleeves etc. Lifting lug, eyebolts, etc. as required for the proper handling of each pump set shall be furnished.

**5.09.14 Suction Bell**

The pumps under Group-A, C and D shall be complete with adequately dimensioned suction bell to guide and streamline intake fluid.

**5.09.15 Material of Construction**

For material of construction of various parts of data specification sheet Annexure-I shall be referred to.

**6.00.00 INSPECTION AND TESTING**

**6.01.00** All pumps shall be tested at the shop for capacity, head, efficiency and brake horse power. These tests are to be done according to the requirements of "Hydraulic Institute Standard".

**6.02.00** The pump integral accessories like thrust bearing, pump motor coupling etc. shall be subject to tests as per manufacturer's standard.

**6.03.00** Test on motors, control panels, starter panels, cables shall be conducted as per the requirement of Vol.II F1 & F2 of this specification and as per Quality



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Assurance Plan to be approved by Owner during detail Engineering.

6.04.00 After delivery/erection at site, pumps shall be operated to prove satisfactory and trouble free performance.

6.05.00 In addition to these tests also refer lead specification Vol. IIA.

**7.00.00 DRAWINGS, DATA, INFORMATION REQUIRED**

7.01.00 Location and dimension of all sumps which requires assisted evacuation, present in the areas covered under the scope of this specification.

7.02.00 List of location of Group-A and Group-D pumps.

7.03.00 Characteristic curves of pumps showing effective head, pump input power, efficiency, submergence and NPSH, against capacity ranging from shut-off condition to 125% of rated capacity for Group A, B & D pumps and to 150% of rated capacity for Group C pumps.

7.04.00 Speed vs. torque curve of the pump corresponding to recommended mode of pump starting, super-imposed on speed vs. torque of the motor, corresponding to 80% and 100% rated voltage.

7.05.00 Diagram showing the type of lubrication system etc.





## ANNEXURE-I

## DATA SPECIFICATION SHEET

		Group-A	Group-B	Group-C	Group-D
1.	Pumps				
1.1	Rated Capacity (Cu.M/hr.)	<----- Refer ANNEXURE - II ----->			
1.2	Total Head at rated Capacity (MLC)	<----- DO ----->			
1.3	Nos. Required	<----- DO ----->			
1.4	Duty	<----- Intermittent ----->			
1.5	Pump Design Standard	<----- IS-5120/ IS:1710----->			
1.6	Parallel operation required	Yes	No	No	Yes
1.7	Material of Construction				
	a) Base plate/Cover Plate	<----- M.S. IS-2062 / Equivalent ----->			
	b) Column Pipe	<----- M.S. IS-2062 / Equivalent ----->			
	c) Casing	<----- 2% NiCl, IS-210, FG-260 (*)----->			
	d) Impeller	<----- 2% NiCl, IS-210, FG-260 (**)----->			
	e) Pump/Impeller Shaft	<----- SS. AISI-316 ----->			
	f) Shaft Sleeve	<----- SS. AISI-316 (Hardened) ----->			
	g) Shaft Coupling	<----- SS. AISI-410 ----->			
	h) Shaft Bearing	BUSH GM as per IS-306 Gr.1 / Equivalent			
	i) Gland	<----- C.I., IS-210, FG-260/Equivalent ----->			
	j) Gland Packing	<----- Braided Graphite-free Teflon -->			***
	k) Fasteners coming in contact with water	<----- SS. AISI-304 ----->			
	l) Fasteners not coming in contact with water	<----- Carbon Steel ----->			
	m) Discharge pipe	MS IS-1239/ Equivalent	--	--	MS IS-1239/ Equivalent
	n) Motor stool	<----- Close Grained C.I.----->			







		Group-A	Group-B	Group-C	Group-D
1.8	Range of Operation	<----- Refer ANNEXURE-II ----->			
1.9	Tests and Inspection	<-- As per Cl. No. 6.00.00 and lead specification -->			
1.10	Supply of Accessories & Services (Wherever Applicable) for each group and each rating of Pumps				
	a) Base plate/ Mounting plate		Yes		
	b) Sole Plate		Yes		
	c) Foundation bolts, nuts, sleeves etc.		Yes		
	d) Companion flanges with nuts, bolts & gaskets		Yes		
	e) Unions for external water for cooling/sealing/ lubrication		Yes, if required		
	f) Cooling/ sealing/lubrication system with all accessories, complete with pipes, valves and with instruments		Yes, if required		
	g) Discharge pressure gauge		Yes		
	h) Suction pressure gauge		Yes, for Group-B only		
	i) Pump-motor coupling and guard		Yes		
	j) Eye bolts, lifting tackle etc		Yes		
	k) Pre-lubrication tank and accessories		Yes, if required		
	l) Suction bell		Yes		

Note : \* Alloy CI (min 30 mm thick) BHN 350 min  
 \*\* Ni-hard (min 25 mm thick) BHN 550 min.  
 \*\*\* S.S. Wire reinforced/impregnated graphite teflon.





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## ANNEXURE-II

## SCHEDULE OF SUMP PUMPS

## GROUP-A PUMPS : PERMANENTLY INSTALLED VERTICAL SUMP PUMP

Sl. No.	Location	Numbers required (Total)	Capacity (cum/Hr.) Each	Total head (MLC)	Pit size in which pumps are to be installed (in mm)	Type of liquid to be handled	Remarks
1.	<p>These pumps should be located in the following areas as minimum :</p> <p>i) Power house ground floor sump pits near condenser</p> <p>ii) ACW trench in Power House</p> <p>iii) Any other places felt necessary.</p> <p>These pumps will also be provided in all indoor sumps and outdoor sumps of capacity 5 cu.m.&amp; above and underground cable vaults (if any).</p>	Two pumps (100% capacity) are to be located in each sump pit	Capacity of each pump should be so selected to empty the sump pit in 10 minutes	To be calculated with 10% margin over total dynamic head (TDH = static head + friction losses)	To be decided by the bidder	As described in cl. no. 1.02.01	Discharge pipe sizing should be done taking minimum water velocity to be 2m/sec but should not be less than 50 NB. One gate valve and one non return valve should be provided at pump discharge.

**Note:** For sump pump of FGD Area, please refer Vol-II-B, Section - V



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### GROUP-B PUMPS : HORIZONTAL CENTRIFUGAL TROLLEY MOUNTED PORTABLE SUMP PUMP

Sl. No.	Location	Numbers required (Total)	Capacity (cum/Hr.) Each	Total head (MLC)	Pit size in which pumps are to be installed (in mm)	Type of liquid to be handled	Remarks
1.	Pumps will be used for dewatering of pipelines if required and in sumps which are not very deep within the Plant area	Two (2) Nos. Diesel Engine driven Pumps.	Twenty (20) (Working Range: 0 to 150%)	6	To be finalised by the Bidder	As mentioned in clause no. 1.02.02	To be supplied with suction & discharge pressure gauge and other accessories as specified and shall be trolley mounted. Suction hose should be of 80 NB size. Discharge hose should be of 65 NB size.



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**GROUP-C PUMPS : VERTICAL SUBMERSIBLE PORTABLE SUMP PUMP**

Sl. No.	Location	Numbers required (Total)	Capacity (cum/Hr.) Each	Total head (MLC)	Pit size in which pumps are to be installed (in mm)	Type of liquid to be handled	Remarks
1.	Pumps will be used for dewatering various deep sumps/ pits (e.g. CW pump sump) in case of eventuality.	Two (2) nos. as a minimum requirement.	100 (Working range as per pump characteristic curve for full range of head variation).	Twenty (20) (Range 5 to 25)	To be finalised by the Bidder.	As mentioned in clause no. 1.02.03	To be supplied with discharge pressure gauge and 500 mm M.S. pipe spool at discharge as specified. Discharge hose should be of 100 NB size.







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**GROUP-D PUMPS: PERMANENTLY INSTALLED VERTICAL SUMP PUMP**

Sl. No.	Location	Numbers required (Total)	Capacity (cum/Hr.) Each	Total head (MLC)	Pit size in which pumps are to be installed (in mm)	Type of liquid to be handled	Remarks
1.	<p>These pumps should be located in the following areas as minimum :</p> <p>i) AHP Vacuum Pump House</p> <p>ii) Trench in Pyrite hopper area (MRS system)</p> <p>iii) Any other places felt necessary by the Bidder.</p>	Two pumps (100% capacity) are to be located in each sump pit	Capacity of each pump should be so selected to empty the sump pit in 10 minutes	To be calculated with 10% margin over total dynamic head (TDH = static head + friction losses)	To be decided by the Bidder	As described in Cl. no. 1.02.04	Discharge pipe sizing should be done taking minimum water velocity to be 2m/sec but should not be less than 80 NB. One gate valve and one non return valve should be provided at pump discharge.

Note: Sump pumps to be installed in CHP area, FGD area are covered in respective sections.



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**VOLUME : II-K**  
**SECTION-III**  
**MISCELLANEOUS HOISTS**



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**Volume : II-K  
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Miscellaneous Hoists**



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## SECTION-III

### MISCELLANEOUS HOISTS

#### 1.00.00 GENERAL INFORMATION

- 1.01.00 The hoists will be used for erection and maintenance of various equipment in different buildings under the scope of Entire Package, except FGD and Coal Handling Plant, of 1 x 660 MW Sagardighi Thermal Power Project Unit 5, Phase-III. Hoists for FGD and CHP area are mentioned in Section-V of Volume-IIB and Volume II H1 respectively.
- 1.02.00 Hoists are divided into two separate groups - (a) Hand operated and (b) Electric operated.

#### 2.00.00 CODES AND STANDARDS

The design, manufacture and testing of the equipment covered under this specification shall conform to the latest editions of the following Indian Standards:

- |         |                     |   |   |
|---------|---------------------|---|---|
| 2.01.00 | IS : 3832           | : | Specification for Hand Operated Chain Pulley-blocks.  |
| 2.02.00 | IS : 807            | : | Code of Practice for Design, Manufacture, Erection and Testing (Structural Portion) of Cranes and Hoists. |
| 2.03.00 | IS : 6216           | : | Short link Chain, Grade T(8) for Pulley-blocks & other Lifting Appliances.                                |
| 2.04.00 | IS : 2429 (part -I) | : | Non-calibrated Load Chain for Lifting Purposes.   |
| 2.05.00 | IS : 15560          | : | Point Hook with Shank up to 160 tones - Specification   |
| 2.06.00 | IS : 3938           | : | Specification for Electric Wire Rope Hoists.  |

and other Indian Standards referred to in the above standards.

#### 3.00.00 SCOPE OF WORK

- 3.01.00 Hoists shall be provided in all areas under the scope of this specification (except the areas covered by E.O.T. cranes) where any equipment/component weighing above 100 kg is installed and needs to be handled for maintenance purposes. Number of monorail beams shall be such that the centre line of the hoist and the centre line of equipment to be handled shall be not more than 500 mm.





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- 3.01.01 The location and no. of hoists is to be finalised during detailed engineering. Final arrangement is subject to approval of Owner/Consultant.
- 3.01.02 Monorail hoists shall at least be provided in the areas mentioned in Annexure-I. The list is indicative only and not an exhaustive one.
- 3.01.03 Besides monorail hoists, fixed Chain Pulley blocks of following capacities shall be provided:

<b>Capacity (T)</b>	<b>Nos.</b>
1	10
3	10
5	8
10	3

- 3.02.00 All drive motors and driving gears as necessary.
- 3.03.00 Limit switches for electrical hoist as necessary.
- 3.04.00 Trailing cable with all supporting fixtures as necessary for electric hoists.
- 3.05.00 Pendant control station with all accessories for electric hoists.
- 3.06.00 Lifting lug, eye bolts etc., for handling hoist parts.
- 3.07.00 Protection guard as specified.
- 3.08.00 Lifting hook block assembly for hoists.

#### **4.00.00 SPECIFIC DESIGN REQUIREMENTS**

- 4.01.00 Lifting capacity
- 4.01.01 Capacity of each hoist shall be 1.2 times the maximum working load.
- 4.01.02 Hoists of capacity below 3 tones shall be manual hoists.
- 4.01.03 Hoists of capacity equal and above 3 tones shall be electric hoists.
- 4.02.00 Effort for Mechanical Hoists
- 4.02.01 Hoisting
- Hoisting effort for hoists up to 3 tones capacity shall not be more than 20 kg.



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#### 4.02.02 Trolley Motion

Effort for trolley motion for hoists upto 3 tones capacity shall not be more than 43 Kg.

#### 4.02.03 For Electric operated hoist both hoisting and trolley motion shall be motor operated.

#### 4.03.00 Lift

##### 4.03.01 Lift above operating floor

Highest position of the hook shall be such that during operation of hoists, the vertical distance between bottom of any equipment handled and top of any permanent structure or equipment in the operating area shall be at least one metre.

##### 4.03.02 Approach below operating floor

To be decided by the Bidder for safe and reliable handling of any equipment above half ton below the operating floor.

##### 4.04.00 Length of monorail hoist

To be decided by the Bidder depending on the floor and machine layout. The horizontal distance between the centre line of the hoist and centre line of any installed equipment in its operating shall not be more than half metre.

### 5.00.00 DESIGN AND CONSTRUCTION

#### 5.01.00 All parts requiring replacement or lubrication shall be easily accessible without the need for dismantling of other equipment and structures.

Robust construction and ample rating merging which experience has shown to be necessary shall be ensured throughout manufacture.

#### 5.02.00 All components of hoists of identical capacity and duty shall be interchangeable. The hoists of identical capacity and duty shall be identical in all respects unless otherwise required. The hoist design shall be such that these can be quickly removed from one monorail beam and fixed on another beam without disassembling major components.

#### 5.03.00 All machinery and equipment included under this specification must be equipped with safety devices and clearances to comply with recognized standards and specification requirements.

#### 5.04.00 Cast iron parts wherever used, shall conform to IS:210 - FG 260. Also no wood or other combustible materials shall be used.

#### 5.05.00 Defects in material like fractures, cracks, blowholes, laminations, pitting etc. are not allowed. Rectifications of any such flaw is permissible only with the approval of the Owner.




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- 5.06.00 Each hoist shall be permanently and legibly stamped with the tag number, manufacturer's name, safe working load, grade of load chain (where applicable), range of lift etc.
- 5.07.00 Load chain (where applicable) shall be of grade T(8) as per IS:6216 and Hand chain shall be as per IS:2429 (Part-I) grade 30.
- 5.08.00 Wheels in trolley unit travel shall be single flanged with straight/tapper/barrel shaped tread to suit the monorail. Wheels should be preferably of forged steel construction. Material of construction for wheels of traversing block and hoist gear for hoist used in hazardous areas shall be of non-ferrous material to avoid spark during operation.
- 5.09.00 All gears shall be hardened and tempered steel with machine cut teeth.
- 5.10.00 Hoist (Manually Operated)
- 5.10.01 Manually operated hoists shall be of spur gear chain pulley block type. It shall be suspended from the trolley by a hook. The design of the hoist shall conform to IS:3832 (Specification for hand operated chain pulley blocks).
- The hooks and brakes of hoist shall conform to the requirements stipulated in (a) and (b) below
- a) Hooks shall conform to IS:3832. The load hook shall be swiveling type fitted with a locking device.
  - b) The pulley blocks shall be fitted with an automatic mechanical load brake to prevent self-lowering of load in all working positions. The load brake shall also allow smooth lowering of load without serious overheating.
  - c) All manually operated hoists, unless stated otherwise, shall be trolley suspended type.
- 5.10.02 The trolley of hoists shall be manually operated.
- 5.10.03 The hoists shall be of Mechanism class 2 as per IS:3832.
- 5.11.00 Electric Hoist
- 5.11.01 Electric hoist shall be electric wire rope trolley suspended type. The design, operation, testing of electric hoist shall conform to IS:3938 (Specification for electric wire rope hoist).
- Minimum speed for hoisting shall be 3 m/min. and that of for trolley motion shall be 15 m/min.
- 5.11.02 Lifting hook shall conform to IS 15560 as applicable.
- 5.11.03 Wire rope for hoists shall conform to IS-2266.



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	<b>SAGARDIGHI THERMAL POWER PROJECT, 1 X 660 MW UNIT NO 5, STAGE III.</b>  <b>MILL REJECT SYSTEM (PNEUMATIC TYPE) &amp; COAL BUNKER DEBLOCKING DEVICES</b>  <b>SPECIFIC TECHNICAL REQUIREMENT</b>	SPECIFICATION No: PE-TS-424-160-A001	
		VOLUME: II B	
		SECTION-I	
		SUB-SECTION-IA	
		REV    00	DATE   17.07.21

## Annexure II- Quality Assurance and Inspection requirement

(Refer “QUALITY ASSURANCE REQUIREMENTS, Volume II-A” of Customer’s specification)




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	<b>SAGARDIGHI THERMAL POWER PROJECT, 1 X 660 MW UNIT NO 5, STAGE III.</b>  <b>MILL REJECT SYSTEM (PNEUMATIC TYPE) &amp; COAL BUNKER DEBLOCKING DEVICES</b>  <b>SPECIFIC TECHNICAL REQUIREMENT</b>	SPECIFICATION No: PE-TS-424-160-A001	
		VOLUME: II B	
		SECTION-I	
		SUB-SECTION-IA	
		REV     00	DATE   17.07.21

### Annexure III- Site Information

(Refer “Technical Specification, Volume II-A” of Customer’s specification)

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	<b>SAGARDIGHI THERMAL POWER PROJECT, 1 X 660 MW UNIT NO 5, STAGE III.</b>  <b>MILL REJECT SYSTEM (PNEUMATIC TYPE) &amp; COAL BUNKER DEBLOCKING DEVICES</b>  <b>SPECIFIC TECHNICAL REQUIREMENT</b>	<b>SPECIFICATION No: PE-TS-424-160-A001</b>	
		<b>VOLUME: II B</b>	
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		<b>REV     00</b>	<b>DATE   17.07.21</b>


#### ANNEXURE IV- MANDATORY SPARES

(Refer "REQUIREMENT OF SPARES, TOOLS & TACKLE, Section X, Volume II-A" of Customer's specification)

Note :-

1. If percentage comes as fraction next higher integer should be considered for the purpose of quantity required.
2. The List is tentative & the bidder shall include in the offer any additional items that shall be required for the system in offer as well any item description that may undergo specific technical changes.
3. "Sets of each type", "Sets" means 100% requirement for one stack up assembly.
4. Any item which is quoted as "not applicable" and is found to be "applicable" at a later date shall be supplied by the Bidder without any commercial implications. The Bidder shall note that if there in any change/ variation in equipment/ system during detail engineering which causes any change/ variation in the essential spares quantity, the same shall be supplied without any commercial implications. The price indicated for the mandatory spares shall be considered for the purpose of evaluation.

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		MILL REJECT SYSTEM (PNEUMATIC TYPE) & COAL BUNKER DEBLOCKING DEVICES  SPECIFIC TECHNICAL REQUIREMENT		VOLUME: II B	
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### ANNEXURE V- MAINTENANCE TOOLS & TACKLES

Refer "REQUIREMENT OF SPARES, TOOLS & TACKLE, Section X, Volume II-A" of Customer's specification.

Sl.No.	Description	Qty.	Unit
1	Spur geared chain pulley block of 2.0 tonnes capacity , 3 mtr lift	1	Nos.
2	2 lbs ball pen hammers	2	Nos.
3	Cold Chisel 8"	2	Nos.
4	6" outside and inside caliper	2	Nos.
5	Double end spanners and ring spanners upto one inch size	2	Sets
6	6 feet long measuring tape	1	Nos.
7	a Hacksaw frames 1/2" x 12	4	Nos.
	b HSS blade 12 x 1/2"	6	Nos.
	c Hacksaw blades	6	Nos.
8	Allen keys set	2	Sets
9	Pipe wrenches 18"	2	Nos.
10	10" right angle	1	Nos.
11	12" aluminium spirit levels	2	Nos.
12	Filler Gauges - 8" & 12"	2	Sets
13	10" slide wrenches	2	Nos.
14	6",8",10",12" screw drivers	1	Set
15	Insulated Pliers 8"	1	No.
16	Tommy Bars 6"	2	Nos.
17	a) Cotton Hand Gloves	2	Pairs
	b) Lather Hand Gloves	2	Pairs
18	Lifting wire rope slings 8 ft with eye at each end 1/2 " size and 5/8" size	2	Pair each
19	Ratchet and sockets set for hexagonal head screws & bolts size M-6 to M-24	1	Set
20	Flaring tools with disc	1	Set
21	Grease Gun	1	No
22	Oil Gun	1	No
23	Screw Pitch Gauge	1	No
24	a) JK Flat file 12" smooth	2	Nos.
	b) JK Half round file 12" rough	2	Nos.
	c) JK Half round file 12 " fine	2	Nos.
	d) Square file 12"	2	Nos.
	e) Round File 12"	2	Nos.
25	Line Tester no: 814	2	Nos.
26	a) Cutting Pliers 8"	2	Nos.
	b) Nose Pliers 6"	2	Nos.
27	Soldering iron with flux	1	No.
28	Vice 4" & 12"	1	No. each
29	Taps and Dies	1	No.
30	Steel Scale 12" & 24"	2	each
31	Hand Lamps	2	Nos.
32	Torch with Battery (2 sizes)	2	Nos.

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	<b>SAGARDIGHI THERMAL POWER PROJECT, 1 X 660 MW UNIT NO 5, STAGE III.</b>  <b>MILL REJECT SYSTEM (PNEUMATIC TYPE) &amp; COAL BUNKER DEBLOCKING DEVICES</b>  <b>SPECIFIC TECHNICAL REQUIREMENT</b>	<b>SPECIFICATION No: PE-TS-424-160-A001</b>	
		<b>VOLUME: II B</b>	
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		<b>REV      00</b>	<b>DATE   17.07.21</b>

**ANNEXURE VI- DRAWINGS/DOCUMENTS TO BE SUBMITTED AFTER AWARD OF CONTRACT :** The successful bidder shall submit the following drawings / documents during detail engineering for customer's approval /information:

S.No.	BHEL DRG NO	DRG TITLE	CATEGORY	SCHEDULED SUBMISSION (NO. OF DAYS FROM LOA DATE)	REMARKS
<b>MILL REJECT HANDLING SYSTEM</b>					
1	PE-V0-445-160-A021	QP FOR CONVEYING COMPRESSOR FOR MILL REJECT SYSTEM	A	84	
2	PE-V0-445-160-A010	P & I DIAGRAM OF MRS COMPRESSOR		70	
3	PE-V0-445-160-A017	QAP OF SELF MANUFACTURED- CONVEYING VESSEL , PYRITE HOPPER, BUNKER DISCHARGE GATE, PRESSURE RELIEF VALVE, DENSEVYOR, TERMINAL BOX , ACI BEND, AIR RECEIVER , PNEUMATIC PANEL FOR MILL REJECT SYSTEM	A	42	BASIC DRG.
4	PE-V0-445-160-A033	QP FOR COMPRESSOR MOTOR OF MILL REJECT SYSTEM	A	84	
5	PE-V0-445-160-A030	QP FOR RUPTURE DISC OF MILL REJECT SYSTEM	A	84	
6	PE-V0-445-160-A028	QP FOR METALLIC EXPANSION BELLOW OF MILL REJECT SYSTEM	A	84	
7	PE-V0-445-160-A026	QP FOR BAG FILTER OF MILL REJECT SYSTEM	A	84	
8	PE-V0-445-160-A020	QAP OF MS ERW PIPE OF MILL REJECT SYSTEM	A	84	
9	PE-V0-445-160-A022	TRENCH AND INSERT DETAIL OF MILL REJECT SYSTEM	I	56	BASIC DRG.
10	PE-V0-445-160-A055	OPERATION AND MAINTENANCE MANUAL FOR MRS	I	168	
11	PE-V0-445-160-A052	PAINTING SCHEDULE FOR MRS	I	56	
13	PE-V0-445-160-A049	TECHNICAL DATA SHEET OF CABLE TRAY FOR MRS	I	70	
14	PE-V0-445-160-A048	CONTROL WRITE-UP & INTERLOCK & PNEUMATIC CIRCUIT OF CONVEYING VESSEL, BLOCK LOGIC DIAGRAM/CONTROL SCHEME WITH HMI SCREEN & I/O List	A	70	BASIC DRG.
15	PE-V0-445-160-A059	JUNCTION BOX DATASHEET & SCHEDULE OF MILL REJECT SYSTEM	A	70	
16	PE-V0-445-160-A051	CABLE INTERCONNECTION DIAGRAM FOR MRS	I	98	
17	PE-V0-445-160-A054	CABLE SCHEDULE -SIGNAL AND CONTROL OF MILL REJECT SYSTEM	I	84	
18	PE-V0-445-160-A056	SCHEDULE OF INSTRUMENTS FOR MILL REJECT SYSTEM	I	70	




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	<b>SAGARDIGHI THERMAL POWER PROJECT, 1 X 660 MW UNIT NO 5, STAGE III.</b>  <b>MILL REJECT SYSTEM (PNEUMATIC TYPE) &amp; COAL BUNKER DEBLOCKING DEVICES</b>  <b>SPECIFIC TECHNICAL REQUIREMENT</b>	<b>SPECIFICATION No: PE-TS-424-160-A001</b>	
		<b>VOLUME: II B</b>	
		<b>SECTION-I</b>	
		<b>SUB-SECTION-IA</b>	
		<b>REV      00</b>	<b>DATE   17.07.21</b>

19	PE-V0-445-160-A047	TECHNICAL DATA SHEET OF INSTRUMENTS (LIKE TEMPERATURE SWITCH, TEMPERATURE GAUGE, PRESSURE SWITCH, PRESSURE GAUGE, SOLENOID VALVE , LEVEL SWITCH , AIR FILTER REGULATOR ETC.) OF MILL REJECT SYSTEM	A	70	
20	PE-V0-445-160-A045	GA, TECHNICAL DATA SHEET AND WIRING DIAGRAM OF SUMP PUMP OF MILL REJECT SYSTEM	I	98	
21	PE-V0-445-160-A043	G.A., TECHNICAL DATA SHEET AND FOUNDATION DETAILS OF AIRCOMPRESSOR, GA AND WIRING DIAGRAM FOR LOCAL PANEL OF CONVEYING AIR COMPRESSOR OF MILL REJECT SYSTEM	A	70	BASIC DRG.
22	PE-V0-445-160-A037	GA OF CHAIN PULLEY BLOCK OF MILL REJECT SYSTEM	I	56	
23	PE-V0-445-160-A035	G.A. OF RUPTURE DISC. OF MILL REJECT SYSTEM	I	56	
24	PE-V0-445-160-A034	G.A OF METALLIC EXPANSION BELLOW OF MILL REJECT SYSTEM	I	56	
25	PE-V0-445-160-A027	G.A OF BAG FILTER OF MILL REJECT SYSTEM	I	56	
26	PE-V0-445-160-A025	GA OF KNIFE GATE/PLATE VALVE OF MILL REJECT SYSTEM	I	56	
27	PE-V0-445-160-A024	DESIGN CALCULATION AND STRUCTURAL ARRANGEMENT OF BUNKER AND LOAD DATA OF BUNKER OF MILL REJECT SYSTEM	A	70	BASIC DRG.
28	PE-V0-445-160-A019	G.A OF MRS BUNKER	A	42	BASIC DRG.
29	PE-V0-445-160-A018	CONTROL ROOM LAYOUT--MILL REJECT SYSTEM	A	70	BASIC DRG.
30	PE-V0-445-160-A014	LAYOUT OF MRS COMPRESSOR HOUSE	A	70	BASIC DRG.
31	PE-V0-445-160-A013	EQUIPMENT AND PIPING LAYOUT OF MILL REJECT SYSTEM AND PIPING LAYOUT FROM MRS COMPRESSOR HOUSE	A	56	BASIC DRG.
32	PE-V0-445-160-A011	SUB VENDOR LIST WITH INSPECTION CATEGORY OF MILL REJECT SYSTEM	A	28	BASIC DRG.
33	PE-V0-445-160-A009	P G TEST PROCEDURE OF MILL REJECT SYSTEM	A	140	
34	PE-V0-445-160-A008	GA & DS OF SELF MFG. ITEMS (DENSVEYOR, HOPPER, BNKR DIS. GATE, PRV, ACI BEND, PNEU. PANEL, AIR RECVR, TER. BOX, ETC.) OF MILL REJECT SYSTEM	I	42	BASIC DRG.
35	PE-V0-445-160-A006	P & I DIAGRAM OF MILL REJECT HANDLING SYSTEM	A	28	BASIC DRG.

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	GARGIDIGHI THERMAL POWER PROJECT, 1 X 660 MW UNIT NO 5, STAGE III.	SPECIFICATION No: PE-TS-424-160-A001	
		VOLUME: II B	
		SECTION-I	
	MILL REJECT SYSTEM (PNEUMATIC TYPE) & COAL BUNKER DEBLOCKING DEVICES	SUB-SECTION-IA	
	SPECIFIC TECHNICAL REQUIREMENT	REV 00	DATE 17.07.21

36	PE-V0-445-160-A004	DESIGN PHILOSOPHY AND SYSTEM SIZING CALCULATION OF MILL REJECT SYSTEM	A	28	BASIC DRG.
37	PE-V0-445-160-A003	G.A., TECHNICAL DATA SHEET OF AIR COMPRESSOR MOTOR OF MILL REJECT SYSTEM	A	70	BASIC DRG.
38	PE-V0-445-160-A002	GA OF WATER AND AIR LINE VALVES OF MILL REJECT SYSTEM	I	84	
COAL BUNKER DEBLOCKING DEVICE					
1	PE-V0-445-161-A110	Operation and maintenance manual -COAL BUNKER DEBLOCKING DEVICE	I	84	BASIC DRG.
2	PE-V0-445-161-A104	Schematic (P&ID) drawing for Coal Bunker De blocking System	A	84	BASIC DRG.
3	PE-V0-445-161-A109	GENERAL ARRANGEMENT & Datasheet for Coal De blocking Devices	A	84	BASIC DRG.
4	PE-V0-445-161-A101	MQP for Coal De blocking Devices	A	84	BASIC DRG.

## Notes:

1. The above drawing list is tentative and shall be finalized with the successful bidder after placement of order. While some of the drawings indicated above may not be applicable, some additional drawings may also be required based on scope of work. Drawings /documents indicated at Electrical and C&I specification are also to be submitted as per applicability.
2. Drawings shall be prepared in Auto-Cad latest edition and to the scale. Required no. of hard and soft copies (editable) of the drawings shall be furnished as per requirement specified elsewhere in the specification.
3. Only manual calculation with authentic supporting literature (e.g. extracts of hand Book/ standard/codes) shall be acceptable. All design calculations and drawings shall be in SI system only.
4. All the drawings and documents including general arrangement drawing, data sheet, calculation etc. to be furnished to the customer during detailed engineering stage shall include / indicate the following details for clarity w.r.t. Inspection, construction, erection and maintenance etc.:-
  - a) All drawings and documents shall indicate the list of all reference drawings including general arrangement.
  - b) All drawings shall include / show plan, elevation, side view, cross - section, skin section, blow - up view; all major self-manufactured and bought out items shall be labeled and included in BOQ / BOM in tabular form.
  - c) Painting schedule shall also be made as a part of general arrangement drawing of each equipment / items indicating at least 3 trade names.
  - d) All the drawings required to be furnished to customer during detailed engineering stage shall include technical parameters, details of paints and lubrication, hardness and BOQ / BOM in tabular form indicating all major components including bought out items and their quantity, material of construction indicating its applicable code / standard, weight, make etc.

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- e) Drawings/ documents to be submitted for purchasers review/ approval shall be under Revision A, B, C... etc. while drawings /documents to be submitted thereafter for customer's approval after purchaser's approval shall be under R-0, 1, 2, 3 ....etc.
- f) Drawings and documents not covered above but required to check safety of machines/ system, shall be submitted during detailed engineering stage without any commercial implication.
- g) All drawings shall include "B.O.M" and indicate quantity, material of construction, make along with IS/BS No., Technical parameters, dimensions, hardness, machining symbol and tolerance, requirement of radiography and hydraulic tests, painting details, elevation, side view, plan, skin section and blow-up view for clarity.
- h) All drawings shall be prepared as per BHEL's title block and shall bear BHEL's drawing No.
- i) Schedule of drawings submissions, comment incorporations & approval shall be as stipulated in the specifications. The successful bidder shall depute his design personnel to BHEL's/ Customer's/ Consultant's office for across the table resolution of issues and to get documents approved in the stipulated time.
- j) Bidder to follow the following the drawing submission schedule:
- k) 1st submission of drawings from date of LOI as per the submission schedule.
- l) Every revised submission incorporating comments – within 10 days.
- m) Bidder to submit revised drawings complete in all respects incorporating all comments. Any incomplete drawing submitted shall be treated as non-submission with delays attributable to bidder's account. For any clarification/ discussion required to complete the drawings, the bidder shall himself depute his personal to BHEL for across the table discussions/ finalizations/ submissions of drawings.
- n) BHEL drawing numbers shall be informed after award of contract and essentially to be incorporated in drawings. The pdf files of all drawings and documents shall be named and submitted with BHEL drawing numbers.
- o) Drawings documents above have been identified as basic drawings in remarks column. During contract engineering stage, approval of these drawings from BHEL/Customer shall be treated as clearance to milestone payment for completion of design & engineering.

Upon review of each drawing, depending on the correctness and completeness of the drawing, the same will be categorized and approval accorded in one of the following categories :

- CATEGORY- 1 : Approved
- CATEGORY- 1\* : Approved with comments.  
Resubmit revised drawing incorporating the comments.
- CATEGORY –2 : Approved except as noted, forward final drawing.
- CATEGORY - 3 : Approved except as noted, resubmission required.
- CATEGORY – 4 : Disapproved.
- CATEGORY – 5\* : For information and record with comments.
- CATEGORY – 5 : For information and record.

Drawings resubmitted shall show clearly the portions where the same are revised marking the relevant revision numbers and Employer shall review only such revised portion of documents.


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		SUB-SECTION-IA	
		REV     00	DATE   17.07.21

**B.0 NO.OF DRAWINGS/DOCUMENTS FOR SUBMISSION**

A.	Drawing for Approval	No. of prints/copies (hard prints)
i.	For approval	8
ii.	For final distribution (after the vendor obtains final approval from the customer).	12
B.	Certificate, reports etc. (Material test, inspection report and all other type of tests etc.)	6
C.	O&M Manual	
I.	Draft for approval	2
ii.	For final distribution	12

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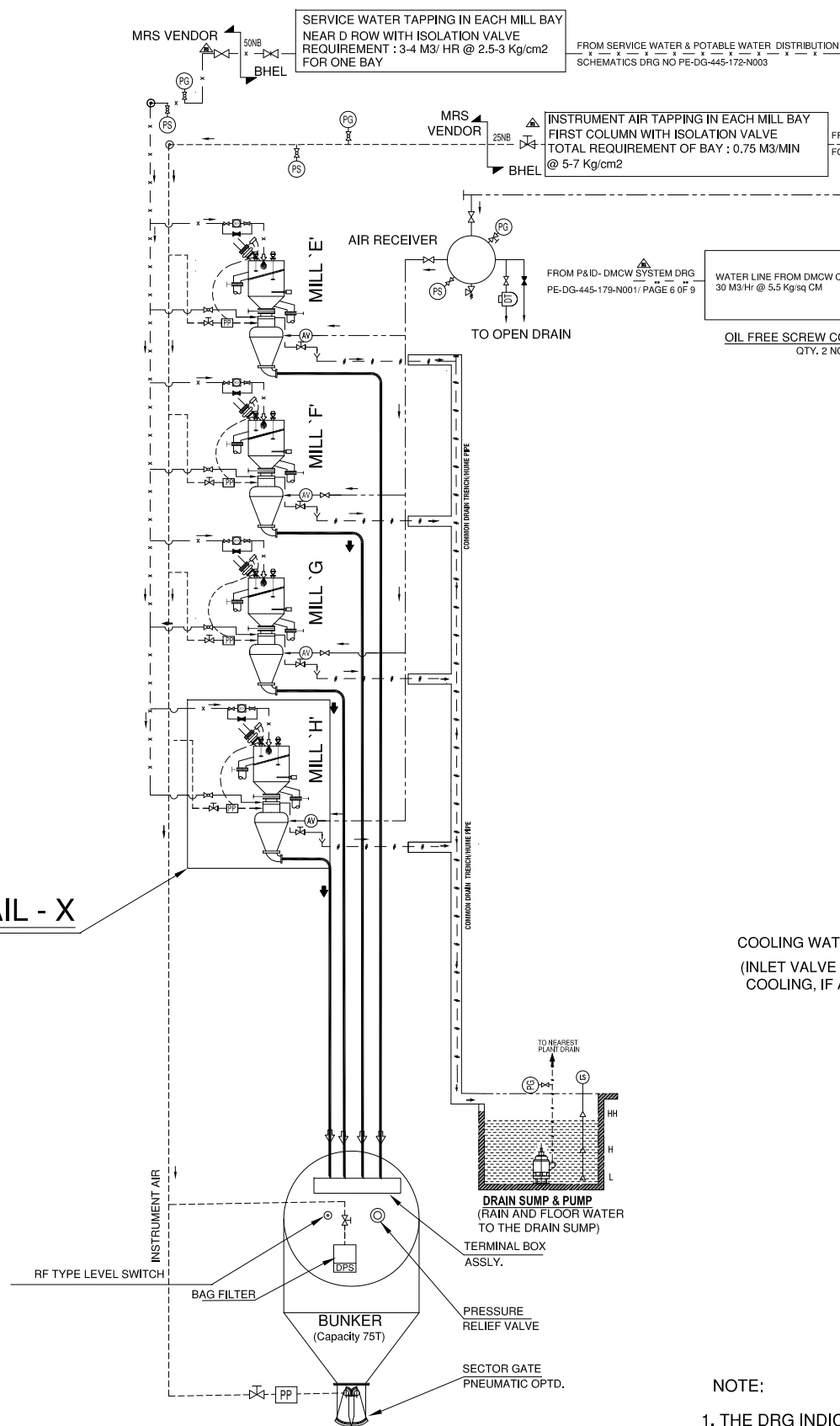
	<b>SAGARDIGHI THERMAL POWER PROJECT, 1 X 660 MW UNIT NO 5, STAGE III.</b>  <b>MILL REJECT SYSTEM (PNEUMATIC TYPE) &amp; COAL BUNKER DEBLOCKING DEVICES</b>  <b>SPECIFIC TECHNICAL REQUIREMENT</b>	SPECIFICATION No: PE-TS-424-160-A001	
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### Annexure VII- Input Drawings & Documents

- 1) Single Line Flow Diagram of Mill Reject handling system – Drg no PE-DG-445-160-A001
- 2) General Arrangement drawing of HP-1103 Mill (with Planetary gear box) - Drg no HY-DG-445-HFC-A001.
- 3) Bowl Mill Foundation- General Arrangement of Bowl Mill Foundation – Drg no PE-DG-445-615-C001.
- 4) Plot Plan - Drg no PE- DG-445-100-M001.
- 5) Flow Scheme for Coal bunker deblocking devices Drg no PE-DG-445-161-A100
- 6) BUNKER SIZING CALCULATION for RAW COAL-CYLINDRICAL WITH CONICAL HOPPER
- 7) MILL BUNKER BUILDING BUNKER AND SUPPORTING DETAIL- Drg no PE-DG-445-616-C014



REFER DETAIL - X

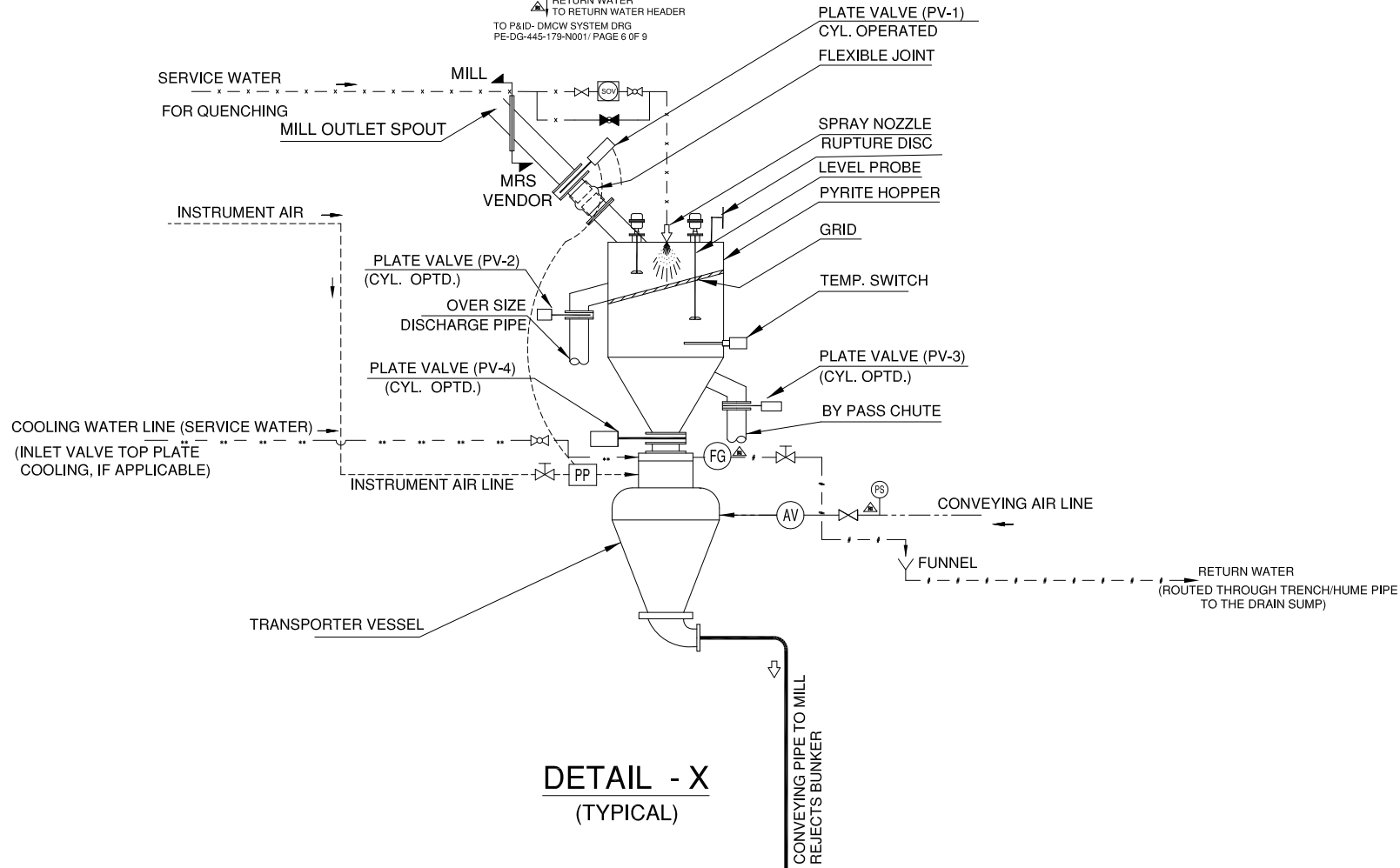


FLOW DIAGRAM OF TYPICAL MILL BAY

NOTE:

1. THE DRG INDICATES BROAD SCOPE & WORKING PRINCIPAL OF THE SYSTEM.  
FLOW DIAGRAM SHALL BE READ IN CONJUNCTION WITH DESIGN MEMORANDUM.
2. RETURN SERVICE WATER FROM TRANSPORTER VESSEL SHALL BE AS PER APPLICABILITY OF MRS VENDOR'S DESIGN.

LEGEND:-							
—	MILL REJECTS	— —	GATE VALVE	—(AV)—	AIR VALVE	—(SOV)—	SOLENOID OPTD. VALVE
----	CONVEYING PIPE	— — —	BALL VALVE	—(PP)—	PNEUMATIC PANEL	—(TG)—	TEMPERATURE GAUGE
----	CONVEYING AIR	— — — —	NORMALLY CLOSED BALL VALVE	—(PG)—	PRESSURE GAUGE	—(TS)—	TEMPERATURE SWITCH
----	INSTRUMENT AIR	— — — — —	NON RETURN VALVE	—(DPS)—	DIFFERENTIAL PRESSURE SWITCH	—(DT)—	DRAIN TRAP
----	COOLING WATER	— — — — — —					
----	SERVICE WATER	— — — — — — —					
----	RETURN WATER	— — — — — — — —					

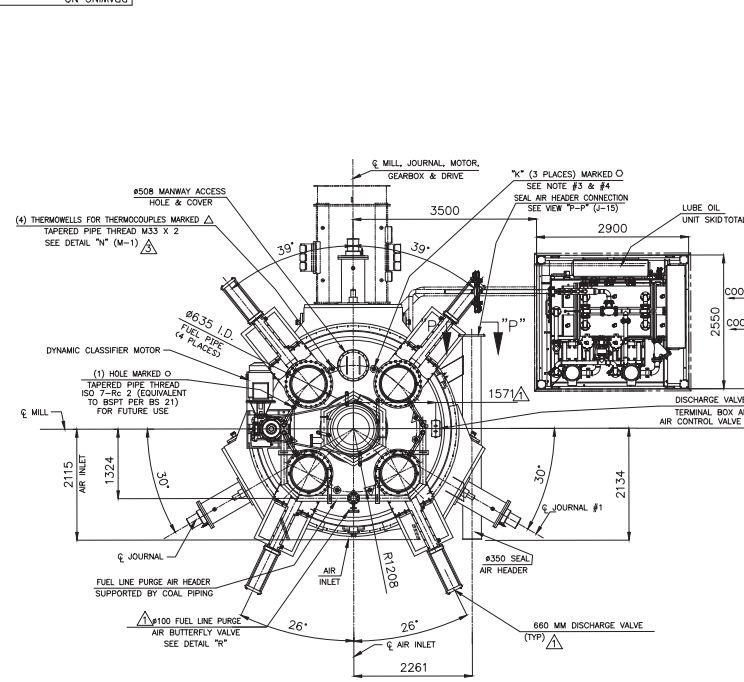
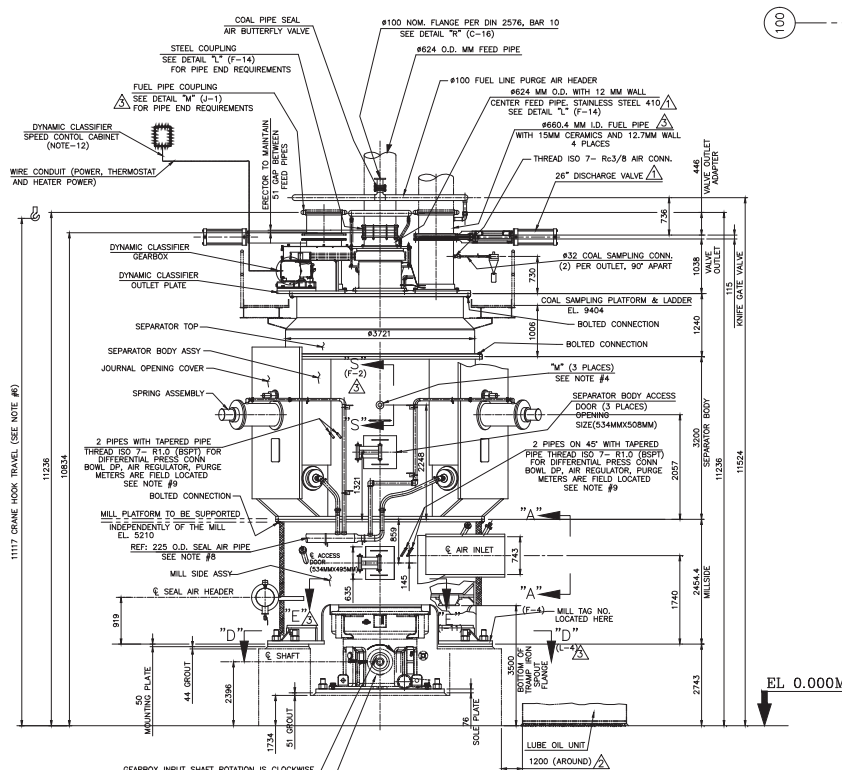


DETAIL - X  
(TYPICAL)

FLOW DIAGRAM OF TYPICAL MILL REJECT

JOB NO.	445
STATUS	CONTRACT
DISTRIBUTION	
TO	
NO.	
REV	
01	06-07-21 VVH VVH SKB

CUSTOMER:		THE WEST BENGAL POWER DEVELOPMENT CORPN. LTD.(WBPDCL)	
CONSULTANT:		1X660MW,SAGARDIGHI THERMAL POWER EXTENSION PROJECT (UNIT #5)	
CONSULTANT:		DEVELOPMENT CONSULTANTS PRIVATE LIMITED KOLKATA	
CONSULTANT:		BHARAT HEAVY ELECTRICALS LIMITED (A GOVERNMENT OF INDIA ENTERPRISE) PROJECTS ENGINEERING MANAGEMENT, NOIDA	
TITLE		SINGLE LINE FLOW DIAGRAM OF MILL REJECT HANDLING SYSTEM	
DRAWN		NAME	
CHECKED		SIGN	
APPROD		DATE	
DRG.NO.		PE-DG-445-160-A001	
SHEET NO		NO OF SHEETS	
1		1	

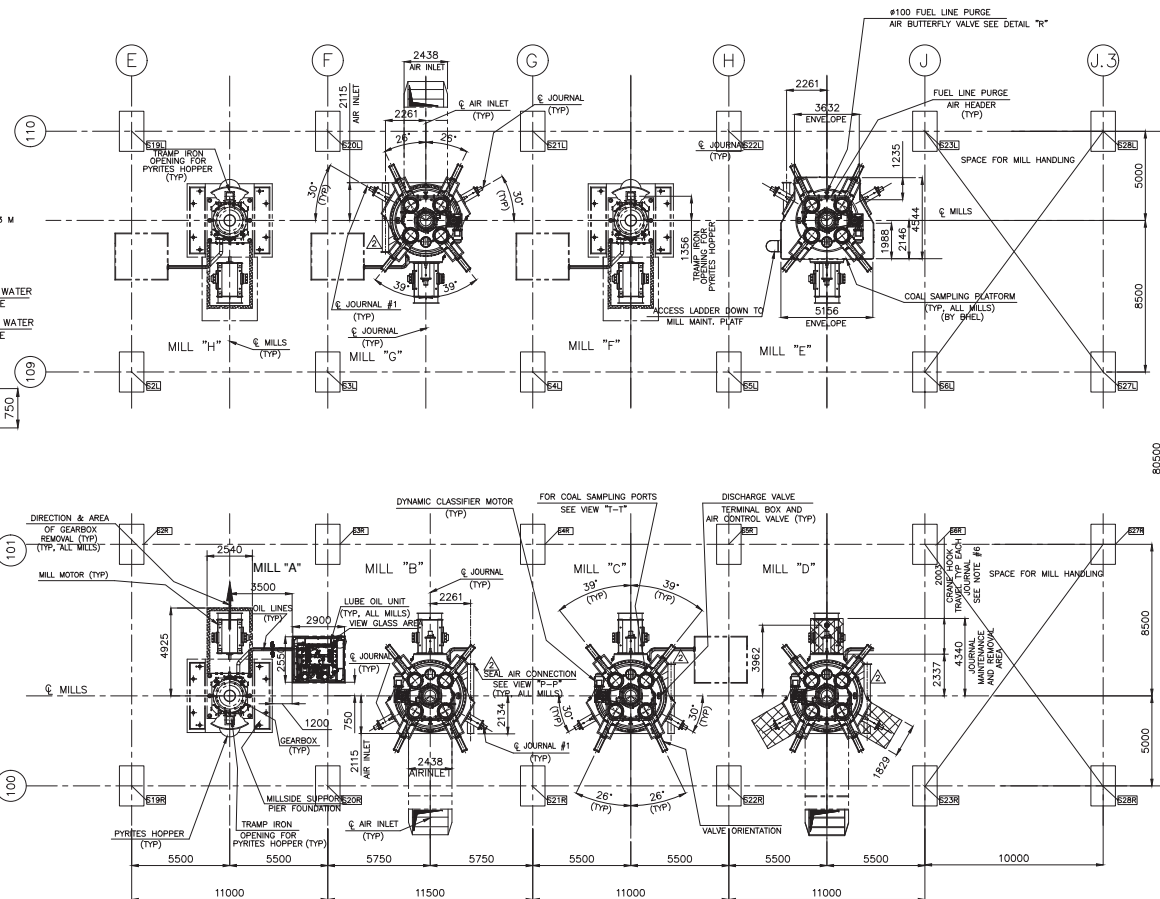
PLAN VIEW  
(SEE NOTE #3)

ELEVATION VIEW

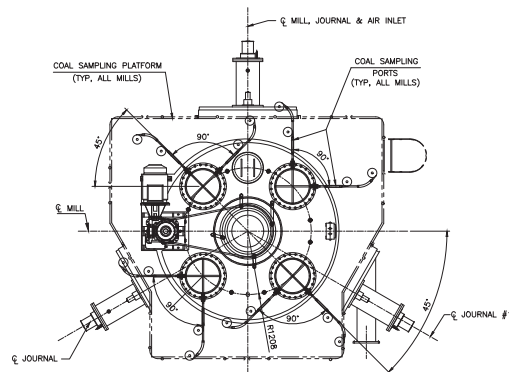
## NOTES:

- ALL DIMENSIONS ARE IN MM. ELEVATIONS SHOWN IN METRES.
- PAINT SHOP COAT IN ACCORDANCE WITH APPROVED PAINTING SCHEDULE.
- FOR RELATIVE LOCATIONS AND TRUE ORIENTATION OF MILL, MILL PARTS AND EXTERNAL EQUIPMENT SEE KEY PLAN.
- FIRE EXTINGUISHING SYSTEM: (PIPING & CONNECTORS IN PIPING CENTRE SCOPE) THE FOLLOWING NOZZLES WILL BE SUPPLIED PER MILL. SIZE NOTED BELOW. LOCATION OF CONNECTIONS SHOWN IN ELEVATION AND PLAN VIEWS.  
(3) NOZZLES "K" PIPE THREAD ISO 7-Rc 1-1/2 -SEPARATOR TOP (ZONE L-14)  
(5) NOZZLES "L" PIPE THREAD ISO 7-R 1-1/2 -MILLSIDE (ZONE F-4 & J-4)  
(3) NOZZLES "M" PIPE THREAD ISO 7-R 1-1/2 -SEPARATOR BODY (ZONE F-15)  
30.66 LPM PER NOZZLE AT 2.812 Kg/cm<sup>2</sup>, MAXIMUM PRESSURE 7.030 Kg/cm<sup>2</sup>  
PURGE AIR 7.08m<sup>3</sup>/min PER MILL REQUIRED FOR NOZZLE @ PRESSURE 254 mm. GREATER THAN UNDER BOWL PRESSURE.
- ALL CONNECTIONS TO BE PER ISO, NOMINAL SIZES IN MM.
- CRANE HOOK TRAVEL FROM GROUND FLOOR TO EL 11117 MM SEE ELEVATION VIEW.
- THE CRANE HOOK MUST TRAVEL 2337 FROM THE  $\phi$  OF THE MILL ALONG THE  $\phi$  OF THE JOURNAL TO 3971 FROM THE  $\phi$  OF THE MILL ALONG THE  $\phi$  OF THE JOURNAL. SEE KEY PLAN.
- EXPECTED SEAL AIR CONSUMPTION FOR PULVERIZER JOURNALS, MAIN SEAL AND SPRINGS IS 80.7 m<sup>3</sup>/min WITH A MILL SEAL AIR HEADER PRESSURE 254 mm WATER COLUMN HIGHER THAN MILL INLET AIR PRESSURE. HIGHER SEAL AIR HEADER PRESSURE WILL RESULT IN GREATER SEAL AIR CONSUMPTION.
- CLEARANCE FOR SEAL AIR PIPE MUST BE MAINTAINED IN PLAN DESIGN.
- INSTRUMENT PURGE AIR: .045 Kg/hr @ 4.5-7.030 Kg/cm<sup>2</sup>.
- SERVICE AIR FOR COAL SAMPLING 0.57m<sup>3</sup>/min @ 5.624 Kg/cm<sup>2</sup>, 49°C INTERMITTENT.
- COAL PIPE SEAL AIR FLOW AND PRESSURE DETERMINED BY FUEL FIRING GROUP / BHEL TRICHY.
- VFD CABINET (1 PER MILL) TO BE LOCATED IN BOILER MCC ROOM. THE DIMENSION OF THE PANEL IS 900(L) X 700 (W) X 2100(H) WITH 500MM CLEARANCE ALL AROUND.
- ALL ELEVATIONS ARE W.R.T EL (+30.0 M, FINISHED GROUND FLOOR LEVEL OF TG BUILDING AND MILL BAY, WHICH CORRESPONDS TO RL(+3) 34.5M.
- MILL REJECT HANDLING SYSTEM IS BY BHEL PEM, MILL MOTOR BY BHEL CHANDLER, MILL MAINTENANCE PLATFORM SCOPE IS IN BHEL TRY SCOPE.
- SEPARATE LOCAL CONTROL PANEL IS NOT ENVISAGED FOR DYNAMIC CLASSIFIER. IT IS DIRECTLY CONTROLLED FROM DCS.

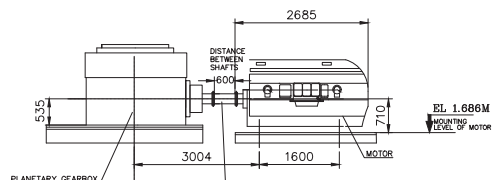
DYNAMIC CLASSIFIER REQUIREMENTS:	
-MOTOR	CLASS F INVERTER DUTY INSULATION, TFC 415 V, 50 HZ, NEMA DESIGN B
-DRIVE	VARIABLE FREQUENCY DRIVE 415 V, 3 PHASE, 50 HZ, IP-54
-45 KW INVERTER DUTY CONSTANT TORQUE	3 PHASE ENCLOSURE WITH AIR CONDITIONERS.
MILL DISCHARGE VALVE REQUIREMENTS:	
A) SOLENOID VALVES SHALL HAVE BODY, TRIM & COIL ENCLOSURE BE OF SS316	
B) LED INDICATION FOR POWER ON THE SOLENOID VALVE	
C) DOUBLE COIL TYPE SOLENOID	
D) DESIGNED FOR AMBIENT TEMPERATURE 0-50 DEG. CELSIUS	
DISCHARGE VALVE TERMINAL BOX - IP-55	
CONDUIT CONNECTION ISO 7-R 1-1/2 (BSPT)	
AIR CONTROL VALVE:	
ELECTRICAL REQUIREMENTS:	240 VAC, RATED FOR CONTINUOUS DUTY, IP 55 RATED, CLASS 1 COILS, DOUBLE SOLENOID, 4 WAY, 5 PORTS THREE POSITION VALVE
AIR REQUIREMENTS:	10.546 kg/cm <sup>2</sup> MAX PRESSURE, 0.20m <sup>3</sup> /min
LIMIT SWITCHES	IP 55, 125 VDC, 5 AMP, 125 VDC, IP 65
ELECTRICAL REQUIREMENTS:	RATED 10 AMP AT 240 VAC, 5 AMP @ 125 VDC, IP 65
LIMIT SWITCH SHALL BE HEAVY DUTY TYPE.	



KEY PLAN - MILL ARRANGEMENT



VIEW "T-T"

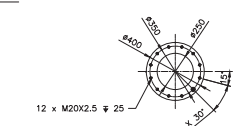
FOR INFORMATION NOT SHOWN ON THE PLATFORM  
(SEE KEY PLAN - MILL ARRANGEMENT)

VIEW "X"

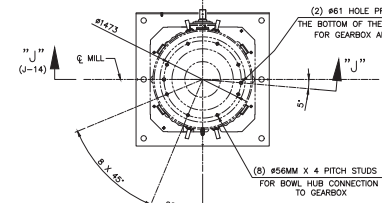
MAJOR COMPONENTS	WEIGHT (ESTIMATED) (MT)	QUANTITY PER MILL
PLANETARY GEAR BOX (W/O OIL)	16.00	1
MILLSIDE ASSEMBLY	19.83	1
BOWL AND BOWL HUB ASSEMBLY	18.35	1
SEPARATOR BODY ASSY. WITH TRUNNION SHAFTS	21.98	1
SEPARATOR TOP	4.74	1
DYNAMIC CLASSIFIER COMPLETE	11.80	1
DYNAMIC CLASSIFIER OUTLET PLATE AND DRIVE ASSEMBLY	9.00	1
JOURNAL SHAFT ASSEMBLY WITH GRINDING ROLL (1)	5.76	3
JOURNAL HEAD ASSEMBLY (1)	3.44	3
JOURNAL OPENING COVER ASSEMBLY WITH SPRING ASSEMBLY (1)	3.91	3
JOURNAL MAINTENANCE: - JOURNAL TILT OUT	6.03	1
- JOURNAL BEARING & END PLAY CHECKING	6.45	

MATERIAL OF MILL WEAR PARTS:

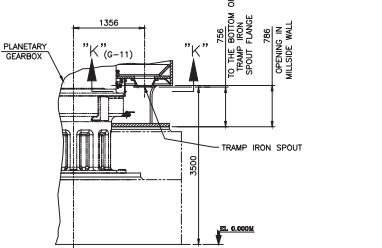
- CLASSIFIER VANES MATERIAL: ABRASION RESISTANT ALLOY STEEL.
- GRINDING ROLL MATERIAL: SINTERED CAST HARDNESS IS MORE THAN 550 BHN.
- BULLRING SEGMENT MATERIAL: SINTERED CAST HARDNESS IS MORE THAN 550 BHN.



VIEW "K-K"

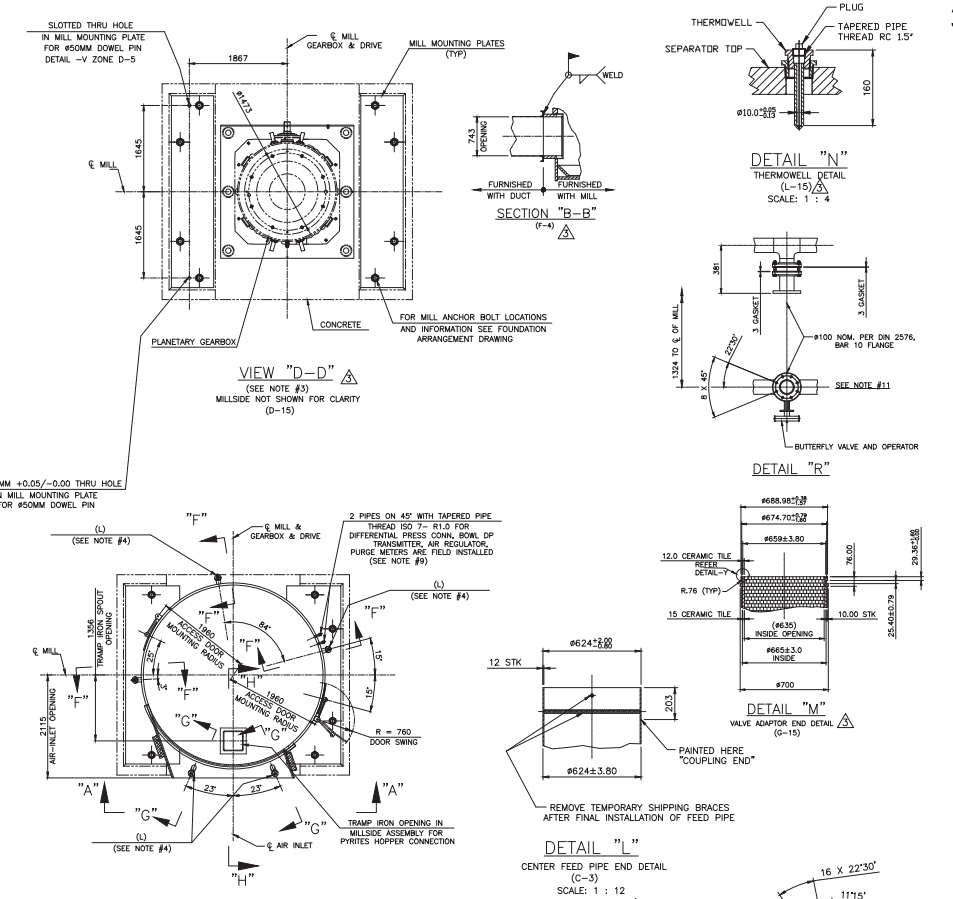
TRAMP IRON SPOUT FLANGE  
(MATING FLANGE 8250 NOM. PER DIN 2576)  
SCALE: 1:12  
(I-11)

VIEW "E-E"

BOWL HUB AND MILLSIDE NOT SHOWN FOR CLARITY  
(E-15)

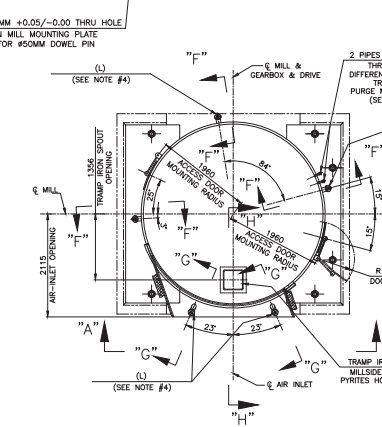
SECTION "H-H"

(D-13 ON VIEW C-C)



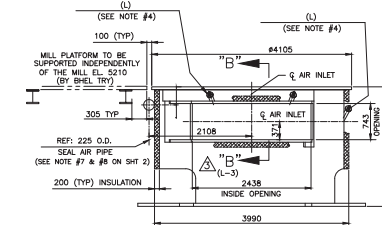
VIEW "D-D"

(SEE NOTE #3)

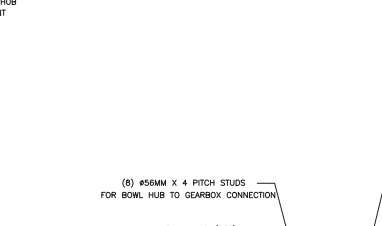
MILLSIDE NOT SHOWN FOR CLARITY  
(D-15)

VIEW "G-G"

(E-13)

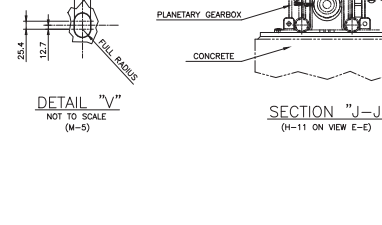


VIEW "A-A"

(SEE NOTE #3 ON SHIT 2)  
(E-14)

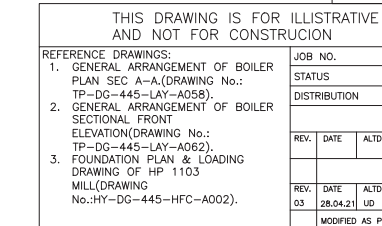
VIEW "B-B"

(SEE NOTE #4)



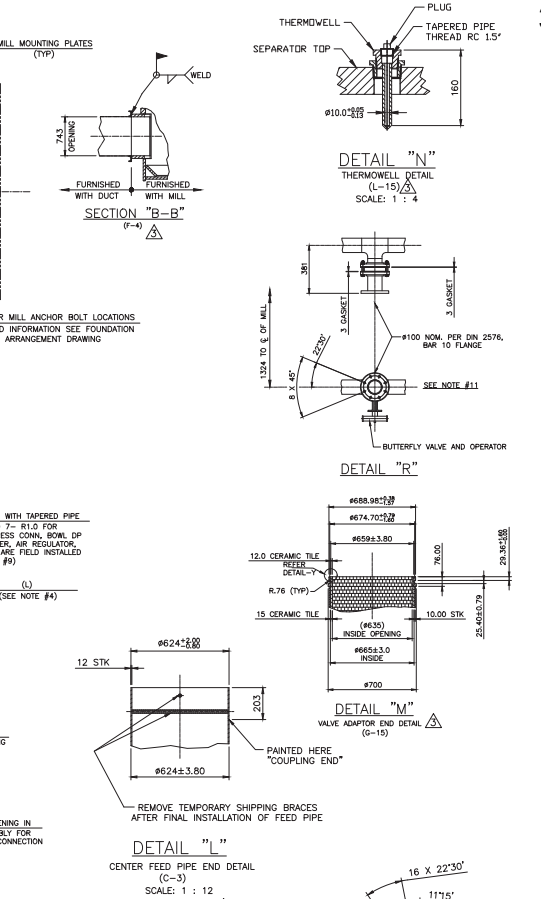
VIEW "C-C"

(SEE NOTE #4)



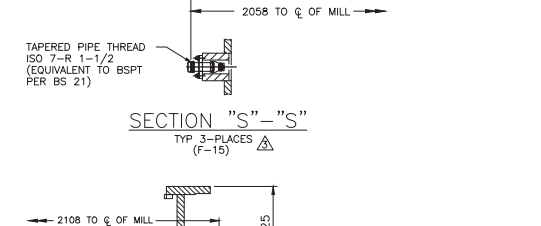
VIEW "F-F"

(SEE NOTE #4)

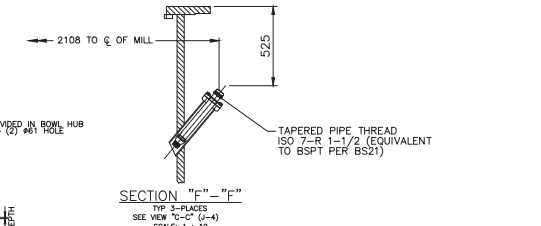


VIEW "P-P"

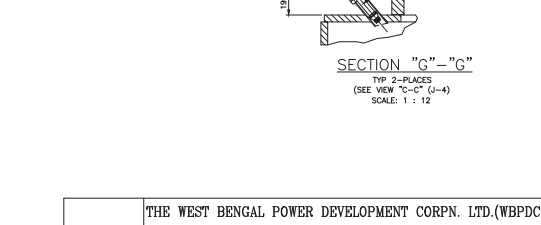
SCALE: 1:12



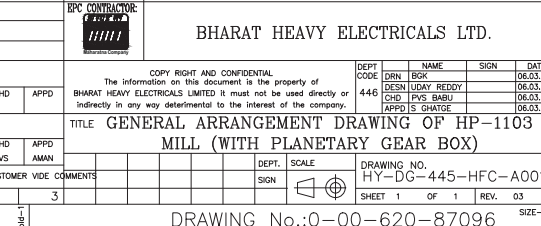
VIEW "S-S"

TYP 3-PLACES  
(F-15)

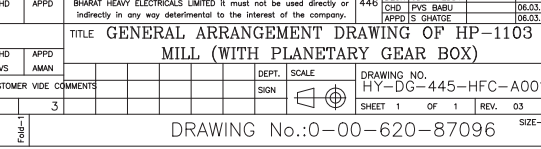
VIEW "T-T"

TYP 2-PLACES  
(G-4)

VIEW "U-U"

TYP 2-PLACES  
(H-4)

VIEW "V-V"

TYP 2-PLACES  
(I-4)

VIEW "W-W"

TYP 2-PLACES  
(J-4)

## CONTRACT

THIS DRAWING IS FOR ILLUSTRATIVE PURPOSES, AND NOT FOR CONSTRUCTION

REFERENCE DRAWINGS:

- GENERAL ARRANGEMENT OF BOILER PLAN SEC A-A (DRAWING No.: TP-DG-445-LAY-A058)
- GENERAL ARRANGEMENT OF BOILER SECTIONAL FRONT ELEVATION (DRAWING No.: TP-DG-445-LAY-A062)
- FOUNDATION PLAN & LOADING DRAWING OF HP 1103 MILL (DRAWING No.: HY-DG-445-HFC-A002)

JOB NO.

STATUS

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REV. DATE ALD CHD APPD

THE WEST BENGAL POWER DEVELOPMENT CORPN. LTD.(WBPDCL)  
1X860MW,SAGARDIGHI THERMAL POWER EXTENSION PROJECT (UNIT #5)DEVELOPMENT CONSULTANTS PRIVATE LIMITED  
KOLKATA

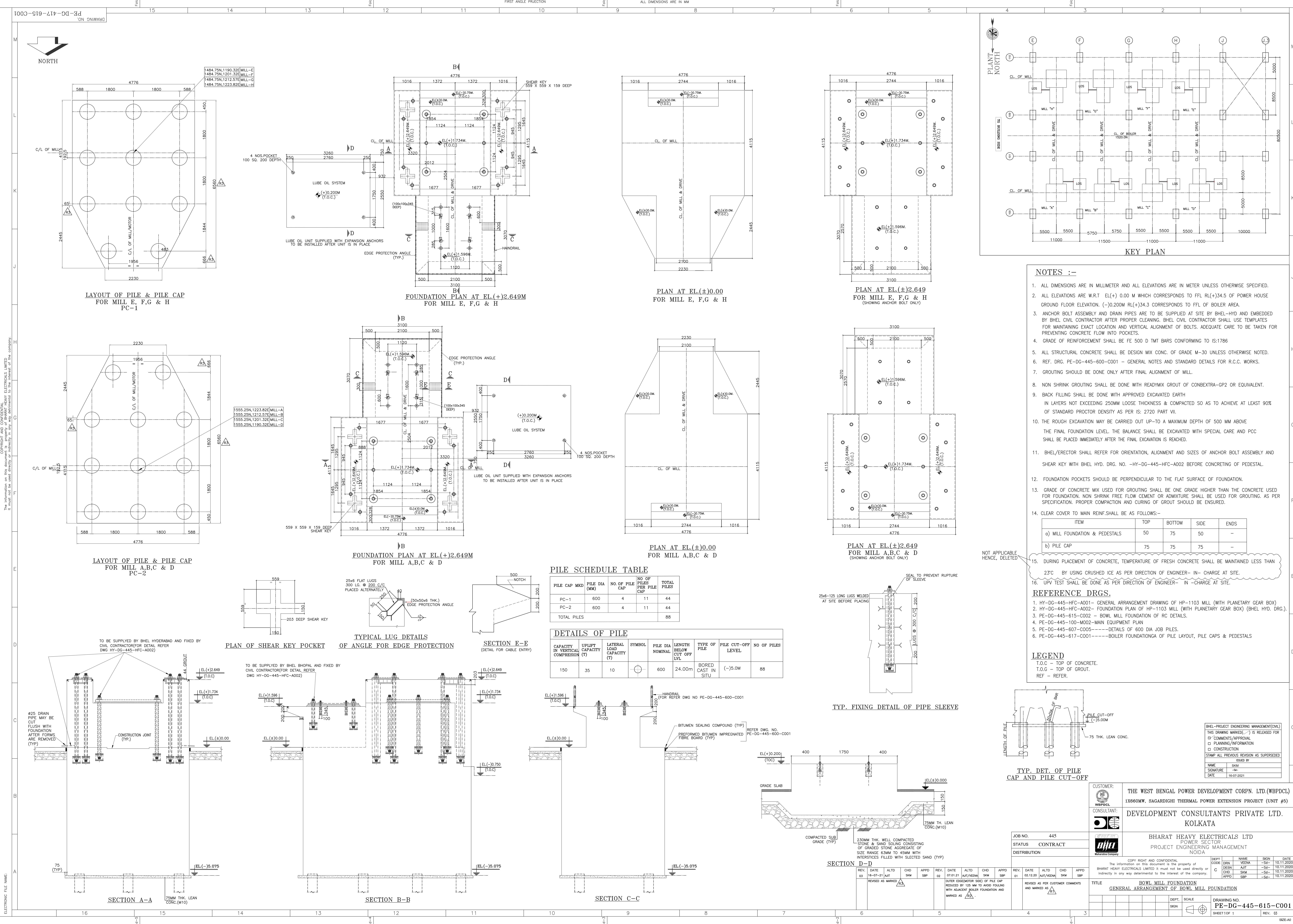
BHARAT HEAVY ELECTRICALS LTD.

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TITLE GENERAL ARRANGEMENT DRAWING OF HP-1103 MILL (WITH PLANETARY GEAR BOX)

DRAWING No. HY-DG-445-HFC-A001  
SHEET 1 OF 1





- NOTES :-**
- ALL DIMENSIONS ARE IN MILLIMETER AND ALL ELEVATIONS ARE IN METER UNLESS OTHERWISE SPECIFIED.
  - ALL ELEVATIONS ARE W.R.T EL(+/-) 0.00 M WHICH CORRESPONDS TO FFL RL(+34.5 OF POWER HOUSE GROUND FLOOR ELEVATION. (-)0.200M RL(+34.3 CORRESPONDS TO FFL OF BOILER AREA.
  - ANCHOR BOLT ASSEMBLY AND DRAIN PIPES ARE TO BE SUPPLIED AT SITE BY BHEL-HYD AND EMBEDDED BY BHEL CIVIL CONTRACTOR AFTER PROPER CLEANING. BHEL CIVIL CONTRACTOR SHALL USE TEMPLATES FOR MAINTAINING EXACT LOCATION AND VERTICAL ALIGNMENT OF BOLTS. ADEQUATE CARE TO BE TAKEN FOR PREVENTING CONCRETE FLOW INTO POCKETS.
  - GRADE OF REINFORCEMENT SHALL BE FE 500 D TMT BARS CONFORMING TO IS:1786
  - ALL STRUCTURAL CONCRETE SHALL BE DESIGN MIX CONC. OF GRADE M-30 UNLESS OTHERWISE NOTED.
  - REF. DRG. PE-DG-445-600-C001 - GENERAL NOTES AND STANDARD DETAILS FOR R.C.C. WORKS.
  - GROUTING SHOULD BE DONE ONLY AFTER FINAL ALIGNMENT OF MILL.
  - NON SHRINK GROUTING SHALL BE DONE WITH READYMIX GROUT OF CONEXTRA-GP2 OR EQUIVALENT.
  - BACK FILLING SHALL BE DONE WITH APPROVED EXCAVATED EARTH IN LAYERS NOT EXCEEDING 250MM LOOSE THICKNESS & COMPACTED SO AS TO ACHIEVE AT LEAST 90% OF STANDARD PROCTOR DENSITY AS PER IS: 2720 PART VII.
  - THE ROUGH EXCAVATION MAY BE CARRIED OUT UP-TO A MAXIMUM DEPTH OF 500 MM ABOVE THE FINAL FOUNDATION LEVEL. THE BALANCE SHALL BE EXCAVATED WITH SPECIAL CARE AND PCC SHALL BE PLACED IMMEDIATELY AFTER THE FINAL EXCAVATION IS REACHED.
  - BHEL/ERECTOR SHALL REFER FOR ORIENTATION, ALIGNMENT AND SIZES OF ANCHOR BOLT ASSEMBLY AND SHEAR KEY WITH BHEL HYD. DRG. NO. -HY-DG-445-HFC-A002 BEFORE CONCRETING OF PEDESTAL.
  - FOUNDATION POCKETS SHOULD BE PERPENDICULAR TO THE FLAT SURFACE OF FOUNDATION.
  - GRADE OF CONCRETE MIX USED FOR GROUTING SHALL BE ONE GRADE HIGHER THAN THE CONCRETE USED FOR FOUNDATION. NON SHRINK FREE FLOW CEMENT OR ADMIXTURE SHALL BE USED FOR GROUTING. AS PER SPECIFICATION. PROPER COMPACTION AND CURING OF GROUT SHOULD BE ENSURED.
  - CLEAR COVER TO MAIN REINF.SHALL BE AS FOLLOWS:-

ITEM	TOP	BOTTOM	SIDE	ENDS
a) MILL FOUNDATION & PEDESTALS	50	75	50	-
b) PILE CAP	75	75	75	-
  - DURING PLACEMENT OF CONCRETE, TEMPERATURE OF FRESH CONCRETE SHALL BE MAINTAINED LESS THAN 25°C BY USING CRUSHED ICE AS PER DIRECTION OF ENGINEER- IN- CHARGE AT SITE.
  - UPV TEST SHALL BE DONE AS PER DIRECTION OF ENGINEER- IN- CHARGE AT SITE.
- REFERENCE DRGS.**
- HY-DG-445-HFC-A001 - GENERAL ARRANGEMENT DRAWING OF HP-1103 MILL (WITH PLANETARY GEAR BOX)
  - HY-DG-445-HFC-A002 - FOUNDATION PLAN OF HP-1103 MILL (WITH PLANETARY GEAR BOX) (BHEL HYD. DRG.)
  - PE-DG-445-615-C002 - BOWL MILL FOUNDATION OF RC DETAILS.
  - PE-DG-445-100-M002-MAIN EQUIPMENT PLAN
  - PE-DG-445-607-C005-----DETAILS OF 600 DIA JOB PILES.
  - PE-DG-445-617-C001-----BOILER FOUNDATIONGA OF PILE LAYOUT, PILE CAPS & PEDESTALS
- LEGEND**  
T.O.C - TOP OF CONCRETE.  
T.O.G - TOP OF GROUT.  
REF - REFER.

**TYP. DET. OF PILE CAP AND PILE CUT-OFF**

LENGTH OF PILE

75 THK. LEAN CONC.

PILE CUT-OFF (-)5.00M

DEPT. CODE

NAME

SIGN

DATE

CUSTOMER:

THE WEST BENGAL POWER DEVELOPMENT CORPN. LTD.(WBPDCL)

1X606MW, SAGARDIGHI THERMAL POWER EXTENSION PROJECT (UNIT #5)

CONSULTANT:

DEVELOPMENT CONSULTANTS PRIVATE LTD.

KOLKATA

BHARAT HEAVY ELECTRICALS LTD

POWER SECTOR

PROJECT ENGINEERING MANAGEMENT

Noida

JOB NO. 445

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REV. DATE ALTD CHD APPD REV. DATE ALTD CHD APPD

REV. 03 16-07-21 ALTD APPD 01 02-12-20 ALTD APPD

REVISED AS MARKED

OUTER EDGE(MOTOR SIDE) OF PILE CAP REDUCED BY 125 MM TO AVOID FOLLING WITH ADJACENT BOILER FOUNDATION AND MARKED AS

TITLE

GENERAL ARRANGEMENT OF BOWL MILL FOUNDATION

DEPT. SCALE

DRAWING NO.

PE-DG-445-615-C001

SHEET 1 OF 1

REV. 03

SIDE-A0