

**TAMILNADU GENERATION AND DISTRIBUTION CORP. LTD.
(TANGEDCO)**

**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**

**TECHNICAL SPECIFICATION
FOR
MILL REJECT SYSTEM (PNEUMATIC TYPE)**

SPECIFICATION NO.: PE-TS-423-160-A001



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



1X800 MW NORTH CHENNAI TPP STAGE III

SPECIFICATION No: PE-TS-423-160-A001

MILL REJECT SYSTEM (PNEUMATIC TYPE)

DATE: MAY 2017

CONTENTS

SECTION	TITLE
I	Specific Technical Requirement
I A	Specific Technical Requirement (Mechanical)
I B	Specific Technical Requirement (Electrical)
I C	Specific Technical Requirement (C&I)
II	Standard Technical Requirement
II A	Standard Technical Requirement (Mechanical)
II B	Standard Technical Requirement (Electrical)
III	Documents to be submitted by the bidder
III A	List of documents to be submitted with the bid
III B	Compliance cum Confirmation Certificate
III C	Pre-bid Clarification Schedule
III D	Guaranteed Utility Requirement
III E	Percentage Break-up of Price Sheet
III F	Guaranteed Power Consumption Format

**TITLE**

1X800 MW NORTH CHENNAI TPP STAGE III
MILL REJECT SYSTEM (PNEUMATIC TYPE)

SPECIFIC TECHNICAL REQUIREMENTS

SPECIFICATION NO. PE-TS-423-160-A001

SECTION - I

REV 00

Sub Section

Date: MAY 2017

SECTION – I**SPECIFIC TECHNICAL REQUIREMENTS**

SUB-SECTION IA – Specific Technical Requirement (Mechanical)

SUB-SECTION IB – Specific Technical Requirement (Electrical)

SUB-SECTION IC – Specific Technical Requirement (C&I)

**TITLE**

**1X800 MW NORTH CHENNAI TPP STAGE III
MILL REJECT SYSTEM (PNEUMATIC TYPE)**

SPECIFIC TECHNICAL REQUIREMENTS

SPECIFICATION NO. PE-TS-423-160-A001

SECTION - I

REV 00

Sub Section -IA

Date: MAY 2017

SUB-SECTION – IA**SPECIFIC TECHNICAL REQUIREMENTS (MECHANICAL)**



TITLE
1X800 MW NORTH CHENNAI TPP STAGE III
MILL REJECT SYSTEM (PNEUMATIC TYPE)
SPECIFIC TECHNICAL REQUIREMENTS

SPECIFICATION NO. PE-TS-423-160-A001
 SECTION - I
 REV 00
 Sub Section -IA Date: MAY 2017

SCOPE OF ENQUIRY / INTENT OF SPECIFICATION

- 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 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 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 The standard quality plan is included in this specification to enable the bidder to understand the extent of inspection and testing requirements to execute this job. The successful bidder has to follow the quality plan as minimum requirement during manufacturing and testing.

**TITLE****1X800 MW NORTH CHENNAI TPP STAGE III
MILL REJECT SYSTEM (PNEUMATIC TYPE)****SPECIFIC TECHNICAL REQUIREMENTS**

SPECIFICATION NO. PE-TS-423-160-A001

SECTION - I

REV 00

Sub Section -IA

Date: MAY 2017

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, 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, inspection window, Maintenance hole (generally closed) water spray nozzles & supporting structures.
- 2 nos. of RF type level switch with probes in redundant mode per pyrite hopper i.e.
high (1+1) in redundant mode
high- high (1+1) in redundant mode
- Two nos. Temp. Switch in redundant mode per pyrite hopper.
- 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.



TITLE
1X800 MW NORTH CHENNAI TPP STAGE III
MILL REJECT SYSTEM (PNEUMATIC TYPE)
SPECIFIC TECHNICAL REQUIREMENTS

SPECIFICATION NO. PE-TS-423-160-A001
 SECTION - I
 REV 00
 Sub Section -IA Date: MAY 2017

- c) 2 nos. mill reject bunkers, i.e., one no. mill reject bunker per mill bay along with structure, liner (conical & straight portion) and lever 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, level transmitter (3D acoustic type), RF type level probe pressure relieve valve, Electric Hoist and monorail arrangement etc.
- d) 2 nos. oil free screw type air compressors with drive motor, local control panel, instruments and all other accessories.
- e) 1 no. air receiver per mill bay complete with drain traps, safety relief valve, instruments and all accessories.
- f) 2 Nos. of Trolley for manual reject disposal.
- g) 1 no. portable type sump pump along with local control panel per mill bay complete with suction (min. 10 m long) & discharge hose (min. 10 m long) with 50 M power cable for pumping out water drains from local pit to nearest plant drain, control panel, instruments and all other accessories.
- h) 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.
- i) 1 lot of Local Control Panel/pneumatic panels/JBs (1 no. for each pyrite hopper) properly mounted on rack along with required Stainless steel impulse/pneumatic tubing.
- j) 1 lot of insulation & cladding, if required, to maintain surface temperature of pyrite hopper within 60° C
- k) 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.
- l) All insert/embedment plates along with dash/anchor fastener, anti-vibration pads below conveying vessel if applicable foundation bolts/ anchor bolts etc. required for bidder's equipment.
- m) Charge of all lubricants and fluids as per GTR
- n) Electrical and C&I scope as per enclosure elsewhere in the specification.
- o) One (1) set of Mandatory Spares as per the list attached in specification.
- p) One (1) set of erection & commissioning spares as required for the complete system.
- q) One (1) set of Maintenance tools and tackles as per the list attached in specification.
- r) All counter- flanges with nuts, bolts and gaskets at all the terminal points.
- s) Relevant scope of supply as per GTR, GCC & SCC.
- t) 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.



TITLE
1X800 MW NORTH CHENNAI TPP STAGE III
MILL REJECT SYSTEM (PNEUMATIC TYPE)
SPECIFIC TECHNICAL REQUIREMENTS

SPECIFICATION NO. PE-TS-423-160-A001
SECTION - I
REV 00
Sub Section -IA **Date: MAY 2017**

1.2 SCOPE OF SERVICES

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

- 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 related to Mill Reject Handling System.
 - ii) Transporter vessel foundation
 - iii) Pit & Trench as required in mill bay
 - iv) Mill reject compressor and Air receiver foundation
 - v) Mill Reject bunker foundation
 - vi) Various cable trenches, pipe pedestals & pipe rack foundation.

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

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

3.0 SERVICES TO BE PROVIDED BY THE CUSTOMER

As per Utility Requirement – Section III D.



TITLE
1X800 MW NORTH CHENNAI TPP STAGE III
MILL REJECT SYSTEM (PNEUMATIC TYPE)
SPECIFIC TECHNICAL REQUIREMENTS

SPECIFICATION NO. PE-TS-423-160-A001
 SECTION - I
 REV 00
 Sub Section -IA Date: MAY 2017

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 tapplings	As mentioned in Utility Requirement – Section III D.

5.0 PERFORMANCE / DEMONSTRATION GUARANTEES (Refer Annexure G)

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 (Refer Annexure K of Painting Specification)

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

8.0 LAYOUT REQUIREMENTS

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

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

	TITLE 1X800 MW NORTH CHENNAI TPP STAGE III MILL REJECT SYSTEM (PNEUMATIC TYPE) SPECIFIC TECHNICAL REQUIREMENTS	SPECIFICATION NO. PE-TS-423-160-A001	
		SECTION - I	
		REV 00	
		Sub Section -IA	Date: MAY 2017
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 ROCEDURE (Reference Annexure B) 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 Annexure L) 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. 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:			

10 of 433



TITLE
1X800 MW NORTH CHENNAI TPP STAGE III
MILL REJECT SYSTEM (PNEUMATIC TYPE)
SPECIFIC TECHNICAL REQUIREMENTS

SPECIFICATION NO. PE-TS-423-160-A001
 SECTION - I
 REV 00
 Sub Section -IA Date: MAY 2017

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

15.0 DRAWINGS ENCLOSED WITH THE SPECIFICATION (Refer Annexure M)

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

- 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.



TITLE 1X800 MW NORTH CHENNAI TPP STAGE III MILL REJECT SYSTEM (PNEUMATIC TYPE) SPECIFIC TECHNICAL REQUIREMENTS	SPECIFICATION NO. PE-TS-423-160-A001	
	SECTION - I	
	REV 00	
	Sub Section -IA	Date: MAY 2017

- 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.
 - 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.

**TITLE****1X800 MW NORTH CHENNAI TPP STAGE III
MILL REJECT SYSTEM (PNEUMATIC TYPE)****SPECIFIC TECHNICAL REQUIREMENTS**

SPECIFICATION NO. PE-TS-423-160-A001

SECTION - I

REV 00

Sub Section -IA

Date: MAY 2017

Annexures

Annexure	Title
A	Equipment Design / Selection Criteria and Customer Specification
B	Quality Assurance
C	Site Information
D	Sub-vendor List
E	Mandatory Spares
F	Maintenance Tools and Tackles
G	Performance guarantees requirement, trail run, commissioning requirement, operation & erection manual, third party inspection, FQP requirement
H	General Technical Requirements
J	Low Pressure Piping
K	Painting Specification
L	Drawings/documents to be submitted after award of contract
M	Input Drawings

**TITLE**

1X800 MW NORTH CHENNAI TPP STAGE III
MILL REJECT SYSTEM (PNEUMATIC TYPE)

SPECIFIC TECHNICAL REQUIREMENTS

SPECIFICATION NO. PE-TS-423-160-A001

SECTION - I

REV 00

Sub Section -IA

Date: MAY 2017

ANNEXURE-A**Equipment Design / Selection Criteria and Customer Specification**



TITLE
1X800 MW NORTH CHENNAI TPP STAGE III
MILL REJECT SYSTEM (PNEUMATIC TYPE)
SPECIFIC TECHNICAL REQUIREMENTS

SPECIFICATION NO. PE-TS-423-160-A001
SECTION - I
REV 00
Sub Section -IA Date: MAY 2017

ANNEXURE A
EQUIPMENT DESIGN/SELECTION CRITERIA

Mill Data		
	No. of mills (working & standby) at 100% BMCR with worst coal firing	9 mills (7 working + 2 standby)
	Type of Mills	HP1103 Bowl Mill
	Elevation of Mill Reject Spout (Tramp iron spout)	2.400m from EL. 0.0m
	Mill Arrangement	Side mill layout
Reject Data		
	Reject Temperature (Normal/Design) (deg. C)	Around 180 deg. C / 200 deg. C
	Max/Normal Size of mill rejects to be handled	(-)50 mm
	Bulk Density for a) Volumetric calculation b) Load calculation	1600 Kg/m ³ 2400 Kg/m ³
System Data		
	Type of mill reject system	Pneumatic conveying system
	System capacity / reject generation	0.65 TPH per mill
Equipment Data		
1.	Pyrite Hopper	
	No of Pyrite Hopper	One (1) no. per mill
	Number of outlet	Three (3) nos.
	Capacity	2 times Transporter Vessel capacity
	Pyrite Hopper Accessories	
	Temperature Switch	Two (2) nos. each per hopper in redundant mode for interlock and alarm purpose
	RF type level switch	Three (3) nos. (1 no. for High level & 2 nos. High - High level in redundant mode) for interlock, permissive and alarm
	Level Probe	Selected level probe shall be suitable for 350 degree temp.
	Water Spray quenching system along with valve station solenoid operated spray nozzle	One (1) no. per hopper
	Rupture disc	One (1) no. per hopper/MOC: Aluminum
	Flexible joint	One (1) no. per hopper
	Oversize reject chute	One (1) no. per hopper
	Bypass Chute	One (1) no. per hopper
	Material of construction	
	Pyrite hopper body	MS as per IS 2062 Gr A, 10 mm THK
	Grid	SS 304/MS IS 2062 with epoxy coat with opening suitable to allow 50mm (max) particle
	Supports, Platform	MS as per IS 2062 Gr A
	Provision of inspection/poking doors in pyrite	Yes



TITLE
1X800 MW NORTH CHENNAI TPP STAGE III
MILL REJECT SYSTEM (PNEUMATIC TYPE)
SPECIFIC TECHNICAL REQUIREMENTS

SPECIFICATION NO. PE-TS-423-160-A001
 SECTION - I
 REV 00
 Sub Section -IA Date: MAY 2017

	hopper	
	Pressure Gauge at each service water and instrument air-line to pyrite hopper	One (1) no.
2.	Knife Gate Valve (Metal to metal seated)	
	Type & Quantity	
	Knife gate valve at Mill outlet - (KGV-1)	One (1) no. 200 NB Pneumatic cylinder operated per hopper
	Knife gate valve at Over size discharge chute of Pyrite Hopper (KGV-2)	One (1) no. 200 NB Pneumatic cylinder operated per hopper
	Knife gate valve at By Pass Chute of Pyrite Hopper (KGV-3)	One (1) no. 200 NB Pneumatic cylinder operated per hopper
	Knife gate valve at Pyrite Hopper outlet (KGV-4)	One (1) no. 200 NB Pneumatic cylinder operated per hopper
	Material of construction	
	Body	Cast Iron 225 BHN (IS 210 Gr. FG 260)
	Knife Gate	10 mm thick SS (ASTM A 240 type 304) (Edge hardened to 350-400 BHN)
	Seat	Replaceable type alloy CI or SS smooth finished with 250 BHN hardness
	Deflection cone	Provided before the pyrite hopper inlet knife gate valve
	Method of operation	Solenoid operated pneumatically actuated with provision for manual override facility
	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.	
3.	Transporter Vessel	
	No. of transporter vessel envisaged	One (1) no. per hopper
	Capacity of transporter vessel	To suit the conveying rate with 85% filling
	Material of construction	
	Transporter vessel	Cast iron or Mild Steel IS - 2062, Gr. A as per ASME code for unfired vessels or as per IS 2825
	Inlet Valve	MOC of inlet valve shall be as per proven design of MRS system supplier suitable for intended application as per IS/BS/International Codes
	Type of valve	Dome/plate/butterfly/swing type as per supplier's proven practice
	Dedicated pneumatic panel with minimum features as mentioned. (One (1) no. per stack up assembly)	- One "Power On" indication - Push button for Probe override operation



TITLE
1X800 MW NORTH CHENNAI TPP STAGE III
MILL REJECT SYSTEM (PNEUMATIC TYPE)
SPECIFIC TECHNICAL REQUIREMENTS

SPECIFICATION NO. PE-TS-423-160-A001
 SECTION - I
 REV 00
 Sub Section -IA Date: MAY 2017

		• Push button for Purge operation (Purge or equivalent system as per vendor's proven practice shall be decided during detail engineering) • Local indication of limit switches of pneumatically operated KGV's and vessel inlet valve.
	Outlet bend (ACI 400BHN)	One (1) no. per transporter vessel
	Conveying velocity	Less than 6m/sec
	Number of cycle per hour	Not more than 6 per hour
4.	Reject conveying pipe	
	Reject conveying pipe size	As per system requirement (to be decided by system supplier)
	Quantity	As per layout requirement
	Material of pipe line	MS ERW IS 1239(Heavy grade) (<=150Nb) / 3589 (>150 Nb)
	Type of joint in pipe line	Flanged
	Distance over which material is to be conveyed and the lift	As per layout requirement
	Conveying pipe bends	
	Material of conveying pipe bends	Alloy CI (400BHN) Radius of bends shall not be less than 3D.
	Quantity	One (1) lot
5.	Bunker & Its Accessories	
	Number required	One (1) no. per bay
	Effective Capacity	55 T per bunker
	Number of outlet	One (1) no. per bunker
	Material of Construction and Thickness	
	Bunker Plates	10mm thick, MS plates as per IS 2062 Gr A/B
	Liners	3 mm THK. SS 304 in Straight & conical portion.
	Discharge gate (Manual)	Twin Sector gates MS to IS 2062 with TISCRAI/SAIL HARD Liner
	Pressure Relief Valve	One (1) no. per bunker
	Level Transmitter & Level Probe	One (1) no. 3D type acoustic type level Transmitter & One (1) no. RF type level probe per bunker
	Terminal Boxes with Up stand on bunker top for terminating the reject conveying pipes	One (1) set per bunker as per IS 2062 Gr. A/B (requirement as per layout). Impacting surface shall be provided with SAIL HARD/TISCRAI liner.
	Clear access/headroom underneath MRS bunker for a road tanker/truck	4.5 m



TITLE
1X800 MW NORTH CHENNAI TPP STAGE III
MILL REJECT SYSTEM (PNEUMATIC TYPE)
SPECIFIC TECHNICAL REQUIREMENTS

SPECIFICATION NO. PE-TS-423-160-A001
 SECTION - I
 REV 00
 Sub Section -IA Date: MAY 2017

6.	Bag Filter on Bunker top with associated instruments	
	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)	1.0 m/min, 10% additional bags to be provided
	Bag cage	MS, IS 2062, Gr. A, 3mm thick, galvanized
	Outlet air quality (SMP level) at bag filter discharge;	Less than 30 mg/NM3
	Differential Pressure Gauge and Differential Pressure Switch	One (1) no. each per bag filter
	Electric hoist over bag filter	- No. of Electric Hoist - 1 no. - Service condition - Class II outdoor - Capacity of Electric hoist shall be selected considering a minimum margin of 25% over the maximum weight of the heaviest equipment/component to be handled
7.	Compressors with drive motor and all other accessories	
	No. and type of compressors	2x100% capacity (1 working + 1 Standby) Oil free 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	75% RH with 45 deg. C. - Each compressor shall be sized to cater air requirement of unit - At least 50% margin shall be provided on compressor capacity over and above the maximum flow requirement. - Noise level- Shall be limited to 85dBA at a distance of 1.0 m in horizontal direction from the nearest surface of the machine and at a height of 1.5 m from the floor level in elevation. Noise level measurement shall be carried out using applicable and internationally acceptable standards. The measurement shall



TITLE
1X800 MW NORTH CHENNAI TPP STAGE III
MILL REJECT SYSTEM (PNEUMATIC TYPE)
SPECIFIC TECHNICAL REQUIREMENTS

SPECIFICATION NO. PE-TS-423-160-A001
SECTION - I
REV 00
Sub Section -IA Date: MAY 2017

		be carried out with calibrated integrating sound level meter meeting the requirement of IEC 651 or BS: 5969 or IS 9779.
	Materials of construction	As per attached specification
	Instrumentation	As per manufacturer's standard practice with redundancy requirement as per attached C & I specification.
8.	Air receiver with isolation valves, instruments & accessories	
	Quantity	Two (2), One (1) no. per bay
	Design Code	ASME Section-VIII or IS: 2825 Class II vessel A corrosion allowance of 3mm (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 5 cub. m.
	Shell/ Body	IS 2002; thickness as per design calculation
	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.
9.	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	
	Quantity	One (1) lot
	Material of construction	Service water, DMCW water and Instrument air pipeline: as per low pressure piping specification. Conveying air pipelines : MS ERW pipes as per IS-1239(≤ 150 NB) (heavy grade)/ 3589(>150NB)



TITLE
1X800 MW NORTH CHENNAI TPP STAGE III
MILL REJECT SYSTEM (PNEUMATIC TYPE)
SPECIFIC TECHNICAL REQUIREMENTS

SPECIFICATION NO. PE-TS-423-160-A001
 SECTION - I
 REV 00
 Sub Section -IA Date: MAY 2017

10.	Type and no. of sump pumps with local control panel	1 no. per bay, trolley mounted portable sump pumps
	Material of construction	
	Casing, suction bell and impeller	2.5 % Ni-CI to IS 210, FG260
	Shaft/Sleeves	EN-8
	Capacity	10 m3/hr with suction and discharge hose of 10m (min)
	Head discharge	10 MWC Head
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	As per Low Pressure Piping Specification

TECHNICAL SPECIFICATION FOR Conveying Air Compressor

Material of Construction

a.	Compressor chamber	:	Cast iron coated with corrosion resistant material
b.	Rotor	:	Forged carbon steel coated with corrosion resistant material; 2 nd stage stainless steel
c.	Timing gears	:	Low alloy steel
d.	Inlet throttle valve & housing	:	Aluminium/stainless steel
e.	Shaft seals	:	High alloy steel
f.	Unloading cylinder header	:	Aluminium
g.	Water separator	:	Cast iron
h.	Non return valves	:	Stainless steel spring loaded type
i.	Blow off valve	:	Stainless steel
j.	Safety valve	:	Brass
k.	Tube of blow off cooler	:	Stainless steel type 304
l.	Cooler casing	:	Carbon steel/SG iron
m.	Gear box casing	:	Cast iron/SG iron
n.	Gears	:	Alloy steel
p.	Bearings	:	Oil lubricated antifriction type suitable for at least 40,000 running hours
q.	Shaft seals	:	Floating restrictive ring type design



2.1.13 MILL REJECT HANDLING SYSTEM

System Description

The scope of Mill Reject System shall include collection of mill rejects from mills and transportation of the same to storage bunker through dense phase pneumatic conveying system. From storage silo the mill rejects shall be disposed off in trucks.

Each mill shall be provided with collection and transportation equipment comprising of one (1) pyrite hopper with water spray arrangement, valves at inlet and outlet and one (1) mill reject vessel. Each mill reject vessel shall be connected to storage silo through conveying pipeline of MS ERW heavy grade. Storage silo shall be of MS construction with SS liners and shall be provided with discharge gate at its outlet to discharge rejects into a truck. The SS liner shall be 3 mm thick SS 304 material.

oil free, rotary, screw air compressors shall be provided for conveying mill rejects from pyrite hoppers to storage bunker. The instrument air required for operation of various pneumatic valves shall be drawn from plant instrument air header. The water required for cooling of valves and for sparging pyrite hoppers shall be drawn from RO stage II reject water. Radio Frequency type level probes shall be provided in pyrite hopper to start/stop evacuation cycle or for indication.

The conveying velocity of reject shall not be more than 6.0 meters/sec and number of cycles shall not be more than 6 per hour.

The scope of supply includes the following:

- (i) One (1) no. pyrite hopper with discharge chute, emergency chute work etc for each mill as required.
- (ii) Two(2) nos. pneumatically operated isolation gates for inlet & outlet of pyrite hoppers complete with compressed air pipework, solenoid valves & supporting arrangement for each pyrite hopper.
- (iii) Conveying pipework from individual mill reject handling equipment to the reject storage silos with all accessories like bends, fixtures, flange joints, structural steel supports, anchors/ inserts/ trestles, walkways etc. as required.
- (iv) Two (2) No. Mill Reject silo in steel construction, having an effective storage capacity of sixteen (16) hours considering all the working mills of the unit in operation and rejecting @ 1% of mill capacity for worst coal condition. Necessary supporting steel structures, platforms, staircase, manual operated unloading gate, 3mm thk SS Plate liners covering straight length portion and conical portion of mill reject storage silo, level switches, air relief devices etc shall be provided.
The storage silos shall be designed to provide a clear access of 4.5 m for a road tanker/ trucks to come under the silo and receive the rejects using suitable chute work.
- (v) Suitable spray quenching, to cool the mill reject in pyrite hoppers. Quenching water shall be provided in pipe rack 1 & 2.



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

- (vi) Two (2) nos air receivers, each of capacity min 10 cum, with all accessories, interconnecting pipework etc shall be provided.
- (vii) Two 2 Nos. (1W+1S) oil free screw compressors, with drives & accessories, to cater to the compressed air requirements of mill reject handling system.
- (viii) Necessary lifting devices of adequate capacity to handle the mill reject handling equipment.
- (ix) Complete instrumentation as indicated in Volume II Section 2.3.
- (x) Necessary electrical equipment as required.
- (xi) Civil structural works associated with mill reject handling system including foundation bolts, pockets, grouting, underpinning etc.

2.1.13.1 Equipment Description

2.1.13.2.1. Pyrite Hopper

One (1) pyrite hopper shall be provided below each bowl mill. The pyrite hopper shall be made of minimum 10 mm thick steel plates conforming to IS 2062. The pyrite hopper shall be provided with one cylinder operated plate valve on upstream which will be normally kept in open position. Grid shall be provided in the hopper to prevent passage of over size material to mill reject vessel. One (1) chain/manual operated plate valve shall be provided to remove rejects collected on the grid manually. Pyrite hopper shall be provided with by pass chute with cylinder operated plate type valve to unload the pyrite hoppers on the ground in case of emergency. Pyrite hopper shall be provided with manual operated plate valve on downstream side which is normally kept in open position. Pyrite hopper shall be provided with level probes and temperature switches. Arrangement of nozzles to spray water shall be provided when temperature goes beyond the preset value.

2.1.13.2.2. Mill Reject Vessel

One (1) mill reject vessel shall be provided for each pyrite hopper to transport mill rejects to storage bunker by means of dense phase conveying system. Transport vessel shall be provided with one cylinder operated inlet valve, outlet valve and air inlet valve. Inlet valve of transport vessel is normally in open position. After lapse of predetermined time or commencement signal by level probe of pyrite hopper, the inlet valve of transport vessel closes and air is injected through air inlet valve and vessel is pressurised. At predetermined pressure, the outlet valve of transport vessel opens and rejects are transported to storage bunker through pipeline. At predetermined pressure, the inlet valve opens and air inlet valve and out valve closes. This cycle goes on repeat.

2.1.13.2.3. Storage Silo

Two (2) nos. of mill reject silos, each with effective capacity of 16 hrs storage and reject generation of 1% of the total coal fired at 100% BMCR condition with worst coal firing shall be provided. The storage bunker shall be provided with stainless steel liners on inner walls. Adequately sized bag filter to vent the transport air to atmosphere, terminal boxes, level probe and pressure relief valve



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

shall be provided over top of storage bunker. Manual operated discharge gate shall be provided at out of storage bunker to unload the rejects into trucks. If necessary, adequately rated chute vibrators shall be furnished to ensure easy unloading of rejects.

2.1.13.2.4. Air Compressors

Two 2 - oil free, multistage, rotary screw type air compressors, one working and one standby shall be provided to supply air required for conveying mill rejects from transport vessel to storage bunker. The compressors shall be of continuous indoor duty complete with air coolers necessary valves with vent pipe work ducted to a safe discharge outlet. The air pipe work shall be of ERW pipes to IS: 3589/1239 heavy quality construction. At least 10% margin shall be provided on compressor capacity over and above the maximum flow requirement.

2.1.13.2.5. Air Receiver

- (i) Two (2) nos Air receiver (**minimum 10 M³** capacity each) shall be provided for mill rejects handling system. Air receivers shall be designed in accordance with ASME Section-VIII or IS: 2825. Corrosion allowance of 3 mm shall be considered for the design. The air receiver shall be of vertical cylindrical design with dished ends.
- (ii) The air receiver shall be designed for 1.5 times the compressor discharge pressure.
- (iii) The air receiver shall have inlet/outlet connections, safety relief valves, fusible plugs, pressure gauges, pressure switch, temperature gauge, flanged pipe connections, inspection manholes with automatic drain traps. Pressure gauges shall be provided at each air inlet line and on air receiver. The air receiver shall have structural platforms for maintenance of safety relief valves and instruments.

2.1.13.2.6. Mill Rejects Conveying Pipeline

Rejects conveying pipeline shall be MS ERW heavy grade to IS: 1239/3589. Pipes shall jointed by welding and all fittings, bends etc shall be alloy cast iron and the radius of bends shall be not less than 3D.



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

2.1.13.3 DATA SHEET FOR MILL REJECT HANDLING SYSTEM

S. No.	Item	Units	Description
1.0	MILL REJECT SYSTEM		
a)	Max Lump size of mill rejects	mm	
b)	Max Rate of Rejects Generated per mil	TPH	0.65
c)	Total No. of Coal Mills per unit	Nos.	9
d)	Temperature of Mill Rejects	Deg C	200 (Max)
e)	Storage Silo Required for mill rejects	Nos.	2
f)	Bulk Density of mill rejects		
i.	i) for volume considerations	T/m3	1.6
ii.	ii) for structural considerations	T/m3	2.4
g)	Design Extraction rate of mill rejects from pyrite hopper		1% of expected coal mill rejects of coal consumption at 100% BMCR considering worst coal
h)	Mill reject conveying capacity	TPH	0.65/MILL
2.0	MILL REJECT HANDLING VALVES		SS 410
a)	Type		Dome/ Type/ Swing Type/ Dome
b)	Material of construction		
i.	Body		Cast Iron 225 BHN
ii.	Plate/ Disc		10 mm Thk 300 - 350 BHN SS
iii.	Seat		Replaceable type alloy CI or SS smooth finished with 250 BHN hardness
iv.	Method of operation		Solenoid operated pneumatically actuated with provision for manual override facility
3.0	TRANSMITTER VESSEL		
a)	Location/ Quantity		Below Pyrite hopper
b)	Type		Suitable for dense phase conveying
c)	Material of Construction		Cast Iron/ fabricated out of MS plate construction will be as per ASME code for unfired pressure vessels or IS 2825
d)	Conveying Pipes		IS 1239 Heavy Grade
e)	Bends/ Fittings/ Laterals		Alloy cast iron 400 BHN
4.0	MILL REJECT STORAGE SILOS		
a)	Quantity		Two
b)	Construction		Steel Construction (MS IS 2062) with 3mm Thk SS 304 lining in conical as well as vertical portion
c)	Type of level measurement and indicator		Continuous/ RF Type
5.0	AIR COMPRESSOR		



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

a)	Type		Oil Free Screw type
b)	Service		Mill Reject Conveying Air
c)	Cooling		Water Cooled (DMCW)
d)	Quantity		Two 2 Nos. (1W+1S)
6.0	BAG FILTER		
a)	Location/ Quantity		One
b)	Type		Reverse pulse jet type
c)	Material of Bags		Polyester needle felt of antistatic type
d)	Air to cloth ratio	m/min	1
e)	Conveying air piping		MS ERW as per IS 1239 Heavy Grade upto 150 NB and IS 3589 above 150 NB.



ELECTRIC HOISTS
1 x 800 MW NORTH CHENNAI TPP STAGE III

2.0.0 CODES AND STANDARDS.

Design and duty of main hoist & cross travel machinery shall be in accordance with IS: 3938 (latest edition).

3.0.0 DESIGN REQUIREMENT

- 1.1 Equipment offered shall be suitable for indoor duty conforming to Class II of IS: 3938.
- 1.2 Equipment shall be designed to operate in non- hazardous area.
- 1.3 Electric hoists shall be pendent operated.
- 1.4 Both hoisting and trolley movement shall be motor driven.
- 1.5 The hoisting motion shall be thru' VVVF drives to achieve creep speed of 10% of main speed.
- 1.6 Wheels shall be single flanged type.
- 1.7 Hook shall be swiveling type and fitted with a safety latch.
- 1.8 Control panel shall be hoist mounted.
- 1.9 Power feeding to the electric hoists shall be thru' PVC shrouded Cu type DSL.
- 1.10 Brakes shall be fail to safety, electro- magnetic type.
- 1.11 Load/overload testing of the hoists shall be carried out as per IS: 3938.
- 1.12 All material, castings and forgings will be of tested quality & certificates shall be made available for review as per approved QAP.

4.0.0 TECHNICAL DATA SHEET

Sl.no	DESCRIPTION	TECHNICAL PARTICULARS
1.0	Type	Steel wire electric hoist with electrically operated trolley
2.0	Scope (Qty., Capacity, Lift, Travel Length)	Refer the separate Annexure A.
3.0	Type of service	Indoor
4.0	Overload test	125% of SWL
5.0	Design Ambient temperature	50° C
6.0	General Design	As per IS: 3938 / 1983 or latest, Class-II duty
7.0	Operating speed	
7.1	Hoisting speed/ Creep speed (thru' VVVF drive)	3 Mtr per min/ creep speed 10% of main speed.
7.2	Trolley speed	6 Mtrs per min
8.0	Type of transmission	Through Electric motor and gear box.
9.0	Wire Rope	
9.1	Construction / core	6 x 36 or 6 x 37 construction, steel core
9.2	Code	IS:2266
9.3	Number of falls	Min. 4
9.4	Factor of safety	Not less than 5
10.0	Load Hook and block	NORMALISED HOOK ONLY
10.1	Type of load hook	Plain shank trapezoidal section with safety latch.



ELECTRIC HOISTS
1 x 800 MW NORTH CHENNAI TPP STAGE III

10.2	Load hook Code	IS: 15560
10.3	Load hook Material	Alloy steel/carbon steel as per IS:15560
10.4	Hook suspension	Thrust bearing
10.5	Material of block suspension	Fabricated from steel plate, Material: IS: 2062
11.0	Gearing	
11.1	Type	Spur / Helical, hardened and tempered with machine cut teeth
11.2	Gear material	Forged steel as per IS 3938
11.3	Lubrication	Oil splash/ grease lubricated
11.4	Bearing type	Antifriction Ball / Roller
12.0	Trolley drive	
12.1	Wheel	Single flange taper thread
12.2	Wheel conform to (Std. / code)	IS: 3938
12.3	Wheel material	Heat treated carbon steel/ low alloy steel, graded cast iron.
12.4	Bearing type	Antifriction Ball / Roller
12.5	Trolley type	Rolled structural steel with side plates extended beyond wheel flanges to protect wheels.
12.6	Hardness	Max hardness 200 BHN
13.0	SHEAVE	
13.1	Material	Cast iron, cast steel or mild steel.
13.2	Bearing type	Antifriction Ball / Roller.
14.0	BRAKE (HOIST)	
14.1	Type	DC EM brakes disc type (fail to safety).
14.2	Capacity	As per IS 3938.
14.3	Number	One number for each motor.
15.0	BRAKE (TROLLEY)	
15.1	Type	DC EM brakes disc type (fail to safety).
15.2	Capacity	As per IS 3938.
15.3	Number	One number for each motor
16.0	ROPE DRUM	
16.1	Material	Cast iron, cast steel or mild steel.
16.2	Flange / Flangeless	Flanged



ELECTRIC HOISTS
1 x 800 MW NORTH CHENNAI TPP STAGE III

16.3	Type of groove	As per manufacturers standard to suit the layout requirement.(Shall be decided during detail engineering)	
17.0	TYPE OF DSL		
17.1	CT travel	PVC shrouded Cu conductor bus bar	
18.0	MOTORS		
18.1	Type	Sq. Cage induction, TEFC, S4 duty, 60% CDF.	
18.2	Number of start	300starts / hr, Motors shall be suitable for direct on-line (DOL) starting	
18.3	Voltage , Phase and Frequency	415V $\pm$ 10%, 3 phase, 50 Hz	
18.4	Class of insulation	Class "F" and temperature rise limited to class B.	
18.5	Type of enclosure	TEFC	
18.6	Degree of protection provided for enclosure	IP-55	
18.7	Margin	10% over maximum continuous load demand of driven equipment under entire operating range including voltage and frequency variation.	
19.0	LIMIT SWITCHES	Hoisting	Trolley
19.1	Type	Snap action, self actuating type	One (1) no. two way limit switch
20.0	Control panel	* Fabricated from CRCA sheet steel not less than 2 mm thick * Degree of protection shall be IP 54. * Power on indicating lamps shall be provided * Panel illumination lamps operated by door switch. * 2 nos earthing terminals on panel. * 20 % spares terminals (clip on type) shall be provided. * Power and control terminals (clip on type) shall be on separate channels. * Gland plate thickness shall be minimum 3mm. * Gland plate shall be double brass compression type.	
20.1	Qty	1 No.	
21.0	Pendent Push buttons	Up /down / forward / Reverse push buttons. Indicative marking for easy operation shall be provided.	
22.0	Power cables	Copper material, minimum size : 6 mm sq ,FRLS insulated, multi strand Copper PVC sheathed armoured cable(for fixed cable) and EPR insulated CSP sheathed cable (for flexible cable)	
23.0	Control cable	Control cables shall have stranded copper conductor, Minimum size 2.5 mm sq. FRLS—insulated, multi strand Copper PVC sheathed armoured cable(for fixed cable) and EPR insulated CSP sheathed cable (for flexible cable) Minimum size 1.5 mm sq.	
24.0	Control Voltage	110 V	

**TITLE**

**1X800 MW NORTH CHENNAI TPP STAGE III
MILL REJECT SYSTEM (PNEUMATIC TYPE)**

SPECIFIC TECHNICAL REQUIREMENTS

SPECIFICATION NO. PE-TS-423-160-A001

SECTION - I

REV 00

Sub Section -IA

Date: MAY 2017

ANNEXURE-B**Quality Assurance**



TITLE
1X800 MW NORTH CHENNAI TPP STAGE III
MILL REJECT SYSTEM (PNEUMATIC TYPE)
SPECIFIC TECHNICAL REQUIREMENTS

SPECIFICATION NO. PE-TS-423-160-A001
SECTION - I
REV 00
Sub Section -IA **Date: MAY 2017**

Annexure-B **QUALITY ASSURANCE**

QUALITY PLANS, INSPECTION & TESTING PROCEDURE

The following Quality plans/ Check lists of mechanical items are attached for ready reference of supplier.

- a) Local Panel
- b) Transport Vessel
- c) Pyrite Hopper
- d) Terminal Box
- e) Bunker Discharge Gate
- f) Pressure Relief Valve
- g) Air Receiver
- h) Rupture Disc
- i) Chain Pulley Block
- j) Bag Filter
- k) Pipes
- l) ACI Bends
- m) Knife Gate Valves
- n) Sump Pumps
- o) Expansion bellow
- p) Plates & Structures

The inspection requirements indicated in the above QP's / CL's shall be adhered to as a minimum. Inspection requirement of some of the items are also elaborated in the technical specification under Sec-IIA. The QP's for above items as well as other items not listed above but required, as part of the system shall be prepared by the successful bidder in project specific format to be finalised with the successful bidder after award of contract.

Standard Quality Plans of few instruments & motors are enclosed elsewhere in the specification, for compliance by the bidder.

All QP's/CL's 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.

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

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

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

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

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

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

		S/Contractor :- Manufacturer :-		Manufacturing Quality Plan Item :- Rupture Disc QAP No. :- LOI Nos:-			Project:- Package :- Mill Rejects System Client :-					
		Contractor :- M/s BHEL			Consultant :-							
Sl. No.	Components / Operations	Characteristics	Classification	Type of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Records	Agency for Checking	Remarks		
1	2	3	4	5	6	7	8	9	10	11		
								TYPE	D	M	C	K
1	Materials Rupture Disc Material	Physical & Chemical Properties	Major	Chemical Analysis, YTS & UTS	1 per Heat	ASTM A240 Type - 304 / Approved Data Sheet / Drg.	ASTM A240 Type - 304 / Approved Data Sheet	MTC	✓	V	V	V
2	Final Inspection Dimension Burst Test of Rupture Disc	Measurement Functional	Major Major	Measurement Burst Test @ 200 Degree Centigrade	100% 1 per lot offered	App. Drawing Approved drawing / Datasheet	App. Drawing Min 0.4 bar (g) @ 200 degree C Max 0.6 bar (g) @ 200 degree C / App. Data Sheet	IR / Burst Test Certificate	✓	P	W	W
		LEGENDS:- Records identified by ✓ shall be essentially included in QA documentation. TC- Test Certificate, IR - Insp. Report M-> Manufacturer/Sub Contractor, C-> Contractor (BHEL) or their nominated agency & K -> Client P->Perform, V-> Verification, W-> Witness			For Client Use:-			Document No.:-				
Manufacturer / Sub Vendor SIGNATURES		Contractor			Name & Signature of Approving Authority with Seal							

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

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

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

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

Document No.:-

** -> DPT & Hydro -Test of Manifold to be witnessed by vendor

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

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

● Test on bag filter casing: In case bag filter is assembled in casing at site, smoke/ bubble test shall be carried out on the bag filter casing to ensure that the casing is free of welding defect. However, if assembly of bag filter & casing is done at shop, relevant NDT shall be carried out as per approved MQP for checking the soundness of weld subjected to customer approval.

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

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

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

3	Final Inspection												
3.3	Performance Test with Calibrated Test Lab Motor	Q Vs Head, Power & Efficiency, Noise & Vibration	Major	Measurement & Curves	100%	Approved Drg / Data Sheet / HIS	Approved Drg / Data Sheet / HIS	IR	✓	P	W	W	Noise - 85 db max. & Vibration - 50 microns max.
3.2	Pump strip test in case of doubt due to abnormal sound	Undue Wear	Major	Visual / Strip Test	100%	Mfr's Standard	No Undue Wear	IR	✓	P	W	W	
3.3	Painting	Visual & Measurement	Major	Visual & Measurement	100%	As per approved Painting Schedule	As per approved Painting Schedule	IR	-	P	-	-	
		LEGENDS:-				For Client Use:-		Document No.:-					
		Records identified by ✓ shall be essentially included in QA documentation. TC- Test Certificate, IR - Insp. Report											
Manufacturer / Sub Vendor		M-> Manufacturer/Sub Contractor, C-> Contractor (BHEL) or their nominated agency & N -> CLIENT											
SIGNATURES		P->Perform, V-> Verification, W-> Witness											
		Name & Signature of Approving Authority with Seal											

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

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

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

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

Notes:

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

**TITLE**

**1X800 MW NORTH CHENNAI TPP STAGE III
MILL REJECT SYSTEM (PNEUMATIC TYPE)**

SPECIFIC TECHNICAL REQUIREMENTS

SPECIFICATION NO. PE-TS-423-160-A001

SECTION - I

REV 00

Sub Section -IA

Date: MAY 2017

**ANNEXURE-C
SITE INFORMATION**

**1 x 800MW NORTH CHENNAI COAL BASED SUPER CRITICAL THERMAL POWER
PROJECT STAGE – III, TAMIL NADU, INDIA**

SERVICE WATER ANALYSIS

Sr. No	Parameter	Unit	SWRO Permeate (After Passivation)
1.	pH at 25 ⁰ C	-	7.5-8.5
2.	TDS	ppm	<600
3.	Calcium	ppm	>50
4.	Magnesium	ppm	3.3
5.	Sodium	ppm	175
6.	Potassium	ppm	5.9
7.	Stronium	ppm	0.03
8.	Ammonia	ppm	0.07
9.	Barium	ppm	0.003
10.	Alkalinity	ppm	>50
11.	Chlorides	ppm	<300
12.	Sulphate	ppm	9.2
13.	Nitrate	ppm	10.4
14.	Fluoride	ppm	0.05
15.	Boron	ppm	0.06
16.	Silica	ppm as SiO ₂	0.001

ANNEXURE – D

Sub-vendor List

SUB-VENDOR LIST MILL REJECT HANDLING SYSTEM (PNEUMATIC TYPE)

SR. NO.	ITEM	SUPPLIERS	PLACE	REMARKS
I	SELF MFG ITEMS			
1.	PYRITE HOPPER	SUPPLIERS/SUB-VENDORS	VENDORS MFR. WORKS	IN CASE BID HAS BEEN SUBMITTED ON COLLABORATION ROUTE, ITEMS IDENTIFIED UNDER SELF-MANUFACTURED ITEMS SHALL BE SOURCED FROM COLLABORATOR/ PRINCIPAL/ APPROVED AND PROVEN SOURCES OF PRINCIPAL
2.	DENSEVEYOR	SUPPLIERS/SUB-VENDORS		
3.	BUNKER DISCHARGE GATE (SECTOR GATE)	SUPPLIERS/SUB-VENDORS		
4.	TERMINAL BOX	SUPPLIERS/SUB-VENDORS		
5.	PRESSURE RELIEF VALVE	SUPPLIERS/SUB-VENDORS		
6.	PNEUMATIC PANEL	SUPPLIERS/SUB-VENDORS		
7.	PYRITE HOPPER	SUPPLIERS/SUB-VENDORS		
II	BOUGHT OUT ITEMS			
A	MECHANICAL			
1.	BAG FILTER	ORIENT FAN (FORMER ACCO)	KOLKATA	
		THERMAX	PUNE	
		BATLIBOI	SURAT	
		FLAKT	MUMBAI	
2.	DRAIN TRAPS	SPIRAX MARSHAL	MUMBAI	MAIN CONTRACTOR COC ALONG WITH MANUFACTURER STD. TC TO BE SUBMITTED.
		GREAVES COTTON	MUMBAI	
3.	GATE. GLOBE. CHECK VALVES- C.I	LEADER	JULLANDHAR	
		KBL	KONDAPURI	
		BANKIM	HOWRAH	
		H.SARKAR	HOWRAH	
		SURYA VALVES AND INSTRUMENTS MFG CO.	CHENNAI	
		ATAM VALVES PVT. LTD.	JALANDHAR	
		FLUIDLINE VALVES COMPANY PVT.LTD.	MUMBAI	
		G.M. DALUI AND SONS PVT.LTD.	HOWRAH	
		A.V. VALVES LTD	AGRA	
		VENUS PUMPS AND ENGG. WORKS	KOLKATA	
		LEADER	JULLANDHAR	
		KBL	KONDAPURI	
		BANKIM	HOWRAH	
		H.SARKAR	HOWRAH	
		SURYA VALVES AND INSTRUMENTS MFG CO.	CHENNAI	
4.	GATE. GLOBE. CHECK VALVES- G.M	LEADER	JULLANDHAR	MAIN CONTRACTOR COC ALONG WITH MANUFACTURER STD. TC TO BE SUBMITTED.
		SANT VALVES	JULLANDHAR	
		A.V. VALVES LTD	AGRA	
		ATAM VALVES PVT. LTD.	MUMBAI	
		VALTECH INDUSTRIES		
5.	GATE. GLOBE. CHECK VALVES- C.S / F.S	KSB	COIMBOITORE	
		WEIR BDK	HUBLI	
		FOURESS	MUMBAI	
		LEADER	JULLANDHAR	
		AUDCO (L&T)	CHENNAI	
6.	BALL VALVES	MICRO FINISH	HUBLI	MAIN CONTRACTOR COC ALONGWITH
		WEIR BDK	HUBLI	

SUB-VENDOR LIST MILL REJECT HANDLING SYSTEM (PNEUMATIC TYPE)

SR. NO.	ITEM	SUPPLIERS	PLACE	REMARKS
		PRECISION ENGG.	MUMBAI	MANUFACTURER STD. TC TO BE SUBMITTED.
		WEIR BDK ENGG INDUSTRIES	NEW DELHI	
		FLOW CHEM. INDUSTRIES	AHEMDABAD	UPTO 50 NB 800 CLASS: 350NB 150 CLASS
		AUDCO	CHENNAI	
		AKAY INDIA	HUBLI	UPTO 50NB 800 CLASS
		A V VALVES	AGRA	
		ASIAN INDUSTRIAL VALVES & INSTRUMENTS LTD.	CHENNAI	
		ATAM VALVES	JALANDHAR	(1) BALL VALVES: FCS/FSS - 1/2" TO 2" #800 & CCS/CSS - 2.1/2" TO 4" # 150 (2) BALL VALVES: GUN METAL VALVES SIZE 15 NB TO 80 NB - UPTO PN16.0
		GM ENGINEERING	RAJKOT	
		HAWA VALVES (INDIA) PVT. LTD.	NAVI MUMBAI	SIZE UP TO 2" & #800 WITH MOC AS FCS & FSS AND FOR SIZE FROM 65 NB TO 150 NB & #150 WITH MOC AS CCS AND CSS.
		INTERVALVE (INDIA) LTD.	PUNE	STEEL BALL VALVES UPTO 50NB, #800 AND 65NB TO 150NB. #150
		NILON VALVES PRIVATE LIMITED	AHMEDABAD	
		LEADER VALVES LTD.	JALANDHAR	CAST STEEL UPTO 200 MM, CLASS 150/300.
		DEMBLA VALVES LTD.	THANE	
		SURYA VALVES AND INSTRUMENTS MFG CO.	CHENNAI	FOR CARBON STEEL/STAINLESS STEEL UPTO SIZE 200NB.
		UNIFLOW	CHENNAI	
		VALTECH INDUSTRIES	MUMBAI	FORGED CARBON & ALLOY STEEL BALL VALVES, SCREWED TYPE BALL VALVES RATING 800, SIZES UPTO 50 & CC& ALLOY STEEL BALL VALVES RATING 150, SIZES 65 TO 200 FLANGED TYPE.
		VAAS AUTOMATION	NEW DELHI	
		BELGAUM AQUA VALVE	BELGAUM	
7.	SAFETY RELIEF VALVES	LEADER	JULLUNDHAR	
		BHEL	TRICHY	
		KEYSTONE (TYCO FLOW CONTROL)	HALOL	
8.	MS G.I / ERW PIPES	JINDAL	GHAZIABAD/HISSAR	UPTO 350 NB ERW PIPES AS PER IS 1239/3589
		SURYA ROSHNI	BAHADURGARH	UPTO 400 NB
		SAIL	ROURKELA	
		TATA TUBE	JAMSHEDPUR	UPTO 150 NB ERW PIPES AS PER IS 1239
		PSL	CHENNAI/VIZAG/KUTCH/DAMAN	SPIRAL WELD SAW AS PER IS 3589
		LALIT PROFILE	THANE	SPIRAL WELD SAW AS PER IS 3589

SUB-VENDOR LIST MILL REJECT HANDLING SYSTEM (PNEUMATIC TYPE)

SR. NO.	ITEM	SUPPLIERS	PLACE	REMARKS
		SAMSHI PIPES INDUSTRIES	VADODARA	SPIRAL WELD SAW AS PER IS 3589
		MUKUT PIPES	RAJPURA	LONGITUDINAL SAW (SINGLE SIDE WELD) AS PER IS 3589
		INDUS TUBES	G B NAGAR	UPTO 300 NB ERW PIPES AS PER IS 1239/3589
		MANN IND	INDORE	SPIRAL WELD SAW AS PER IS 3589
		SURENDRA ENGG	RAJPURA	SPIRAL WELD SAW AS PER IS 3589
		PRATIBHA PIPES & STRUCTURE PVT LTD	THANE	SPIRAL WELD SAW AS PER IS 3589
		JCO GAS PIPE	CHINDWARA	SPIRAL WELD SAW AS PER IS 3589
		NUKAT TANKS AND VESSELS	TARAPUR	LONGITUDINAL SAW (SINGLE SIDE WELD) AS PER IS 3589
		DADU PIPES	SIKRANDRABAD	UPTO 300 NB ERW PIPES AS PER IS 1239/3589
		GOOD LUCK TUBES	SIKANDRABAD	
		ADVANCE STEEL TUBES	SAHIBABAD	
		BIHAR TUBES	SIKANDRABAD	
		HI TECH PIPES	SIKANDRABAD	
		RATNAMANI	KUTCH/AHMEDABAD/CHHATRAL	UPTO 400 NB ERW PIPES AS PER IS 3589 AND SAW AS PER IS 3589
		MAHARASHTRA SEAMLESS	RAIGAD	200-500 NB ERW PIPES AS PER IS 3589
		WELSPUN	ANJAR/BHARUCH	UPTO 400 NB ERW PIPES AS PER IS 1239/3589 AND SAW AS PER IS 3589
		JINDAL	GHAZIABAD/HISSAR	UPTO 150 NB
		SURYA ROSHNI	BAHADURGARH	UPTO 350 NB ERW PIPES AS PER IS 1239/3589
		SAIL	ROURKELA	UPTO 400 NB
9.	ACI BENDS	CRAWLEY & RAY	HOWRAH	
		MENON METALLICS	PUNE	
		PARAMOUNT	NAGPUR	
		NORTHERN ALLOY	BHAV NAGAR	
10.	PLATE VALVE/KNIFE GATE VALVE (H/W OPTD & CYLINDER OPTD)	VAAS INDUSTRIES	CHENNAI	
		ORBINOX	COIMBATORE	
		FOURESS	BANGALORE	
		DEZURIKK	CHENNAI	
		JAASH	INDORE	
		VAAS INDUSTRIES	CHENNAI	
		ORBINOX	COIMBATORE	
11.	METTALIC EXPANSION BELLOWS	MB METTALIC BELLOWS	CHENNAI	
		SUR INDUSTRIES	KOLKATA	
		LONE STAR	CHENNAI	
12.	RUPTURE DISC	BS & B SAFETY SYSTEM	CHENNAI	
13.	CHAIN PULLEY BLOCK	HERCULES (INDEF)	MUMBAI	MAIN CONTRACTOR COC ALONGWITH MANUFACTURER STD. TC TO BE SUBMITTED.
		LEAP	NEW DELHI	
		TRACTEL	FARIDABAD	
		LIFTING EQUIPMENTS & ACESSORIES	DELHI	

SUB-VENDOR LIST MILL REJECT HANDLING SYSTEM (PNEUMATIC TYPE)

SR. NO.	ITEM	SUPPLIERS	PLACE	REMARKS
14.	CONVEYING COMPRESSOR (RECIPROCATING)	KIRLOSKAR PNEUMATICS	PUNE	
		INGERSOLL RAND	AHEMDABAD	
	CONVEYING COMPRESSOR (SCREW TYPE)	ELGI	COIMBOITORE	
		ATLAS COPCO	BELGIUM. ASSEMBLY AND TESTING AT PUNE	
		KIRLOSKER PNEUMATIC PUNE	PUNE	
15.	SUMP PUMP (WATER SERVICE)	KISHORE PUMPS	PUNE	
		SU MOTORS	MUMBAI	
		BEST & CROMPTON	CHENNAI	
		SAM	COIMBOITORE	
16.	PNEUMATIC ACTUATOR/ CYLINDER (UP TO 12")	SCHARDER	PUNE	
		NUCON	HYDERABAD	
		VASS	CHENNAI	
		ROTEX	MUMBAI	
17.	MS PLATES / STRUCTURES & SS LINERS (REFER NOTE - 3)	SAIL		
		ISPAT INDUSTRIES		
		ESSAR STEEL		
		IISCO		
		JSW		
		RINL		
		LLOYD STEEL INDUSTRIES LTD.		
		TISCO		
		JSPL		
18.	GRATING	INDIANA	PUNE	
19.	TOOLS AND TACKLES	BRANDED		
20.	AIR RECEIVER	SUPPLIERS/SUB-VENDORS	VENDORS MFR. WORKS	SELF-MANUFACTURING
		PARKAIRE	NEW DELHI	
		TEMASME VESELLEX	NOIDA	
		UNITED ENGG WORKS	NASIK	
		INTIGRATED ENGINEERS	PUNE	
		DIAMOND FABRICATOR	PUNE	
		SUPPLIERS/SUB-VENDORS	VENDORS MFR. WORKS	
		PARKAIRE	NEW DELHI	
		TEMASME VESELLEX	NOIDA	
21.	STRAINERS (Y-TYPE & BASKET TYPE)	MULTITEX FILTRATION ENGINEERS LIMITED,	NOIDA	
		SAROJINI ENTERPRISES	KOLKATA	
		OTOKLIN FILTERS	MUMBAI	
		BHATIA ENGINEERING CO.	DELHI	
		JAYPEE INDUSTRIES PVT. LTD.	DELHI	
		FILTRATION ENGINEERS (I) PVT. LTD.	MUMBAI	
		OTOKLIN GLOBAL BUSINESS	MUMBAI	

SUB-VENDOR LIST MILL REJECT HANDLING SYSTEM (PNEUMATIC TYPE)

SR. NO.	ITEM	SUPPLIERS	PLACE	REMARKS
		LIMITED		
		SUNGOV ENGINEERING PVT. LTD.	DELHI	
		GRAND PRIX	FARIDABAD	
		MULTITEX FILTRATION ENGINEERS LIMITED,	NOIDA	
		SAROJINI ENTERPRISES	KOLKATA	
		OTOKLIN FILTERS	MUMBAI	
		BHATIA ENGINEERING CO.	DELHI	
		JAYPEE INDUSTRIES PVT. LTD.	DELHI	
22.	DRAIN PUMP (SUBMERSIBLE)	SU MOTORS	MUMBAI	MAIN CONTRACTOR COC ALONGWITH MANUFACTURER STD. TC TO BE SUBMITTED.
23.	HORIZONTAL/VERTICAL CENTRIFUGAL PUMP	KBL	KIROLSKARWADI	
		M&P	PUNE	
		FLOWMORE	GHAZIABAD	
		SULZER PUMPS INDIA LTD.	NAVI MUMBAI	
		WORTHINGTON	GHAZIABAD	
		BHARAT PUMPS & COMPRESSORS LTD	ALLAHABAD	
		FLOWSERVE INDIA CONTROLS PVT. LTD.	COIMBATORE	
		JYOTI LTD.	VADODARA	
	VERTICAL CENTRIFUGAL PUMP	KISHORE PUMP	PUNE	
		SAM TURBO	COIMBATORE	
		KSB	PUNE	
		BEST AND CROMPTON	CHENNAI	
		VOLTAS	MUMBAI	
		V-FLO PUMPS & SYSTEMS CO. LTD.,	BEIJING, CHINA	
24.	FITTINGS	M.S. FITTINGS	KOLKATA	
		METAL LLOYDS	MUMBAI	
		TRUE FORGE	FARIDABAD	
		TUBE PRODUCTS	BARODA	
		NL HAZRA	KOLKATA	
		GUJRAT INFRA PIPES	BARODA	
		EDWARDS	USA	
		PIPEFIT ENGINEERS	BARODA	
		SIDDARTH & GAUTAM	FARIDABAD	
		EBY	MUMBAI	
25.	S.S. PIPES (FOR SMALL QUANTITY 500 M)	REMI	MUMBAI	
		RATMANI	AHMEDABAD	
		APEX TUBES	BEHROR	
		CHOKSI	AHMEDABAD	
26.	STEEL PLATE, STRUCTURAL STEEL AND SECTION FOR FIRE WATER STORAGE TANK	SAIL	ANY PLANT	FOR SMALL QUANTITY: AUTHORISED STOCKIST/ DEALER OF APPROVED LISTED MAKES FOR WHICH TCS/IRS WILL BE FURNISHED
		ESSAR STEEL		
		TISCO		
		RINL		
		JINDAL		

SUB-VENDOR LIST MILL REJECT HANDLING SYSTEM (PNEUMATIC TYPE)

SR. NO.	ITEM	SUPPLIERS	PLACE	REMARKS
		LLOYD		
		ISPAT		
		INDIAN IRON & STEEL CO. LTD		
27.	GEARED MOTOR	PBL	ANAND - V.V NAGAR	
		PREMIUM	PUNE	
		BONFIGLIOLI	CHENNAI	
		SEW	GERMANY	
		IC	AURANGABAD	
28.	ELECTRIC HOIST	ARMSEL MHE PVT. LTD	BANGALORE	CAPACITY UPTO 10 TONS. BOIS BHEL APP.SUB-VENDORS.
		ALPHA SERVICES	BHIWADI	
		CONSOLIDATED HOISTS PVT LTD	PUNE	
		CENTURY CRANE ENGINEERS PVT. LTD.	FARIDABAD	
		EDDY CRANES PVT. LTD.	MUMBAI	
		GRIP ENGINEERS PVT. LTD.,	FARIDABAD	
		GLOBAL TECHNOLOGIES	HYDRABAD	
		HERCULES HOISTS LTD.	KHALAPUR	UPTO 25.0 T CAPACITY.
		LIFTING EQUIPMENTS AND ACCESSORIES	DELHI	
		MANGLA HOISTS PVT LTD	DELHI	
		MEEKA MACHINERY PVT. LTD.	AHEMDABAD	UPTO 15 TONNES.
		REVA INDUSTRIES LTD.	FARIDABAD	
		ROCKWELL HOISTO CRANES PVT. LTD.	BAHADURGARH	
		SAFEX ENERGY PVT. LTD.	AHEMDABAD	
		TUOBRO FURGUSON (INDIA) PVT LTD	KOLKATA	
		TECHNO INDUSTRIES	AHEMDABAD	
29.	MRHS - SILO	SUPPLIERS/SUB-VENDORS	VENDORS MFR. WORKS/ SITE	
30.	FQP RECEIPT, STORAGE & ERECTION	SUPPLIERS/SUB-VENDORS	VENDORS MFR. WORKS	
B	ELECTRICAL & INSTRUMENTATION			
1.	MOTORS	SIEMENS	MUMBAI	FOR HT AND LT MOTOR
		NGEF	BANGALORE	UP TO 15KW
		KEC	BANGALORE/HUBLI	HUBLI UP TO 90KW
		CGL	AHEMAD NAGAR	
		ABB	FARIDABAD/ BANGALORE	FARIDABAD UP TO 55KW, BANGALORE ABOVE 55KW & UP TO 200KW.
		MARATHON	KOLKATA	FOR HT AND LT MOTOR
		CROMPTON GREEVES	AHMEDABAD	FOR HT AND LT MOTOR
		JYOTI	VADODARA	FOR LT MOTOR ONLY
		LHP	SOLAPUR	UP TO 120 KW
		BHEL	BHOPAL	FOR HT MOTOR ONLY
		BHARAT ELECTRIC (BHEL)		FOR LT MOTOR ONLY

SUB-VENDOR LIST MILL REJECT HANDLING SYSTEM (PNEUMATIC TYPE)

SR. NO.	ITEM	SUPPLIERS	PLACE	REMARKS
		BBL	MUMBAI	UP TO 160KW (LT MOTOR ONLY)
2.	ANNUNCIATORS	IIC	MUMBAI	
		PECON	AHEMDABAD	
		PROCON	CHENNAI	
3.	PULSE VALVE	ASCO	CHENNAI	
		MANIK	PUNE	
4.	CABLE GLANDS	SUNIL & CO.	KOLKATTA	
		ARUP ENGG.	KOLKATTA	
		QUALITY PRECISION	KOLKATTA	
		COMET	MUMBAI	
5.	CABLE LUGS	DOWELLS	MUMBAI	
		BILLET (3D)	VALSAD	
		WAGO	INDIA	
		COMET	MUMBAI	
		CHETNA	NASHIK	
6.	MICRO-PROCESSOR / MICRO-CONTROLLER	ALLEN BRADLY	BANGALORE	
		SIEMENS	BANGALORE	
		GE	BANGALORE	
		SCHENIDER	BANGALORE	
7.	CABLE TERM.& JOINT KITS	3M ELECTRO AND COMMUNICATION INDIA P.LTD	RAJENDRA PLACE, DELHI	CABLE TERM.& JOINT KITS
		HARI CONSOLIDATED PVT.LTD.,NEW DELHI	JHANDEWALAN, NEW DELHI-DELHI	
		RAYCHEM RPG PRIVATE LIMITED	JANAKPURI NEW DELHI	
		YAMUNA CABLE ACCESSORIES PVT. LTD.	AMBALA ROAD, JAGADHRI YAMUNANAGAR-HARYANA	
8.	PAINT	ASIAN PAINTS (I) LTD.	ANY PLANT	
		BERGER PAINTS INDIA LTD		
		GOODLASS NEROLAC		
		JENSON & NICHOLSON (I) LTD		
		CDC CARBOLINE (I) LTD.		
		SHALIMAR PAINTS LTD.		
		ADDISON PAINTS LTD		
		GRAND POLYCOAT		
		BOMBAY PAINTS		
		HEMPLE PAINTS (SINGAPORE)		
		JOTUN PAINTS		

C&I ITEMS

Package Code	Package Name	Supplier Name	Supplier Communication Address	Remarks
145-06000-A	PRESSURE SWITCH/DIFF. PRESSURE SWITCH	DRESSER INDUSTRIES INC.	Mr. Nishit Patel/Mr. Anuj Verma Plot No.2306, Phase II, GIDC Chhatral Kalol Phone- 02764-233682 Pincode : 382729 Email : Nishit.patel@ashcroftindia.com	, ,
145-06000-A	PRESSURE SWITCH/DIFF. PRESSURE SWITCH	Barksdale GmbH, Germany	Michael Weileder Dorn Assenheimer, Strasse 27 Reichelsheim Phone- +91-9999107840 Pincode : D-61203 Email : msingh@barksdale.de	, ,
145-06000-A	PRESSURE SWITCH/DIFF. PRESSURE SWITCH	SWITZER PROCESS INSTRUMENTS PVT. LTD.	Mr. V S Jayaprakash, No.127 & 128, SIDCO North Phase, Ambattur Estates CHENNAI Phone- 044-26252017/2018 Pincode : 600050 Email : marketing@switzerinstrument.com	Name changed from "M/s Switzer Instrument Ltd." to "M/s Switzer Process Instruments Pvt. Ltd." w.e.f.
145-06000-A	PRESSURE SWITCH/DIFF. PRESSURE SWITCH	PRECISION MASS PRODUCTS PVT. LTD.	Mr. Nishit Patel/Mr. Anuj Verma Plot No.2306, Phase II, GIDC Chhatral Kalol Phone- 9999464663 Pincode : 382729 Email : sales@precisionmass.com	Registration of "M/s Ashcroft India Pvt. Ltd." substituted to "M/s Precision Mass Products Pvt. Ltd." as
145-06000-A	PRESSURE SWITCH/DIFF. PRESSURE SWITCH	GENERAL INSTRUMENTS CONSORTIUM	Mr. Amarendra Kulkarni 194/195, Gopi Tank Road, Off. Pandurang Naik Marg, Mahim Mumbai Phone- 9323195251 Pincode : 400016 Email : amarendra@general-gauges.com	Workas at- GAUGES BOURDON INDIA PVT. LTD. (A MFG. UNIT OF GENERAL INSTRUMENTS CONSORTIUM , PLOT
145-06000-A	PRESSURE SWITCH/DIFF. PRESSURE SWITCH	SOR INC.	LARRY DEGARMO/Avdresh Chandra, 14685 W. 105TH STREET LENEXA Phone- 09810905139, Pincode : 66215 Email : Ldegarmo@sorinc.com, avdresh@sherman-india.com,	, ,
145-06000-A	PRESSURE SWITCH/DIFF. PRESSURE SWITCH	INDFOS INDUSTRIES LIMITED	B-20-21, INDUSTRIAL AREA, MEERUT ROAD, GHAZIABAD Phone- 0120-2712016 Pincode : Email : mktg@indfos.com	, ,
145-06000-A	PRESSURE SWITCH/DIFF. PRESSURE SWITCH	INDFOS (INDIA) LIMITED	MR.L.C.VENKATRANGAN/MR.B.KANNAN New No.17, II Floor, Adwawe Towers, Dr.Sevalia Shivaji Salai, T.Nagar Chennai Phone- +91 44 24353407 Pincode : 600017 Email :	, ,
145-06000-A	PRESSURE SWITCH/DIFF. PRESSURE SWITCH	Kaustubha Udyog,	S.No. 36/1/1, Singhad Road, Vadgaon Khurd, Near Lokmat Press, Pune, Phone- 020-24393577, Pincode : Email : pressure@vsnl.com,	, ,
145-07000-A	ANALYTICAL INSTS.SAMPLE COOLER	EMERSON PROCESS MANAGEMENT (INDIA) PVT.LTD.	Mr. Amit Pathankar/Vikram Raj Singh 206-210,BALARAMA BUILDING 2ND FLR. BANDRA EAST MUMBAI Phone- 9619121500 Pincode : 400051 Email :	, ,
145-07000-A	ANALYTICAL INSTS.SAMPLE COOLER	FORBES MARSHAL PVT. LTD.	A-33/34, MIDC ESTATE, H-BLOCK, PIMPRI, PUNE Phone- 27470171,27477472 Pincode : 411018 Email : nkaushal@forbesmarshall.com	, ,
145-07000-A	ANALYTICAL INSTS.SAMPLE COOLER	SIEMENS LIMITED	Dr. Armin Bruck/Sandeep Mathur 130, Pandurang Budhkar Marg Worli Mumbai Phone- 0124 383 7377 Pincode : 400018 Email : ankit.varshney@siemens.com	, ,
145-08000-A	PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	A.N. INSTRUMENTS PVT. LTD.	MARKETING DIVISION, 5th FLOOR, 59-B, CHOWRINGHEE ROAD, KOLKATA Phone- 24757784,22472509 Pincode : 700020 Email : anidel@bol.net.in	, ,
145-08000-A	PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	BOSE PANDA INSTRUMENTS PVT.LTD.	Mr. Partha Bose 44, Saheed Hemanta Kumar Bose, Sarani, Kolkata Phone- +91 33 2548 7220 Pincode : 700074 Email : parthabosebpi@gmail.com; bosepanda@vsnl.net	Trial to Hold as per SEARP amd-3,w.e.f. 15-09-12 , Supplier registered in trial category on
145-08000-A	PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	PRECISION MASS PRODUCTS PVT. LTD.	Mr. Nishit Patel/Mr. Anuj Verma Plot No.2306, Phase II, GIDC Chhatral Kalol Phone- 9999464663 Pincode : 382729 Email : sales@precisionmass.com	Registration of "M/s Ashcroft India Pvt. Ltd." substituted to "M/s Precision Mass Products Pvt. Ltd." as
145-08000-A	PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	Baumer Technologies India Pvt. Ltd.	Mr. Shyam Warilani/Mr. V Suresh Babu 36, DAMJI SHAMJI INDUSTRIAL COMPLEX, OFF.-MAHAKALI CAVES ROAD, ANDHERI(E) MUMBAI Phone- +91 99589 25151 Pincode :	, NAME HAS BEEN CHANGED FROM M/S WAAREE INSTRUMENTS LTD. TO M/S BAUMER TECHNOLOGIES INDIA
145-08000-A	PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	H.GURU INSTRUMENTS (SOUTH INDIA) P. LTD	32,INDUSTRIAL SUBURB YESWANTHAPUR BANGALORE Phone- 080-23370300, Pincode : 560022 Email : info@hgurusouth.com	, ,
145-08000-A	PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	FORBES MARSHALL (HYD) LTD.	MR SAILESH PATALAY/MR. M K SRINIVASAN PLOT NO.A-19/2, & T-4/2, IDA, NACHARAM, HYDERABAD Phone- 9849913704 Pincode : 500 076 Email : mksrinivasan@forbesmarshall.com	, ,
145-08000-A	PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	H.GURU INDUSTRIES	Mr. G. D. Hazra/Mr. P. K. Mitra 10 B, HO-CHI-MINH SARANI, KOLKATA Phone- 033 2282 2463 / 1637 Pincode : 700071 Email : mguru@vsnl.net	, Financial limit reviewed on 05.06.2014; ,
145-08000-A	PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	GAUGE BOURDON INDIA PVT. LTD.	194/195, Gopi Tank Road, Off Pandurang Naik Marg, Mahim Mumbai, Phone- 011-41607463, Pincode : 400016, Email : gicdelhi@general-gauges.com,	Registered as per 26th MISCC-Electrical and C&I dtd. 06.03.2014. ,
145-10000-A	TEMPERATURE GAUGE	FORBES MARSHALL (HYD) LTD.	MR SAILESH PATALAY/MR. M K SRINIVASAN PLOT NO.A-19/2, & T-4/2, IDA, NACHARAM, HYDERABAD Phone- 9849913704 Pincode : 500 076 Email : mksrinivasan@forbesmarshall.com	, ,
145-10000-A	TEMPERATURE GAUGE	GOA INSTRUMENTS INDUSTRIES PVT.LTD.,	D2/5, Mapusa Industrial Estate, Mapusa, Goa, Phone- 09326054551, Pincode : 403507, Email : sumukh@goainstruments.com,	GCC Rev.5 has been accepted in toto. , ,
145-10000-A	TEMPERATURE GAUGE	H.GURU INSTRUMENTS (SOUTH INDIA) P. LTD	32,INDUSTRIAL SUBURB YESWANTHAPUR BANGALORE Phone- 080-23370300, Pincode : 560022 Email : info@hgurusouth.com	, ,
145-10000-A	TEMPERATURE GAUGE	GAUGE BOURDON INDIA PVT. LTD.	194/195, Gopi Tank Road, Off Pandurang Naik Marg, Mahim Mumbai, Phone- 011-41607463, Pincode : 400016, Email : gicdelhi@general-gauges.com,	, ,
145-10000-A	TEMPERATURE GAUGE	GOA THERMOSTATIC INSTRUMENTS PVT.LTD.	FLAT -B , GF, HILL CROWN APTS., COLLEGE ROAD, MAPUSA Phone- Pincode : 403525 Email : gtilworks@pyro-electric.in	, ,
145-10000-A	TEMPERATURE GAUGE	H.GURU INDUSTRIES	Mr. G. D. Hazra/Mr. P. K. Mitra 10 B, HO-CHI-MINH SARANI, KOLKATA Phone- 033 2282 2463 / 1637 Pincode : 700071 Email : mguru@vsnl.net	, Financial limit reviewed on 05.06.2014; ,
145-10000-A	TEMPERATURE GAUGE	A.N. INSTRUMENTS PVT. LTD.	MARKETING DIVISION, 5th FLOOR, 59-B, CHOWRINGHEE ROAD, KOLKATA Phone- 24757784,22472509 Pincode : 700020 Email : anidel@bol.net.in	, ,
145-10000-A	TEMPERATURE GAUGE	Baumer Technologies India Pvt. Ltd.	Mr. Shyam Warilani/Mr. V Suresh Babu 36, DAMJI SHAMJI INDUSTRIAL COMPLEX, OFF.-MAHAKALI CAVES ROAD, ANDHERI(E) MUMBAI Phone- +91 99589 25151 Pincode :	, NAME HAS BEEN CHANGED FROM M/S WAAREE INSTRUMENTS LTD. TO M/S BAUMER TECHNOLOGIES INDIA
145-10000-A	TEMPERATURE GAUGE	PRECISION MASS PRODUCTS PVT. LTD.	Mr. Nishit Patel/Mr. Anuj Verma Plot No.2306, Phase II, GIDC Chhatral Kalol Phone- 9999464663 Pincode : 382729 Email : sales@precisionmass.com	Registration of "M/s Ashcroft India Pvt. Ltd." substituted to "M/s Precision Mass Products Pvt. Ltd." as

145-11000-A	LEVEL GAUGE	BLISS ANAND PVT. LTD.	Mr. Vikas Anand/ Mr.RGRajan 92B & 93 B , IMT MANESAR Gurgaon Phone- 0124-4366000 TO 9 Pincode : 122001 Email : sales@blissanand.com	' , ,
145-11000-A	LEVEL GAUGE	TOSHNIWAL BROTHERS PVT.LTD.	WORKS:TOSHNIWAL IND.PVT.LTD, INDUSTRIAL ESTATE MAKHUPURA, AJMER Phone- 441171 Pincode : 305002 Email : toshniwalprocess@gmail.com	' , ,
145-11000-A	LEVEL GAUGE	SIGMA INSTRUMENTS CO.	Gopal Kannan/R Gopinath 201, ANANDRAJ INDUSTRIAL ESTATE, OFF.LBS MARG, SONAPUR LANE, BHANDUP (W) MUMBAI Phone- +919821038162 Pincode : 400078 Email :	' , ,
145-12000-A	FLOW ELEMENT	MICRO PRECISION PRODUCTS PVT. LTD.	K.P. CHANDHOK/ATUL CHANDHOK 4, LINK ROAD, FARIDABAD Phone- 9810265688 Pincode : 121002 Email : pal@microa1.com	REGISTERED AS MSED VENDOR W.E.F.15.11.2011 FOR FY 2011-12. ,
145-12000-A	FLOW ELEMENT	TM TECNOMATIC SPA	MR. ANTONIO NOVIELLO/Mrs. Enrica Bazzocc VIA DELLE INDUSTRIE, 36 CREMONA Phone- 39037221574 Pincode : 26100 Email : info@tmttecnomatic.com	' , ,
145-12000-A	FLOW ELEMENT	STAR-MECH CONTROLS (I) PVT.LTD.	SUSHILLOTAM, SUSHILLOTAM, 29/3A/3, SASANE NAGAR, HADAPSAR, PUNE Phone- 02026970450 Pincode : 411028 Email : marketing@starmech.net	' , ,
145-12000-A	FLOW ELEMENT	INSTRUMENTATION LTD.	KANJIKODE WEST, PALAKKAD, PALAKKAD Phone- 2566127-130,2567128 Pincode : 678623 Email : icvldil@gmail.com;fa2@ilpgt.com	SICK PSU. BIFR CASE. , ,
145-13000-A	TEMP. ELEMENT	DETRIVE INSTRUMENTATION & ELECTRONICS LTD.	320, TV INDUSTRIAL ESTATE, OFF.DR.A.BESANT ROAD, BEHIND GLAXO, WORLI, MUMBAI Phone- 24934125,24938403 Pincode : 400025 Email : trivtech@vsnl.com	' , ,
145-13000-A	TEMP. ELEMENT	Tempsens Instrument (I) Pvt Ltd	MR. V.P.RATHI/MR. HEMANT RATHI B-188A ROAD NO.5 , M.I.A UDAIPUR Phone- 09352420069 Pincode : 313003 Email : info@tempsens.com	' , ,
145-13000-A	TEMP. ELEMENT	Thermal Instrument India Pvt. Ltd.	Mr. Raghavendra M. Kulkarni 194/195, Gopi Tank Road Behind Citylight Cinema,Mahim Mumbai Phone- 09322664709 Pincode : 400016 Email : ramk@giconindia.com	Registered as per 11th MISCC-Electrical and C&I (FY 2014-15) dt. 20.09.2014. , ,
145-13000-A	TEMP. ELEMENT	TM TECNOMATIC SPA	MR. ANTONIO NOVIELLO/Mrs. Enrica Bazzocc VIA DELLE INDUSTRIE, 36 CREMONA Phone- 39037221574 Pincode : 26100 Email : info@tmttecnomatic.com	' , ,
145-13000-A	TEMP. ELEMENT	TECHNO INSTRUMENTS	Abhijit Gohel/Mr. Amit Pandya Plot No. 1145/1, Uma Converter Lane, Santej,Ta. Kalol, Gandhinagar Phone- 9909925223 Pincode : 382721 Email : amit@techno-instruments.com	' , ,
145-13000-A	TEMP. ELEMENT	Baumer Technologies India Pvt. Ltd.	Mr. Shyam Warilani/Mr. V Suresh Babu 36, DAMJI SHAMJI INDUSTRIAL COMPLEX, OFF.-MAHAKALI CAVES ROAD, ANDHERI(E) MUMBAI Phone- +91 99589 25151 Pincode :	' , NAME HAS BEEN CHANGED FROM M/S WAAREE INSTRUMENTS LTD. TO M/S BAUMER TECHNOLOGIES INDIA
145-13000-A	TEMP. ELEMENT	PYRO ELECTRIC INSTRUMENTS GOA PVT.LTD.	M. D. BICHU/R. M. BICHU G.B, HILL CROWN APARTMENTS, COLLEGE ROAD, MAPUSA Phone- 9326114601 Pincode : 403507 Email : priyanka.marketing@pyro-electric.in	' , ,
145-13000-A	TEMP. ELEMENT	TOSHNIWAL INDUSTRIES PVT. LTD.,	Industrial Estate, Makhupura, Ajmer, Phone- 9352009000, Pincode : 305002, Email : info@tipl.com,	GCC Rev.5 has been accepted in toto. , ,
145-13000-A	TEMP. ELEMENT	GAUGE BOURDON INDIA PVT. LTD.	194/195, Gopi Tank Road, Off Pandurang Naik Marg, Mahim Mumbai, Phone- 011-41607463, Pincode : 400016, Email : gicdelhi@general-gauges.com,	' , ,
145-13000-A	TEMP. ELEMENT	GOA INSTRUMENTS INDUSTRIES PVT.LTD.,	D2/5, Mapusa Industrial Estate, Mapusa, Goa, Phone- 09326054551, Pincode : 403507, Email : sumukh@goainstruments.com,	GCC Rev.5 has been accepted in toto. , ,
145-14000-A	TRANSMITTERS	Moore Industries International Inc.	Leonard.W. Moore/ Matt Moren 16650 Schoenborn St. North Hills Phone- +1 818 830 5548 Pincode : 91343 Email : mmoren@miinet.com	INDIAN REPRESENTATIVE: CHEMTROL INDUSTRIES LTD, , ,
145-14000-A	TRANSMITTERS	PANAM ENGINEERS	Mr. Santosh Shukla 203, Jaisingh Business,Parsiwada, Sahar road,Andheri(East), Mumbai, Phone- 9892179529, Pincode : 400099, Email : santosh@panamengineers.com,	' , ,
145-14000-A	TRANSMITTERS	TOSHNIWAL INDUSTRIES PVT. LTD.,	Industrial Estate, Makhupura, Ajmer, Phone- 9352009000, Pincode : 305002, Email : info@tipl.com,	GCC Rev.5 has been accepted in toto. , ,
145-14000-A	TRANSMITTERS	SBEM PVT. LTD.	MR.N.K. BEDARKAR/MR. VISHWANATH KARANDIK 39, ELECTRONIC CO.OP. ESTATE, PUNE SATARA ROAD PUNE, Phone- 912041030100 Pincode : 411009 Email :	Reviewed in MISCC dt. 21.07.2015 for non-response in 4 consecutive tender enquiry. , Technical limit
145-14000-A	TRANSMITTERS	Endress + Hauser (India) Pvt. Ltd.,	Mr. Prakash Vaghela 215-216, DLF Tower 'A', Jasola District Centre, New Delhi, Phone- 9717593001, Pincode : 110025, Email : prakash.vaghela@in.endress.com,	For temperature transmitter only. , ,
145-14000-A	TRANSMITTERS	ABB LIMITED	MR. RAJIV GOVIL 14, MATHURA ROAD, FARIDABAD Phone- 09971085678 Pincode : 121003 Email : vipin.swami@in.abb.com	(1) A GROUP COMPANY OF ABB, NOW. (2) NAME OF VENDOR CHANGED FROM BIRLA-KENT
145-14000-A	TRANSMITTERS	Pune Techrol Pvt. Ltd.	N.P.Khatani/Sudhakar Badiger S-18, MIDC Bhosari, Pune Phone- 9850560042 Pincode : 411 026 Email : ho@punetechrol.com	Technical limit reviewed on 12.10.2015; , Manufacturing works: J-52/7, MIDC, Bhosari, Pune ,
145-14000-A	TRANSMITTERS	V. AUTOMAT & INTRUMENTS (P) LTD.	Mr. R. K. BASSI/Mr. PRAVEEN KUMAR F-61, OKHLA INDL.AREA, PH-1 NEW DELHI Phone- 9810005826 Pincode : 110 020 Email : sales@vautomat.com	Technical limit reviewed on 12.10.2015; , Technical limit reviewed on 30.04.2014 ,
145-14000-A	TRANSMITTERS	YOKOGAWA INDIA LIMITED,	PLOT NO.96, ELECTRONICS CITY COMPLEX, HOSUR ROAD, BANGALORE, Phone- 080-41586000, Pincode : Email : uday.shankar@in.yokogawa.com,	Subject to submission of renewed ISO certificate & compliance to GCC; Relevant documents (ISO 9001:2008
145-14000-A	TRANSMITTERS	NIVO CONTROLS PVT. LTD.	Mr. Praveen Toshniwal 104-115, Electronic Complex, Indore Phone- 0731-4081305 Pincode : 452010 Email : sales@nivocontrols.com	Registered in permanent category as per 11th MISCC-Electrical and C&I (FY 2014-15) dt. 20.09.2014. , Technical
145-14000-A	TRANSMITTERS	SMART INSTRUMENTS LTD, BRAZIL	Agents: Digital Electronic Ltd. 74/11 'C' Cross Road MIDC Andheri (East) MUMBAI Phone- 28208477 Pincode : 400093 Email : corp@delbby.rpgms.ems.vsnl.net.in	Technical limit reviewed on 12.10.2015; , Technical limit reviewed on 30.04.2014 ,
145-14000-A	TRANSMITTERS	SIEMENS LIMITED	Dr. Armin Bruck/Sandeep Mathur 130, Pandurang Budhkar Marg Worli Mumbai Phone- 0124 383 7377 Pincode : 400018 Email : ankit.varshney@siemens.com	Comm Add: Attn Mr K.K.Bedi/ Mr Sanjay Satpute, Siemens Ltd. EFIE, Plot no 6A, Sec-18, Maruti Industrial
145-14000-A	TRANSMITTERS	EMERSON PROCESS MANAGEMENT (INDIA) PVT.LTD.	Mr. Amit Paithankar/Vikram Raj Singh 206-210,BALARAMA BUILDING 2ND FLR. BANDRA EAST MUMBAI Phone- 9619121500 Pincode : 400051 Email :	' , ,
145-14000-A	TRANSMITTERS	Honeywell Automation India Limited	Mr. Ritwij Kulkarni 917, INTERNATIONAL TRADE TOWER, NEHRU PLACE, NEW DELHI Phone- 9890200584 Pincode : 110019 Email : rajesh.chaudhary@honeywell.com	' , ,

145-15000-A	TEMPERATURE SWITCH	TOSHNIWAL BROTHERS PVT.LTD.	WORKS:TOSHNIWAL IND.PVT.LTD, INDUSTRIAL ESTATE MAKHUPURA, AJMER Phone- 441171 Pincode : 305002 Email : toshniwalprocess@gmail.com	' , ,
145-15000-A	TEMPERATURE SWITCH	DRESSER INDUSTRIES INC.	Mr. Nishit Patel/Mr. Anuj Verma Plot No.2306, Phase II, GIDC Chhatral Kalol Phone- 02764-233682 Pincode : 382729 Email : Nishit.patel@ashcroftindia.com	' , ,
145-15000-A	TEMPERATURE SWITCH	SOR INC.	LARRY DEGARMO/Avdhesh Chandra, 14685 W. 105TH STREET LENEXA Phone- 09810905139, Pincode : 66215 Email : Ldegarmo@sorinc.com, avdhesh@sherman-india.com,	' , ,
145-15000-A	TEMPERATURE SWITCH	INDFOS (INDIA) LIMITED	MR.L.C.VENKATRANGAN/MR.B.KANNAN New No.17, II Floor, Adwave Towers, Dr.Sevalia Shivaji Salai, T.Nagar Chennai Phone- +91 44 24353407 Pincode : 600017 Email :	' , ,
145-15000-A	TEMPERATURE SWITCH	SWITZER PROCESS INSTRUMENTS PVT. LTD.	Mr. V S Jayaprakash, No.127 & 128, SIDCO North Phase, Ambattur Estates CHENNAI Phone- 044-26252017/2018 Pincode : 600050 Email : marketing@switzerinstrument.com	Name changed from "M/s Switzer Instrument Ltd." to "M/s Switzer Process Instruments Pvt. Ltd." w.e.f.
145-25000-A	JUNCTION BOX	K.S.INSTRUMENTS PVT.LTD.	S Raghavan No. 72, 3rd Main, 1st Stage Industrial Suburb, Yeshwanthpur Bangalore Phone- 9880385770 Pincode : 560022 Email : sales1@ksinstruments.net	' , ,
145-25000-A	JUNCTION BOX	Shrenik & Company,	Mr. Mitesh Shah/Mr. Pulin Shah 39 A/3, Panchratna Industrial Estate, Sarkhej-Bavla Road Ahmedabad Phone- 9825024921 Pincode : 382213 Email : sales@pustron.com,	Registered for FRP JB's AND METAL JB's. , Technical limit reviewed on 30.04.2014; , ,
145-25000-A	JUNCTION BOX	SUCHITRA INDUSTRIES	NO-2,OPP-27 AECS LAYOUT 2ND STG REJAMAHALVILAS EXTN 2ND STG BANGALORE Phone- Pincode : Email : suchitra.industriesblr@gmail.com	' , ,
145-25000-A	JUNCTION BOX	FLEXPRO ELECTRICALS PVT. LTD.	Mr. Dineshbhai Zaveri C-1/ 27&37, GIDC, Kabilpore, Navsari Phone- 02637-265140,265003 Pincode : 396424 Email : flexpro@flexproltd.com	Technical limit reviewed on 12.10.2015; , ,
145-25000-A	JUNCTION BOX	AJMER INDUSTRIAL & ENGINEERING WORKS	JIGNESH MAHENDRA AJMERA DENA BANK BLDG.,SHREE NAGESH INDL ESTATE,STATION ROAD, MUMBAI Phone- 022 67973578 Pincode : 400 088 Email : ajmera@ajmera.net,	Reviewed in MISCC dt. 21.07.2015 for non-response in 4 consecutive tender enquiry; , APPROVED FOR
145-31000-A	Cold Junction Compensation Box (CJCB)	CREATIVE INSTRUMENTS & CONTROLS	NO-17/1 , 1ST FLOOR , 11TH CROSS 1ST K BLOCK , RAJAJINAGAR, BANGALORE-560010 Phone- Pincode : Email : crinstruments@gmail.com	' , ,
145-32000-A	INSTRUMENTS TUBE FITTINGS	VIKAS INDUSTRIAL PRODUCTS	S.R.SINGH/NAVEEN SINGH B - 2, SECTOR - 6, NOIDA Phone- +91-9810122070 Pincode : 201301 Email : naveensingh@vsnl.com	' , ,
145-32000-A	INSTRUMENTS TUBE FITTINGS	Fluid Controls Pvt. Ltd.	Sophie Y. Mochhala/Mayur Rajput J.V.PATEL, I.T.I CMPD, B.MADHUKAR MARG, ELPHINSTONE ROADSTN.(WR), MUMBAI Phone- (022) 43338000 Pincode : 400013 Email :	' , ,
145-32000-A	INSTRUMENTS TUBE FITTINGS	AURA INCORPORATED	NIRAJ SHARAN/SUJIT KUMAR W-167A, GREATER KAILASH-II NEW DELHI Phone- 9810182430 Pincode : 110048 Email : niraj@aurainc.com	' , ,
145-32000-A	INSTRUMENTS TUBE FITTINGS	PRECISION ENGINEERING INDUSTRIES	K. SITARAM/ K. SRINIVAS 7,SIDHAPURA INDUSTRIAL ESTATE S.V. ROAD,GOREGAON(W) MUMBAI Phone- 022 42631700 Pincode : 400 062 Email : peiks@vsnl.com	' , ,
145-34000-A	ROTAMETER	Flow Star Engineering Pvt. Ltd.,	MR. KHALID AKHTAR/MR. TAPAN KUMAR JANA Plot No-7 F/2, Northern India Industrial 20/3, Mathura Road FARIDABAD Phone- 9818176380 Pincode : 121005 Email :	VENDOR IS REGISTERED IN MS&D (MICRO) W.E.F.30.11.2011 FOR FY 2011-12 , ,
145-34000-A	ROTAMETER	TANSA EQUIPMENTS PVT. LTD.	Mr. Vardhan Tamhankar, Unit No35/36/41,Om Anand Industrial Est. Mohanjee Sundarjee Road,Raghunath Nagar, Thane Phone- 022-25832323 Pincode : 400604 Email :	' , ,
145-34000-A	ROTAMETER	INSTRUMENTATION ENGINEERS PVT LTD	SH.N.V.RAM GOPAL/MS. N.NIHARIKA PLOTS 1,2,3, PHASE-III, IDA, JEEDIMETLA HYDERABAD Phone- 9848407365 Pincode : 500055 Email : iedelhi@iefloflowmeters.com	' , ,
145-34000-A	ROTAMETER	SCIENTIFIC DEVICES (BOMBAY) PVT LTD,	Office no. 53, Shree Manoshi Complex, Plot No. 5 & 6, Sec-3, Ghansoli (East), Navi Mumbai, Phone- 9892230623, Pincode : 400 701, Email : sdbpl@vsnl.com	' , ,
145-34000-A	ROTAMETER	EUREKA INDUSTRIAL EQUIPMENTS PVT.LTD.	Mr V. K. Pandit/Mr Ashish Shaha 17-20, Royal chambers, Paud Road Pune Phone- 9370469466 Pincode : 411038 Email : sales@eurekaflow.com	' , ,
145-35000-A	LEVEL SWITCH-CAPACITANCE TYPE	SIGMA INSTRUMENTS CO.	Gopal Kannan/R Gopinath 201, ANANDRAJ INDUSTRIAL ESTATE, OFF.LBS MARG, SONAPUR LANE, BHANDUP (W) MUMBAI Phone- +919821038162 Pincode : 400078 Email :	' , ,
145-35000-A	LEVEL SWITCH-CAPACITANCE TYPE	Sapcon Instrument Pvt Ltd.	131, PALSHIKAR COLONY Contact Person- Mr. Ashwin (9826080207) INDORE Phone- +91-731-4085751, Pincode : 452004 Email : sales@sapconinstruments.com	' , ,
145-35000-A	LEVEL SWITCH-CAPACITANCE TYPE	V. AUTOMAT & INTRUMENTS (P) LTD.	Mr. R. K. BASSI/Mr. PRAVEEN KUMAR F-61, OKHLA INDL.AREA, PH-1 NEW DELHI Phone- 9810005826 Pincode : 110 020 Email : sales@vautomat.com	' , ,
145-35000-A	LEVEL SWITCH-CAPACITANCE TYPE	Flow Star Engineering Pvt. Ltd.,	MR. KHALID AKHTAR/MR. TAPAN KUMAR JANA Plot No-7 F/2, Northern India Industrial 20/3, Mathura Road FARIDABAD Phone- 9818176380 Pincode : 121005 Email :	VENDOR IS REGISTERED IN MS&D (MICRO) W.E.F.30.11.2011 FOR FY 2011-12 , ,
145-35000-A	LEVEL SWITCH-CAPACITANCE TYPE	Baumer Technologies India Pvt. Ltd.	Mr. Shyam Warilani/Mr. V Suresh Babu 36, DAMJI SHAMJI INDUSTRIAL COMPLEX, OFF.-MAHAKALI CAVES ROAD, ANDHERI(E) MUMBAI Phone- +91 99589 25151 Pincode :	, NAME HAS BEEN CHANGED FROM M/S WAAREE INSTRUMENTS LTD. TO M/S BAUMER TECHNOLOGIES INDIA.
145-35000-A	LEVEL SWITCH-CAPACITANCE TYPE	NIVO CONTROLS PVT. LTD.	MR.PRAVEEN TOSHNIWAL/MR. NITIN TAMHANE 104-115, ELECTRONIC COMPLEX, INDORE Phone- 07314081300 Pincode : 452010 Email : sales@nivocontrols.com	' , ,
145-35000-A	LEVEL SWITCH-CAPACITANCE TYPE	SOR INC.	LARRY DEGARMO/Avdhesh Chandra, 14685 W. 105TH STREET LENEXA Phone- 09810905139, Pincode : 66215 Email : Ldegarmo@sorinc.com, avdhesh@sherman-india.com,	' , ,
145-35000-A	LEVEL SWITCH-CAPACITANCE TYPE	Pune Techrol Pvt. Ltd.	N.P.Khatan/Sudhakar Badiger S-18, MIDC Bhosari, Pune Phone- 9850560042 Pincode : 411 026 Email : ho@punetechrol.com	' , ,
145-35000-A	LEVEL SWITCH-CAPACITANCE TYPE	LEVCON INSTRUMENTS PVT. LTD.	Mr Shayak Gupta/Badal Jana Rajkamal', 7th floor, 13, Camac Street KOLKATA Phone- 0 33 2283 2766 Pincode : 700017 Email : b.jana@levcongroup.com	' , ,
145-35000-A	LEVEL SWITCH-CAPACITANCE TYPE	BLISS ANAND PVT. LTD.	Mr. Vikas Anand/ Mr.RGRajan 92B & 93 B , IMT MANESAR Gurgaon Phone- 0124-4366000 TO 9 Pincode : 122001 Email : sales@blissanand.com	' , ,
145-36000-A	LEVEL SWITCH-CONDUTIVITY TYPE	SOR INC.	LARRY DEGARMO/Avdhesh Chandra, 14685 W. 105TH STREET LENEXA Phone- 09810905139, Pincode : 66215 Email : Ldegarmo@sorinc.com, avdhesh@sherman-india.com,	' , ,

145-36000-A	LEVEL SWITCH-CONDUCTIVITY TYPE	LEVCON INSTRUMENTS PVT. LTD.	Mr Shayak Gupta/Badal Jana Rajkamal', 7th floor, 13, Camac Street KOLKATA Phone- 0 33 2283 2766 Pincode : 700017 Email : b_jana@levcongroup.com	' ,
145-36000-A	LEVEL SWITCH-CONDUCTIVITY TYPE	V. AUTOMAT & INSTRUMENTS (P) LTD.	Mr. R. K. BASSI/Mr. PRAVEEN KUMAR F-61, OKHLA INDL.AREA, PH-1 NEW DELHI Phone- 9810005826 Pincode : 110 020 Email : sales@vautomat.com	' ,
145-36000-A	LEVEL SWITCH-CONDUCTIVITY TYPE	HI-TECH SYSTEMS & SERVICES LTD.	Mr. Vikash Agrawal/Mr. Tarun Debnath 119, PARK STREET , KOLKATA Phone- 033-22290045 Pincode : 700016 Email : sandeep@hitech.in	Technical limit reviewed on 12.10.2015; , Technical limit reviewed on 30.04.2014; ,
145-36000-A	LEVEL SWITCH-CONDUCTIVITY TYPE	RAMAN INSTRUMENTS PVT.LTD.	Mr. N R Shenoy/Mr G B Viji 8, First Floor.Plot : 160A Bait-Ush-Sharaf, 29th Road,Bandra(W) MUMBAI Phone- 09692331381 Pincode : 400050 Email : ramanbpl@vsnl.com	Technical limit reviewed on 12.10.2015; , Technical limit reviewed on 30.04.2014; ,
145-36000-A	LEVEL SWITCH-CONDUCTIVITY TYPE	Sapcon Instrument Pvt Ltd.	131, PALSHIKAR COLONY Contact Person- Mr. Ashwin (9826080207) INDORE Phone- +91-731-4085751, Pincode : 452004 Email : sales@sapconinstruments.com	' ,
145-36000-A	LEVEL SWITCH-CONDUCTIVITY TYPE	BLISS ANAND PVT. LTD.	Mr. Vikas Anand/ Mr.RGRajan 92B & 93 B , IMT MANESAR Gurgaon Phone- 0124-4366000 TO 9 Pincode : 122001 Email : sales@blissanand.com	' ,
145-36000-A	LEVEL SWITCH-CONDUCTIVITY TYPE	SIGMA INSTRUMENTS CO.	Gopal Kannan/R Gopinath 201, ANANDRAJ INDUSTRIAL ESTATE, OFF.LBS MARG, SONAPUR LANE, BHANDUP (W) MUMBAI Phone- +919821038162 Pincode : 400078 Email :	' ,
145-37000-A	LEVEL SWITCH-FLOAT TYPE	SIGMA INSTRUMENTS CO.	Gopal Kannan/R Gopinath 201, ANANDRAJ INDUSTRIAL ESTATE, OFF.LBS MARG, SONAPUR LANE, BHANDUP (W) MUMBAI Phone- +919821038162 Pincode : 400078 Email :	Vendor shall source import contents of Level Switch (Conductivity Type) from Mobrey Measurement, an
145-38000-A	INSTRUMENTS PIPE FITTINGS	VIKAS INDUSTRIAL PRODUCTS	S.R.SINGH/NAVEEN SINGH B - 2, SECTOR - 6, NOIDA Phone- +91-9810122070 Pincode : 201301 Email : naveensingh@vsnl.com	' ,
145-38000-A	INSTRUMENTS PIPE FITTINGS	Fluid Controls Pvt. Ltd.	Sophie Y. Mochhala/Mayur Rajput J.V.PATEL, I.T.I CMPD, B.MADHUKAR MARG, ELPHINSTONE ROADSTN.(WR), MUMBAI Phone- (022) 43338000 Pincode : 400013 Email :	' ,
145-38000-A	INSTRUMENTS PIPE FITTINGS	PRECISION ENGINEERING INDUSTRIES	K. SITARAM/ K. SRINIVAS 7,SIDHAPURA INDUSTRIAL ESTATE S.V. ROAD,GOREGAON(W) MUMBAI Phone- 022 42631700 Pincode : 400 062 Email : peiks@vsnl.com	' ,
145-38000-A	INSTRUMENTS PIPE FITTINGS	AURA INCORPORATED	NIRAJ SHARAN/SUJIT KUMAR W-167A, GREATER KAILASH-II NEW DELHI Phone- 9810182430 Pincode : 110048 Email : niraj@aurainc.com	' ,
145-42000-A	ULTRASONIC FLOW METERS	CHEMTROLS INDUSTRIES LTD	Mr. K. NANDAKUMAR AMAR HILL, SAKI VIHAR ROAD, POWAI, MUMBAI Phone- 022-67151261 Pincode : 400072 Email : manikandan@chemtrols.com	Exclusive distributor for the territory of India of M/s Flexim Instruments Asia Pte Ltd., Singapore; agreement
145-42000-A	ULTRASONIC FLOW METERS	Rockwin Flowmeter India Pvt. Ltd.	B-24, Site-IV, Sahibabad Industrial Area Ghaziabad, Phone- 9810129687 Pincode : 201010, Email : amiya@rockwin.com	' ,
145-42000-A	ULTRASONIC FLOW METERS	FLASH FORGE PVT LTD	Mr. Gautam Makker, 503, 'A'-wing, Delhi, Orchard Avenue Road, Powai Mumbai Phone- 022-42784300 Pincode : 400076 Email : hemendrapatil@f-f.co.in	Exclusive partner for bidding of BHEL tender for M/s Endress & Hauser make Ultrasonic Flowmeters and MOU
145-42000-A	ULTRASONIC FLOW METERS	NIVUS GMBH	Mr. Marcus Fischer Im Taele 2, D - 75031 Eppingen Phone- 00491712233770 Pincode : Email : carolin.schuster@nivus.com	M/s Automation and Maintenance Systems approved as authorised distributor of M/s Nivus GmbH w.e.f.
145-45000-A	INSTRUMENT FITTINGS	AURA INCORPORATED	NIRAJ SHARAN/SUJIT KUMAR W-167A, GREATER KAILASH-II NEW DELHI Phone- 9810182430 Pincode : 110048 Email : niraj@aurainc.com	' ,
145-45000-A	INSTRUMENT FITTINGS	Comfit & Valve Pvt. Ltd.	Mr. Jeetu Jain/Mr. Vinay Sosa Survey No. 23/1, Part 2, Ahmedabad-Mehsana Highway Laxmipura, Nandasani Phone- 02764-267036/37 Pincode : 382705 Email : marketing@com-	' ,
145-45000-A	INSTRUMENT FITTINGS	HP VALVES & FITTINGS INDIA PVT. LTD.	S. Harichandran/P.S. Pandi B-11, Mugappair Industrial Estate, CHENNAI Phone- 044 26252537 Pincode : 600037 Email : sales@hpvalvesindia.com	' ,
145-45000-A	INSTRUMENT FITTINGS	PRECISION ENGINEERING INDUSTRIES	K. SITARAM/ K. SRINIVAS 7,SIDHAPURA INDUSTRIAL ESTATE S.V. ROAD,GOREGAON(W) MUMBAI Phone- 022 42631700 Pincode : 400 062 Email : peiks@vsnl.com	' ,
145-45000-A	INSTRUMENT FITTINGS	Arya Crafts & Engineering Pvt. Ltd.	Mr.Sanjay Brahman/Mr.Shyam Vazirani 102, Vora Industrial Estate No.4 Navghar, Vasai Road (E) Dist.Thane, Mumbai Phone- +91-250-2392246 Pincode : 401210 Email :	' ,
145-45000-A	INSTRUMENT FITTINGS	Perfect Instrumentation Control (India) Pvt. Ltd.	MD Hussain Shaikh/Shahanawaz Khan Gala No. 168, Loheki Chwal,216/ 218, Maulana Azad Rd. Nagpada Junction Mumbai Phone- 91-9324383121 Pincode : 400008 Email :	' ,
145-45000-A	INSTRUMENT FITTINGS	FLUIDFIT ENGINEERS PVT. LTD.	Mr. Abbas Bhola Potia Building No. 2, Office No. 3,292, Bellasis Road,Mumbai Central (East) Mumbai Phone- 9920044113 Pincode : 400008 Email : ab@fluidfitengg.com	Registered as per 22nd Electrical and C&I MISCC Meeting dtd. 15.01.2014 ,
145-45000-A	INSTRUMENT FITTINGS	VIKAS INDUSTRIAL PRODUCTS	S.R.SINGH/NAVEEN SINGH B - 2, SECTOR - 6, NOIDA Phone- +91-9810122070 Pincode : 201301 Email : naveensingh@vsnl.com	' , Financial limit reviewed on 05.06.2014 ,
145-45000-A	INSTRUMENT FITTINGS	Fluid Controls Pvt. Ltd.	Sophie Y. Mochhala/Mayur Rajput J.V.PATEL, I.T.I CMPD, B.MADHUKAR MARG, ELPHINSTONE ROADSTN.(WR), MUMBAI Phone- (022) 43338000 Pincode : 400013 Email :	Name changed from M/s Hyd-Air Valves Pvt. Ltd. to M/s Fluid Controls Pvt. Ltd. as per 25th MISCC-Electrical
145-45000-A	INSTRUMENT FITTINGS	PANAM ENGINEERS	Mr. Santosh Shukla 203, Jaisingh Business,Parsiwada, Sahar road,Andheri(East), Mumbai, Phone- 9892179529, Pincode : 400099, Email : santosh@panamengineers.com,	' ,

SI No.	Package Name	Vendor Name	LOCATION
1	LOCAL CONTROL PANELS	C and S ELECTRIC LTD.	New Delhi
		PYROTECH ELECTRONICS PVT. LTD.	Udaipur
		PROCON INSTRUMENTATION PVT. LTD.	Chennai
		INDUSTRIAL CONTROLS & APPLIANCES PVT LTD	Mumbai
2	ANALYSERS (ALL TYPES)	ABB INDUSTRIES AG	SWITZERLAND.
		ROSEMOUNT ANALYTICAL INC	IRVINE
		ENDRESS + HAUSER INDIA PVT. LTD.	MUMBAI
		HACH LANGE S.A.R.L CH-1222,	VESENAZ
		SWAN Analytische Instrumente AG, CH-8340	Hinwii
		METTLER-TOLEDO INDIA PVT. LTD.,	MUMBAI
		THERMO ORION INC	BEVERLY
3	UPS	EMERSON NETWORK POWER,	AMBERNATH
		EMERSON NETWORK POWER	PUNE
		HITACHI-HIREL,	GANDHINAGAR
		KELTRON,	TRIVANDRUM
		CONSUL NEOWATT POWER SOLUTIONS,	PUNE
5	MOTORISED ACTUATOR	ROTARK	UK
		AUMA	Bengaluru
		WEIR BDK VALVES	Hubli
		LIMITORQUE	Faridabad
6	AIR FILTER REGULATOR	PLACKA	Chennai
		SHAVO-NORGREN	Mumbai
		SCHRADER SCHORILL DUNCAN LTD.	Mumbai
		FAIRCHILD	USA
		SMC PNEUMATICS	Noida
7	SOLENOID VALVE	ASCO	USA
		ROTEX	Vadodra
		SCHRADER	Pune
		AVCON	Mumbai
		HERION-NORGREN	Germany
		IMI-NORGREN	Germany
		JAFFERSON	Argentina

ELECTRICAL ITEMS

SUB-VENDOR LIST FOR LT MOTORS

SL NO.	VENDOR NAME	
1	ABB	14, MATHURA ROAD, FARIDABAD, HARYANA-121003
2	BHARAT BIJLEE LTD.	BHARAT BIJLEE LIMITED, 1ST FLOOR, 7-B, RAJINDRA PARK, PUSA ROAD, NEW DELHI - 110 060.
3	CROMPTON GREAVES	3RD FLOOR, EXPRESS BUILDING,9-10, BAHADUR SHAH ZAFAR MARG, NEAR ITO CROSSING,NEW DELHI-110002, INDIA
4	GE-POWER	KAMAK TOWER, 3RD FLOOR, PLOT NO. 12-A, TVK INDUSTRIAL ESTATE, EKKADUTHANGAL, GUINDY, CHENNAI-600032
5	KIRLOSKAR ELECTRIC CO LTD.	P.O. BOX 5555 , MALLESWARAM WEST ,BANGALORE 560055
6	LAXMI HYDRAULICS PVT. LTD	129/130, INDUSTRIAL ESTATE PATIL NAGAR, HOTGI ROAD SOLAPUR- 413003, MAHARASHTRA
7	MARATHON	MARATHON ELECTRIC INDIA PRIVATE LTD.SECTOR - 11, MODEL TOWN, FARIDABAD - 121006
8	NGEF	POCKET NO.10, FLAT NO. 37 & 38, EXPANDABLE DDA FLATS, NASIRPUR DWARKA, PHASE-I NEW DELHI-110 045
9	RAJINDRA ELECT INDUSTRIES	14 SHAH IND.ESTATE VEERA DESAI RD,ANDHERI(W) MUMBAI-400053
10	SIEMENS	RC-IN I S NR DEL AREA, JIL BUILDING, TOWER-B, PLOT NO. 78, SECTOR 18, GURGAON-122015, INDIA

SUB-VENDOR LIST FOR GLANDS

1	ALLIED TRADERS & EXPORTERS	C-124 A, SECTOR-2, NOIDA -201 301, UTTAR PRADESH, INDIA
2	ARUP ENGG & FOUNDRY WORKS	391/119,PRINCE ANWAR SHAH ROAD, CALCUTTA-700068
3	BALIGA LIGHTING EQPT.PVT.LTD.	63A,CP RAMASWAMY ROAD, ALWARPET,P.B.No 6910, CHENNAI- 600018
4	COMMET BRASS PRODUCTS	NUTAN CHEMICAL COMPOUND, WALBHAT ROAD, GOREGAON, MUMBAI-400063
5	DOWELLS	M/S. DOWELLS ELECTRICALS 47/47A, SATGURU INDUSTRIAL ESTATE. OFF AAREY ROAD, GOREGOAN (EAST). MUMBAI 400 063.
6	ELECTROMAC INDUSTRIES	27/28AF NEW EMPIRE IND.ESTT., R.KRISHNA MANDIR RD.JB NGR ,ANDHERI(E),MUMBAI-400059
7	INCAB	HARE STREET,KOLKATA,WEST BENGAL-700001

SUB-VENDOR LIST FOR LUGS

1	DOWELLS	M/S. DOWELLS ELECTRICALS 47/47A, SATGURU INDUSTRIAL ESTATE. OFF AAREY ROAD, GOREGOAN (EAST). MUMBAI 400 063.
2	UNIVERSAL MACHINES LTD.	4,B.B.D.BAG (EAST) 90,STEPHEN HOUSE,5TH FLR CALCUTTA-700001

NOTE:

1.THE SUB VENDOR LIST ABOVE IS INDICATIVE ONLY AND IS SUBJECT TO BHEL AND CUSTOMER APPROVAL DURING DETAILED ENGINEERING STAGE WITHOUT ANY COMMERCIAL & DELIVERY IMPLICATION TO BHEL. BIDDER TO PROPOSE SUB VENDOR WITHIN 4 WEEKS OF PLACEMENT OF LOI. THEREAFTER NO REQUEST FOR ADDITIONAL SUB-VENDOR SHALL BE ENTERTAINED.

2.THE INSPECTION CATEGORY WILL BE INTIMATED AFTER AWARD OF CONTRACT BY BHEL/CUSTOMER. HOWEVER THE SAME WILL BE ADHERED BY THE BIDDER WITHOUT ANY COMMERCIAL AND DELIVERY IMPLICATION TO BHEL/ CUSTOMER.

ANNEXURE – E

MANDATORY SPARES

5.1.1 SPARES

The Bidder shall include in his scope of supply all the necessary Mandatory spares, Start up and commissioning spares and recommended spares and indicate these in the relevant schedules of the Bid Form and Price Schedules. The general requirements pertaining to the supply of these spares is given below:-

5.1.2 MANDATORY SPARES

- i) The bidder shall indicate the prices for each and every item (except for items not applicable to the bidder's design) in the 'Schedule of mandatory Spares' whether or not he considers it necessary for the Employer to have such spares. If the bidder fails to comply with the above or fails to quote the price of any spare item, the cost of such spares shall be deemed to be included in the contract price. The bidder shall furnish the population per unit of each item in the Bid Forms and Price Schedules.
- ii) Whenever the quantity is mentioned in "sets" the bidder has to give the item Details and prices of each item.
- iii) The Employer reserves the right to buy any or all the mandatory spares parts.
- iv) The prices of mandatory spares indicated by the Bidder in the Bid Proposal Sheets shall be used for bid evaluation purposes.
- v) All mandatory spares shall be delivered at site at least two months before Scheduled date of initial operation of the first unit. However, spares shall not be dispatched before dispatch of corresponding main equipment.
- vi) Wherever quantity is specified both as a percentage and a value, the Bidder has to supply the higher quantity until and unless specified otherwise.

5.1.3 RECOMMENDED SPARES

- i) In addition to the spare parts mentioned above, the contractor shall also provide a list of recommended spares for 3 years of normal operation of the plant and indicate the list and total prices in relevant schedule of the Bid Form and Price Schedules. The Employer reserves the right to buy any or all of the recommended spares. The recommended spares shall be delivered at project site at least two months before the scheduled date of initial operation of first unit. However, the spares shall not be dispatched before the dispatch of the main equipment.
- ii) Price of recommended spares will not be used for evaluation of the bids. The price of these spars will remain valid up to 6 months after placement of Notification of Award for the main equipment. However, the Contractor shall be liable to provide necessary justification for the quoted prices for

these spares as desired by the Employer.

5.1.4 START-UP & COMMISSIONING SPARES

Start-up and commissioning spares are those spares which may be required during the start-up and commissioning of the equipment/system. All spares used till the plant is handed over to the employer shall come under this category. The Contractor shall provide for an adequate stock of such start up and commissioning spares to be brought by him to the site for the plant erection and commissioning. They must be available at site before the equipment are energized. The unused spares, if any, should be removed from there only after the issue of Taking Over certificate. All start up spares which remain unused at the time shall remain the property of the Contractor.

- 5.1.5 The Bidder shall include in his scope of supply all the necessary Mandatory spares, start up and commissioning spares and recommended spares and indicate these in the relevant schedules of the Bid Form and Price Schedules. The general requirements pertaining to the supply of these spars is given below.
- 5.1.6 The Contractor shall indicate the service expectancy period for the spares parts (both mandatory and recommended) under normal operating conditions before replacement is necessary.
- 5.1.7 All spares supplied under this contract shall be strictly interchangeable with the parts for which they are intended for replacements. The spares shall be treated and packed for long storage under the climatic conditions prevailing at the site e.g. small items shall be packed in sealed transparent plastic with desecrator packs as necessary.
- 5.1.8 All the spares (both recommended and mandatory) shall be manufactured along with the main equipment components as a continuous operation as per same specification and quality plan.
- 5.1.9 The contractor will provide Employer with cross-sectional drawings, catalogues, assembly drawings and other relevant documents so as to enable the Employer to identify and finalize order for recommended spares.
- 5.1.10 Each spares part shall be clearly marked or labelled on the outside of the packing with its description. When more than one spares part is packed in a single case, a general description of the content shall be shown on the outside of such case and a detailed list enclosed. All cases, containers and other packages must be suitably marked and numbered for the purposes of identification.
- 5.1.11 All cases, containers or other packages are to be opened for such examination as may be considered necessary by the Employer.
- 5.1.12 The contractor will provide the Employer with all the addresses and particulars of his sub-suppliers while placing the order on vendors for items/components/equipment covered under the contract and will further ensure with his vendors that the Employer, if so desires, will have the right to place order for spares directly on them on mutually agreed terms based on offers of such vendors.

- 5.1.13 The Contractor shall warrant that all spares supplied will be new and in accordance with the contract Documents and will be free from defects in design, material and workmanship.
- 5.1.14 In addition to the recommended spares listed by the contractor, if the employer further identifies certain particular items of spares, the contractor shall submit the prices and delivery quotation for such spares within 30 days of receipt of such request with a validity period of 6 months for consideration by the Employer and placement of order for additional spares if the Employer so desires.
- 5.1.15 The Contractor shall guarantee the long term availability of spares to the Employer for the full life of the equipment covered under the contract. The Contractor shall guarantee that before going out of production of spares parts of the equipment covered under the Contract, He shall give the Employer at least 2 years advance notice so that the latter may order his bulk requirement of spares, if he so desires. The same provision will also be applicable to sub-contractors. Further, in case of discontinuance of manufacture of any spares by the Contractor and/or his sub-contractors, Contractor will provide the Employers, two years in advance, with full manufacturing drawings, material specifications and technical information including information on alternative equivalent makes required by the Employer for the purpose of manufacture/procurement of such items.

GENERAL NOTE:

1. Wherever quantity has been specified as percentage (%), it shall mean percentage (%) of the total population of the item in the station (project), unless specified otherwise and the fraction will be rounded off to the next higher whole number.
2. Wherever the quantities have been indicated for each type, size, thickness, material, radius, range etc. these shall cover all the items supplied and installed and the break up for these shall be furnished in the bid.
3. In case spares indicated in the list are not applicable to the particular design offered by the bidder, the bidder should offer spares applicable to offered design with Quantities generally in line with the approach followed as per the list from Volume - II.
4. Identification:

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



TITLE

**TECHNICAL SPECIFICATION
OF
MILL REJECT HANDLING SYSTEM
1X800MW NORTH CHENNAI TPP**

DOCUMENT NO. PE-TS-423-160-A001

REV 0

SHEET

Mandatory spares list for Mill Reject Handling System

ONE 'SET' REFERS TO ONE COMPLETE SET REQUIRED FOR ONE COMPRESSOR / EQUIPMENT

Sl. No.	Equipment Name	Quantity
1	DOME TYPE INLET VALVE	
	DOME SHAPED HEAD FOR INLET VALVE	1 NO
	INFLATABLE SEAL FOR INLET VALVE	4 NOS
	INSERT RING	1 NO
	SPIGOT PIECE	1 NO
	TOP PLATE	1 NO
	EXTERNAL LIP SEAL	4 NOS
	SHAFT SEAL	4 NOS
	O' RING	4 NOS
	SPRING PIN (INNER)	2 NOS
	SPRING PIN (OUTER)	2 NOS
	SET OF GASKET	2 NOS
	PNEUMATIC CYLINDER SEAL KIT	1 NO
	AIR LIMIT SWITCH SEAL KIT	1 NO
	QUICK EXHAUST VALVE DIAPHRAGM FOR SEAL	1 NO
	QUICK EXHAUST VALVE DIAPHRAGM FOR PNEUMATIC CYLINDER	1 NO
	SILENCER FOR VALVE ASSEMBLY	1 NO
2	CONVEYING LINE UPTO SILO TOP	
	PIPE LINE FITTINGS, BENDS, SPOOL PIECES	8 NOS. FOR EACH SIZE AND TYPE.
3	KNIFE TYPE ISOLATION VALVE	
	ASSEMBLY OF GATE	2 NOS
	SLIDE GATE	2 NOS
	VALVE STEM	2 NOS
4	ACTUATORS COMPLETE WITH MOTOR FOR ALL MOTORIZED VALVES OF EACH TYPE AND RATING.	5 % IN EACH SIZE, TYPE RATING & MAKE.
5	REVERSE PULSE JET BAG FILTER	
	FILTER BAGS	8 NOS
	PULSE VALVE COIL	2 NOS
	PULSE VALVE DIAPHRAGM	2 NOS
	SPRAY NOZZLE FOR SURGE HOPPER	4 NOS
6	AIR COMPRESSOR	
6.1	DRY AIR INTAKE FILTER	2 NOS
6.2	COMPLETE SET OF LOADING – UNLOADING VALVE ASSEMBLY	4 SETS
6.3	LOW PRESSURE COMPRESSOR ELEMENT	2 SET
6.4	HIGH PRESSURE COMPRESSOR ELEMENT	2 SET

बी एच डी रत्न 	TITLE		DOCUMENT NO. PE-TS-423-160-A001																																																										
	TECHNICAL SPECIFICATION OF MILL REJECT HANDLING SYSTEM 1X800MW NORTH CHENNAI TPP																																																												
			REV 0																																																										
			SHEET																																																										
<table><tr><td>6.5</td><td>INTER COOLER TUBE BUNCH</td><td>2 SET</td></tr><tr><td>6.6</td><td>AFTER COOLER TUBE BUNCH</td><td>2 SET</td></tr><tr><td>6.7</td><td>AUTOMATIC PURGE DRAIN VALVE FOR INTER COOLER AND AFTER COOLER(AUTO DRAIN TRAP)</td><td>2 SET</td></tr><tr><td>6.8</td><td>AIR OUTLET CHECK VALVE</td><td>4 SET</td></tr><tr><td>6.9</td><td>RUBBER AIR OUTLET COMPENSATOR</td><td>2 SET</td></tr><tr><td>6.10</td><td>LUBE OIL FILTER</td><td>4 SET</td></tr><tr><td>6.11</td><td>LUBE OIL PRESSURE REGULATING VALVE</td><td>2 SET</td></tr><tr><td>6.12</td><td>DIFFERENTIAL OIL SEALS FOR LUBE OIL SYSTEM</td><td>4 SET</td></tr><tr><td>6.13</td><td>COOLING WATER INLET AND OUTLET CONNECTION RUBBER BELLOWS</td><td>4 SET</td></tr><tr><td>6.14</td><td>GEAR BOX COMPONENT</td><td></td></tr><tr><td></td><td>DIFFERENT OIL SEALS</td><td>4 SET</td></tr><tr><td></td><td>SET OF BEARINGS</td><td>2 SET</td></tr><tr><td></td><td>BREATHING SYSTEM</td><td>4 SET</td></tr><tr><td>6.15</td><td>COMPONENTS OF L.P ELEMENTS</td><td></td></tr><tr><td></td><td>GEAR PINION</td><td>2 SET</td></tr><tr><td>6.16</td><td>COMPONENT OF HP ELEMENT</td><td></td></tr><tr><td></td><td>GEAR SETS</td><td>2 SET</td></tr><tr><td></td><td>DIFFERENT SAFETY VALVES</td><td>2 SET</td></tr><tr><td></td><td>FLEXIBLE RUBBER STUD COUPLINGS FOR COUPLING COMPRESSOR TO THE MOTOR</td><td>2 SET</td></tr></table>					6.5	INTER COOLER TUBE BUNCH	2 SET	6.6	AFTER COOLER TUBE BUNCH	2 SET	6.7	AUTOMATIC PURGE DRAIN VALVE FOR INTER COOLER AND AFTER COOLER(AUTO DRAIN TRAP)	2 SET	6.8	AIR OUTLET CHECK VALVE	4 SET	6.9	RUBBER AIR OUTLET COMPENSATOR	2 SET	6.10	LUBE OIL FILTER	4 SET	6.11	LUBE OIL PRESSURE REGULATING VALVE	2 SET	6.12	DIFFERENTIAL OIL SEALS FOR LUBE OIL SYSTEM	4 SET	6.13	COOLING WATER INLET AND OUTLET CONNECTION RUBBER BELLOWS	4 SET	6.14	GEAR BOX COMPONENT			DIFFERENT OIL SEALS	4 SET		SET OF BEARINGS	2 SET		BREATHING SYSTEM	4 SET	6.15	COMPONENTS OF L.P ELEMENTS			GEAR PINION	2 SET	6.16	COMPONENT OF HP ELEMENT			GEAR SETS	2 SET		DIFFERENT SAFETY VALVES	2 SET		FLEXIBLE RUBBER STUD COUPLINGS FOR COUPLING COMPRESSOR TO THE MOTOR	2 SET
6.5	INTER COOLER TUBE BUNCH	2 SET																																																											
6.6	AFTER COOLER TUBE BUNCH	2 SET																																																											
6.7	AUTOMATIC PURGE DRAIN VALVE FOR INTER COOLER AND AFTER COOLER(AUTO DRAIN TRAP)	2 SET																																																											
6.8	AIR OUTLET CHECK VALVE	4 SET																																																											
6.9	RUBBER AIR OUTLET COMPENSATOR	2 SET																																																											
6.10	LUBE OIL FILTER	4 SET																																																											
6.11	LUBE OIL PRESSURE REGULATING VALVE	2 SET																																																											
6.12	DIFFERENTIAL OIL SEALS FOR LUBE OIL SYSTEM	4 SET																																																											
6.13	COOLING WATER INLET AND OUTLET CONNECTION RUBBER BELLOWS	4 SET																																																											
6.14	GEAR BOX COMPONENT																																																												
	DIFFERENT OIL SEALS	4 SET																																																											
	SET OF BEARINGS	2 SET																																																											
	BREATHING SYSTEM	4 SET																																																											
6.15	COMPONENTS OF L.P ELEMENTS																																																												
	GEAR PINION	2 SET																																																											
6.16	COMPONENT OF HP ELEMENT																																																												
	GEAR SETS	2 SET																																																											
	DIFFERENT SAFETY VALVES	2 SET																																																											
	FLEXIBLE RUBBER STUD COUPLINGS FOR COUPLING COMPRESSOR TO THE MOTOR	2 SET																																																											

72 of 433

1 X 800 MW NORTH CHENNAI TPP

PACKAGE - MILL REJECT SYSTEM

LIST OF MANDATORY SPARES

	415V Motors	
1	Terminal plates	10 Nos. each for small motors upto 30 kW & 4 Nos. each for more than 30 kW
2	Heaters	2 sets
3	Greasing arrangements	4 sets each type of motor
4	Motor of each type and rating	10% of the installed quantity or minimum 1 number whichever be higher
5	Bearings (DE and NDE) for each type and rating of motor	4 set
	D C Motors (If Applicable)	
1	Carbon brushes	10 sets each type
2	Brush assemblies	2 sets each type
3	Terminal blocks	2 sets each type
4	Heaters	2 sets each type
5	Pulleys	2 sets each type
6	Motor of each type and rating	10% of the installed quantity or minimum 1 number whichever be higher
7	Bearings (DE and NDE) for each type and rating of motor	4 sets

1X800MW NORTH CHENNAI SUPERCRITICAL THERMAL POWER PROJECT
STAGE III IN THE EXISTING PREMISES OF NCTPS

MANDATORY SPARES

III. MANDATORY SPARES (C & I):

S No	Name/ Description of Spares	Unit	Qty
	The quantity of following spares includes a minimum of 20 % spares for replacement of each type of lamps, PBs, ILPBs, fuse, MCB, MCCB used in the equipment/system offered by him even if this is not detailed below.		
i)	Measuring Instruments - Indicators, Recorders, Electrical Metering and Skid Mounted Instruments	Lot	1
1	10% of the number of indicators, recorders and meters offered from each model for the project or a minimum of one number per model, whichever is more. These instruments shall be supplied with three sets of blank scales.		
2	For skid mounted instruments (if any) - 10% of total number of instruments for each model and type for the project or a minimum of one number for each model and type, whichever is more.		
ii)	Temperature Elements and Thermowells	Lot	1
1	10% spare thermocouple/RTD elements, suitable for replacement for each type and length of element furnished with thermocouple/RTD assemblies, or a minimum of one number of each type & length, whichever is more.	%	10%

1X800MW NORTH CHENNAI SUPERCRITICAL THERMAL POWER PROJECT
STAGE III IN THE EXISTING PREMISES OF NCTPS

MANDATORY SPARES

S No	Name/ Description of Spares	Unit	Qty
2	10% thermo wells for each type of temperature sensors or a minimum of one for each type, whichever is more	%	10%
3	Temperature Transmitters and Electronic Transmitters (For Pressure, DP, Temp, Flow, Level), Temperature, Pressure, Flow & Level Switch, safety switches, Gauges, meters, Transducer or any other instrument etc.		
	10% of total number of instruments/transducers offered for each model and type for the project or a minimum of one number, whichever is more.	Lot.	1
iii)	Flue Gas Analyzers & CEMS	Lot	1
	Spare parts shall be furnished in accordance with manufacturer's recommendations for five years continuous operation or minimum quantities indicated as below (whichever is more)		
1	One set of electronic modules comprising of at least one number of each type of module for each analyzer type.		
2	A spare cooling and purging air blower unit and set of air filters shall be furnished for each stack analysis system.		
3	One set of light source and detector unit for smoke density analyzer.		

1X800MW NORTH CHENNAI SUPERCRITICAL THERMAL POWER PROJECT
STAGE III IN THE EXISTING PREMISES OF NCTPS

MANDATORY SPARES

S No	Name/ Description of Spares	Unit	Qty
4	One set of infrared source and detector unit for CO analyzer.		
5	Two Nos. of Zirconia Cell, ceramic filters, heater & thermo couple assembly for flue gas oxygen analyzer.		
6	Two No. of chopper motor, two nos. protection window, one no. of heater cartridge for CO analyzer.		
7	Electronic Module/Mother Board /Signal Processing Unit for each type of Analyzer.		
8	1 no. Power supply module of each type of Analyzer.		
9	2 nos. UV Lamp with adopter with SO2 analyzer.		
10	1 no. of each type Light source and detector unit for SPM, and NOX/SOX analyzer.		
11	Set of filters 1 No. Of each type		
12	Analyzers spares like transmitter lens and receiver lens, protection windows for transmitter & receiver, integral pressure and temperature sensors, signal processing unit, electronic modules 1 No. of each type for each type of flue gas analyzer.		
iv)	Distributed Control System and Other Electronic Systems/Sub-Systems/ VMS / MIS / LAN / Simulator / WAN / CAAQMS and any other system as supplied as per Tender Specification etc.	Lot	1
1	Electronic modules - 10% of number for each type or minimum of 2 number for each type whichever is high.	%	10
2	Auto/Manual stations, set-point/bias stations etc.:- 10% of the number of stations offered for the project from each type or a minimum of 2 number from each model, whichever is more.		
3	Twenty percent spare replacement for each type of control logic power supply fuses, MCB, MCCB, at each current rating required for the project.	%	20
4	Ten (10) percent or 2 no. (Whichever is more) Electronic cards of each type used for Servers supplied with any control system.		

**1X800MW NORTH CHENNAI SUPERCRITICAL THERMAL POWER PROJECT
STAGE III IN THE EXISTING PREMISES OF NCTPS**

MANDATORY SPARES

S No	Name/ Description of Spares	Unit	Qty
5	10% of electric to pneumatic converters of each type utilized with automatic control system using pneumatic drives or a minimum of one of each type, whichever is more.		
6	Plug-in type keyboard - 10 nos. of each type/model and mouse - 20 nos. of each type/model.	No.	10
7	Two Nos control OWS and Two Nos. utility/Engineering OWS of each type with complete accessories & monitors.	No.	4
8	10 boxes of DVD/CD along with Five no. DVD/CD drive unit of each type.	No.	10
9	Process I/O Cards - 10% of the number of cards offered for the project from each category/model or at least 2 No. of each type/model (Whichever is more)		
10	200 mts. each set of data highway cable with adequate connectors of each type.	Sets	1
11	Five nos. hard disc drive unit of each type as offered for each system complete	No.	5
12	10% or 5 nos (whichever is more) of prefab cable connectors of each type.	No.	5
13	Ten (10) percent or five no. (Whichever is more) of cubicle power supply power supply modules of each type and rating.	No.	5
14	Ten (10) percent of the total quantity of each type of interposing/coupling relays.	Sets	1
15	Ethernet Switches, & other communication hardware etc.:- 10% of the number of hardware offered for the project from each type or a minimum of 2 number from each model, whichever is more.	No.	2
16	10% or Five no. (Whichever is more) of each type of Sensors with special cables, Power supply modules, Relay, Interface Module, and electronic modules used for vibration monitoring system.	Sets	1
17	Ten (10) percent or 3 no. of each type printer toners (whichever is more) for all printers of the total quantity of each type.	No.	3

1X800MW NORTH CHENNAI SUPERCRITICAL THERMAL POWER PROJECT
STAGE III IN THE EXISTING PREMISES OF NCTPS

MANDATORY SPARES

S No	Name/ Description of Spares	Unit	Qty
18	2 nos. of each type 132 columns DMP printer head of the total quantity of each type.	No.	2
19	2 nos. of each type Drum for A3 sized scanner cum copies, printer 3 nos. 24" LED monitor, 1 no. 29" LED monitor and 5 nos. 22" LED monitors.	No.	2
20	Twenty (20) percent or 2 no. (Whichever is more) RJ 45 connector with box of each type.	No.	2
21	Ten (10) percent or 2 no. (Whichever is more) Hooters, Buzzers, Cooling fans of each type.	%	10
22	Interface cables 2 sets of each type/model	Sets	1
23	Power supply modules (AC to DC convertors) 10% or Five no. (Whichever is more) of each type/model	No.	5
v)	Steam and Water Analysis System (SWAS)	Sets	1
1	Ten spare high pressure reducing elements for sample flow.		
2	Four spare ion exchange columns with resin as utilized with Cation conductivity analyzers.		
3	Two nos. spare conductivity cells of each type as utilized with conductivity monitors.		
4	Two nos. spare pH flow-through type cells of each type used with pH monitors.		
5	All chemical reagents required for 12 months continuous operation of all analyzers from date of taking over.		
6	All chemical reagents required for 12months operation at the colorimetric silica analyzers from the date of taking over.		
7	One (1) no. of Electronic Modules for each type of Analyzer.		
8	Two (2) no. of each type of pressure gauge, solenoid valves, temperature gauge, Back Pressure regulating valves, 3 way grab valves, needle valves, isolation valves, PRV, flow switch, flow indicator and temperature switch, erection hardware's, valves in SWAS.		
9	Three (3) No of each type Primary coolers/secondary coolers.		

1X800MW NORTH CHENNAI SUPERCRITICAL THERMAL POWER PROJECT
STAGE III IN THE EXISTING PREMISES OF NCTPS

MANDATORY SPARES

S No	Name/ Description of Spares	Unit	Qty
vi)	Relay Based Control Panels	Sets	1
1	10% LEDs for indicating lights shall be furnished.		
2	Three times, the one hundred percent (300% of installed) spare replacement control circuit fuses/MCB/MCCB of each current rating required shall be furnished.		
3	20% spare replacement relays modules & contactors of each type.		
vii)	Alarm Annunciation System	Sets	1
1	20% spares of each type installed shall be provided for logic modules, group card modules, power supply modules, Hooters and any other electronic module.		
2	5% spares of each size shall be provided for un-engraved window boxes complete with LED etc.		
3	20% of installed LEDs for annunciation facia windows and LEDs box assemblies offered for the project shall be provided as mandatory spares.		
4	One (1) spare annunciator hooter of each type.		
viii)	Erection hardware	Sets	1
1	Ten (10) percent of each type & Size installed instrument valve, manifold for each type, rating, model number and size of devices supplied for the project.		
2	Ten (10) percent of total number of condensate pots or four numbers whichever is higher of each type & Size installed.		
3	Ten (10) percent of each type & Size installed Fittings		
iv)	LVS	Sets	1
1	20% spare LEDs of each type & size		
2	50% spare or min 6 nos. LVS Filters		
3	3 nos. or 20% whichever is more Electronic cards of each type for LVS		
4	2 set of interfacing cables of each type & size.		

1X800MW NORTH CHENNAI SUPERCRITICAL THERMAL POWER PROJECT
STAGE III IN THE EXISTING PREMISES OF NCTPS

MANDATORY SPARES

S No	Name/ Description of Spares	Unit	Qty
5	3 nos. or 20% whichever is more power supply modules of each type for LVS		
6	3 nos. or 20% whichever is more Cooling modules of each type		
7	2 nos. LVS controllers of each type for LVS		
x)	Master Slave Clock system	Sets	1
	As per Manufacturer's Recommendation for Three Years Continuous Operation or minimum quantities indicated (whichever is more). One no. Electronic cards (each type & model), One no. signal conditioner card (each type & model), Cubicle power supply power supply modules - Ten (10) percent or 2 nos (whichever is more) of Installed of each type and rating, two no. slave clocks of each type used for Master slave clock system.		
xi)	Plant Security and surveillance system –	Sets	1
	As per Manufacturer's Recommendation for Three Years Continuous Operation or minimum quantities indicated (whichever is more). One no. Electronic cards of each type, One no. of PTZ controller of each type, Electronic modules of each type used for server system, special cables & connector (5 sets) of each type, 2 no. cartridges for air filter of each type, 5 nos. relay & 5 nos. power supply modules of each type and two no. Camera of each type used for Plant security and surveillance system. 10% or 2 nos. min whichever is more - Automatic door sensors. 10% or 2 nos. min whichever is more – Card reader.		
xii)	AAQMS		Lot
	As per Manufacturer's Recommendation for Three Years Continuous Operation or minimum quantities indicated (whichever is more). One no. Electronic cards of each type used for AAQMS (Ambient Air Quality Monitoring System) system. However following Minimum mandatory spares shall be considered by bidder:-		
1	Electronic Module/Mother Board /Signal Processing Unit for each type of Analyzer.		

1X800MW NORTH CHENNAI SUPERCRITICAL THERMAL POWER PROJECT
STAGE III IN THE EXISTING PREMISES OF NCTPS

MANDATORY SPARES

S No	Name/ Description of Spares	Unit	Qty
2	Power supply module of each type for each Type of Analyzer.		
3	UV Lamp with adopter with SO2 analyzer.		
4	Light source and detector unit for SPM, and NOX/SOX analyzer.		
5	Pump for SPM Analyzer		
6	2 no. each type of conference hall mike & speakers.		
xiii)	HMS	Sets	1
	As per Manufacturer's Recommendation for Three Years Continuous Operation and One no. Electronic cards, of each type used for Hart Management system.		
xiv)	Mandatory Spares for Control valves, Power Cylinder, Control Dampers, Actuators and Accessories		
a	Following spares shall be furnished for control valves, Power Cylinder, Control Dampers as applicable.	Lot	1
1	One set of spare control valve stem packing for each control valve.		
2	Two moulded rubber diaphragms for each control valve.		
3	One sets of each of O-rings and rubber gaskets for each control valve.		
4	100 percent qty. of lubricants for gaskets for each control valve on one year consumption basis.		
5	2 sets of limit switches and 1 set of valve positioner for each control valve.		
6	20 percent of position transmitter (4-20mA) for total qty. of control valve.		
7	One (1) set of valve trims (such as plug, stem, seat ring / cage, guide bushing, stem lock pin, packing retaining ring, etc.) for each control valve.		
8	One completes actuator of each type or min 10% for each type and size whichever is more.		
9	20 percent of Solenoid valves or min 2 no. of each type for total qty. of control valves.		
10	20% of I to P converters, Pressure regulators.		

1X800MW NORTH CHENNAI SUPERCRITICAL THERMAL POWER PROJECT
STAGE III IN THE EXISTING PREMISES OF NCTPS

MANDATORY SPARES

S No	Name/ Description of Spares	Unit	Qty
e	1 NO of flow Nozzle for each PRDS De Super heater & Spray water Desuperheater and Orifice plate for CEP flow.		
xv)	Mandatory Spares for Boiler Tube leak Detection System	Lot	1
	Following mandatory spares along with their individual price required for maintaining boiler tube leak detection system to supply along with the package.		
1	2nos. acoustic transducer with rear connector sealed to IP-65		
2	2 nos. flexible high temperatures lead, 3metre long for acoustic transducer.		
3	2 nos. acoustic s field amplifier / processor mounted in a die cast aluminum or polycarbonate box sealed to IP-65 with mounting brackets, pairs.		
4	1 no. A/D Convertor cards/field signal interface module for 32 or more channels.		
5	1 no. Alarm relay output card.		
6	Consumables like batteries, fuses etc. for two years operation of boiler tube leak detection system		
xvi)	Mandatory spares not covered above	Lot	1
	Bidder to supply 10% or 1 no. (whichever is more) of each type of sensor/instrument, analyzers /special instruments/Electronic card, instrumentation/mechanical fittings etc. for any other electronic system, feeder control cabinets, hydra step (EWLI), Vibration Monitoring System, CCTV, C&I Lab Instruments, On line Carbon in Ash analyzer system, On line Coal mass flow/speed measurement system, On line secondary air flow measurement system Mass Flow meter, Solid flow meter, 3 D Acoustic type level transmitters, Nucleonic & non nucleonic density transmitter etc.		

1X800MW NORTH CHENNAI SUPERCRITICAL THERMAL POWER PROJECT
STAGE III IN THE EXISTING PREMISES OF NCTPS

MANDATORY SPARES

S No	Name/ Description of Spares	Unit	Qty
xvii)	Other Related Control and Instrumentation Systems/Equipments		
	Other SG related sub-systems		
1	Flame Monitoring System	Lot.	1
(i)	Complete Flame Scanner Assembly including scanner head assembly, scanner housing, and fiber optic cables.		20% or 4 nos. whichever is more.
(ii)	Flame Scanner Lens.		100%
(iii)	Electronic cards for scanners		10% or 2 nos. of each type whichever is more.
(iv)	Power Supply Modules		10% or 2 nos. of each type whichever is more.
2	Coal Feeders	Lot.	
(i)	Calibration Motor		10% or 2 nos. whichever is more.
(ii)	Correction Motor		10% or 2 nos. whichever is more.
(iii)	Motion monitor		10% or 2 nos. whichever is more.
(iv)	Speed pick-up		10% or 2 nos. whichever is more.
(v)	Torque switch		10% or 2 nos. whichever is more.

1X800MW NORTH CHENNAI SUPERCRITICAL THERMAL POWER PROJECT
STAGE III IN THE EXISTING PREMISES OF NCTPS

MANDATORY SPARES

S No	Name/ Description of Spares	Unit	Qty
8	Solenoid valves	Lot.	1
(i)	Solenoids for SG pneumatic drives / valves.		20% or 2 nos. of each type whichever is more.
(ii)	Solenoid valves.		20% or 2 nos. of each type whichever is more.
(iii)	Diaphragms		20% or 2 nos. of each type whichever is more.
9	Mill and Air heater Fire detection system.		
(a)	Thermocouple		10% or 2 nos. whichever is more
(b)	Process actuated switches		10% or 1 no. whichever is more
(c)	Electronic cards		20% or 2 nos. whichever is more
	Other TG related Sub-systems		
	Turbine Supervisory System / EHTC / TSC / ATT / ATRS / GSPC / TDBFP etc.		
(i)	Power Supply assemblies of all types		10% or 2 nos. of each type whichever is more



TITLE
1X800 MW NORTH CHENNAI TPP STAGE III
MILL REJECT SYSTEM (PNEUMATIC TYPE)
SPECIFIC TECHNICAL REQUIREMENTS

SPECIFICATION NO. PE-TS-423-160-A001
SECTION - I
REV 00
Sub Section -IA
Page 1 of 1

ANNEXURE-F
MAINTENANCE TOOLS & TACKLES

Sl.No.	Description	Qty.	Unit
1	Spur geared chain pulley block of 2.0 tonnes capacity , 3 mtr.	1	Nos.
2	2 lbs ball pen hammers	2	Nos.
3	Cold Chisel 8"	2	Nos.
4	6" outside and inside caliperse	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 ropeslings 8 ft with eye at each end 1/2 " size and 5/8" size	2	Pair each
19	Wrachet 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.

**TITLE**

**1X800 MW NORTH CHENNAI TPP STAGE III
MILL REJECT SYSTEM (PNEUMATIC TYPE)**

SPECIFIC TECHNICAL REQUIREMENTS

SPECIFICATION NO. PE-TS-423-160-A001

SECTION - I

REV 00

Sub Section -IA

Date: MAY 2017

ANNEXURE-G

**Performance guarantees requirement, trail run, commissioning
requirement, operation & erection manual, third party inspection,
FQP requirement**



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

1X800 MW NCTPS TPP

BHEL DOCUMENTS NO. PE-TS-423-160-A001

SECTION-I

SUB SECTION-IA

REV. NO. 00

DATE:

Page

**ANNEXURE -G
PERFORMANCE GAUARNTEE & LIQUIDATED DAMAGES**

Performance Guarantee test shall comprise of

Guarantee Under Category – I

Liquidated damages are applicable for following guarantees:

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

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

Guarantee Under Category – III

The parameters/capabilities to be demonstrated for various systems/ equipment shall include but not be limited to the following:

- i) Continuous effective discharge and conveying at the rated capacity of the mill rejects without spillage or blockage in the system.
- ii) Following shall be demonstrated at site for compressor
- Capacity and discharge pressure of each air compressor
 - Power consumption of each air compressor at its rated duty point with its own motor.
- iii) Guarantees of all equipment as per approved data sheet & quality plan.
- iv) Particulate emission rate from bag filters less than 30 mg/nm³ of air shall be demonstrated at site
- v) Vibration and noise level of each compressor and any other rotating equipment shall be demonstrated at site.
- vi) Parallel operation of air compressors, if applicable, shall be demonstrated at site.
- vii) Noise: All the plant, equipment and systems covered under this specification shall perform continuously without exceeding the noise level over the entire range of output and operating frequency.

The equivalent 'A' weighted sound pressure level measured at a height of 1.5 m above floor level in elevation and at a distance of one (1) metre horizontally from the nearest surface of any equipment/machine, furnished & installed under these specification, expressed in decibels to a reference of .0002 microbar shall not exceed 85 dba except for –



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

1X800 MW NCTPS TPP

BHEL DOCUMENTS NO. PE-TS-423-160-A001

SECTION-I

SUB SECTION-IA

REV. NO. 00

DATE:

Page

- Safety valves & associated vent pipes for which it shall not exceed 105 dba.
- Regulating drain valves in which it shall be limited to 90 dba.

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

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

Guarantee under Modification, Alteration and Rejection

1. Conveying capacity (tph)
2. Compressor capacity/numbers (NM3/min)

11.0 QUALITY PLAN (For manufacture of equipment)

- 11.1 The Quality plan is a document, which presents in a tabular form. The Quality Control checks and tests to be undertaken by the Contractor during the various stages of manufacture and dispatch in order to meet the requirements of this Contract. This plan shall detail the components manufactured, characteristics being controlled, and acceptance norms for this characteristic and the agency responsible for performance and witnessing the checks.
- 11.2 After issuance of LOI, the Contractor shall submit to the Owner the detail quality plans to be followed during manufacture of all major equipment. These quality plans shall be discussed mutually and updated by the Contractor taking into consideration the requirement of the Owner. The quality plan when approved shall form a part of the Contract. This document shall be followed for inspection of the concerned equipment.
- 11.3 The details of the quality assurance / quality checks envisaged by the Contractor during manufacturing of the Equipment supplied by him or procured through his sub vendors / sub-Contractors shall be detailed out in the quality plans to be submitted by the Contractor. The Contractor may also furnish any additional information regarding quality assurance / quality checks in the additional sheets if required. Quality plans for major equipment manufactured by the Contractor or procured through his sub-vendors / sub-Contractors shall be submitted during engineering. After approval of the Owner is accorded various quality plans shall be bound as a booklet and shall be submitted to the Owner as soon as possible. The Contractor shall ensure that the approved quality plans are followed scrupulously by him and by his sub-vendors / sub-Contractors and manufacturing of the items covered under the quality plans shall be taken up only after Owner has approved the quality plan.

12.0 OWNER'S REPRESENTATIVE AT SITE:

SE/Civil/NCTPP Stage III Project, "1X800 MW Coal based North Chennai Supercritical Thermal Power Project Stage-III in the Premises of existing NCTPS, Ennore & Puzhuthivakkam Village, Ponneri taluk, Thiruvallur District, Tamil nadu, India" shall be the Owner's representative at site and shall act as an In-charge for all the site works. The contractor's Resident Engineer shall report to him for all the day to day works.

13.0 CONSIGNEE:

All Material Shall be consigned to:

The Chief Engineer / NCTPP, Stage III
TANGEDCO
Athipattu Pudhunagar,
Chennai 600 120

14.0 PAINTS & CONSUMABLES

- 14.1 Pursuant to the Clause No. 25.0 of Section 3, Volume I, it shall be the responsibility of the contractor to supply all the paints as required.
- 14.2 It shall be the responsibility of The Contractor to supply all consumables like, grease, lubricating oils, all chemicals, ink & graphs for recorders etc., up to satisfactory completion of

trial operation and three months thereafter. The Contractor shall also arrange any additional quantities required specifically for the Performance Guarantee Test. Contractor shall furnish specifications of all such consumables to enable the Owner to purchase his future requirements well in advance

15.0 THIRD PARTY INSPECTION

15.1 Indigenous supplies: - The equipment to be supplied under this Contract shall be inspected during manufacturing as per the quality plan to be finalized. Material verification and stage inspection at all important stages as well as final testing and inspection fall within this scope. The inspection shall be carried out by a third party inspection agency to be appointed by the Owner for indigenous supplies. The cost towards this inspection shall be borne by the Contractor.

15.2 In the case of imported supplies: - For imported materials or non- indigenous supplies, the inspection shall be carried out by a foreign agency of repute to be appointed by the contractor as approved by the Owner. The cost of such inspection shall be borne by the Contractor

16.0 OPERATION AND MAINTENANCE MANUALS

16.1 For all the equipment's supplied by the Contractor, he shall submit to the Owner ten(10) sets of the O&M manuals. The manual shall contain the operational features of the equipment, DOs & DON'Ts, trouble shooting, maintenance schedules for preventive maintenance, detail dimensional drawings, cross sectional drawings, method of assembly etc. to make the Owner's staff acquainted with the equipment as well as to enable them to operate and maintain the same in prescribed manner. Manuals shall contain all information for ordering of the spares, like part name, part no., Drawing/ material Specifications, address of the supplier with phone no. & fax no. etc. Contractor shall ensure that these O&M manuals are made available to the Owner well before starting of initial trials of equipment.

16.2 ERECTION MANUALS

In order to enable the engineers of the Owner to supervise the works properly, Contractor shall furnish five copies of erection manuals depicting therein the erection procedure, special precautions to be taken, various clearance to be maintained, erection checks and tests to be carried out before the equipment is put to initial trials.

17.0 SUBMISSION AND APPROVAL OF DRAWINGS

The contractor shall submit the drawings in sequential order to match with completion of milestone activity. The contractor shall submit all the G.A. drawings, mechanical, electrical and civil drawings, data sheets etc. for approval of the Owner along with the design calculations and general write up wherever involved. The drawings for all the systems shall

be properly coordinated. While scrutinizing the drawings, the Owner shall indicate the corrections to be made in these drawings and documents, which the contractor shall incorporate or justify its correctness. The Contractor then shall submit the revised drawings for approval of the Owner. On approval of the same, Contractor shall furnish six copies and soft copy on CD of these approved drawings to the Owner as per the distribution to be intimated. Any delay in approval of drawings by Owner, due to submission of incorrect data, non-submission of data, non-updating the drawings in line with the corrections indicated shall be to the Contractor's account. During the currency of the contract, if any approved drawings are required to be modified, such details of the modifications required to be carried out shall be separately maintained. On completion of all the works, the Contractor shall incorporate all the changes necessitated in the drawings and submit 6(six) sets of all the "As built" drawing for the records of the Owner. As the drawings shall be approved based on the basic information furnished by the Contractor, approval by the Owner shall not absolve the Contractor of his responsibilities towards correctness of design & performance of the equipment.

18.0 TEST REPORTS

On completion of tests of equipment at manufacturer's works, the Contractor shall furnish 4 copies of test certificates to the Owner for approval and subsequent despatch clearance. The test report shall invariably indicate identification data, including model no., sl. no. etc. of the equipment, method of application and duration of test along with test results. Only on approval of these test results by the Owner or Owner's representative, dispatch clearance will be issued for dispatch of material to site

19.0 FIELD QUALITY PLAN

Erection shall be carried out as per ECC, manufacturer's manual, approved quality plan & best practices of the industry. After completing erection of individual equipment, the equipment shall be tested for starting up. The list of all the inspections, tests to be carried out before starting up of the equipment shall be mutually decided. Subsequent to these tests, the equipment shall be tried as a sub system and further as a system as a whole. All the inspections and tests to be carried during these stages shall be mutually decided and as per the best practices. This schedule of inspections and the tests shall be called as field quality plan and Contractor shall follow the same during various stages of erection, testing and operations.

20.0 COMMISSIONING AND HANDING OVER

20.1 INITIAL TRAIL

On completion of erection of equipment, each item of the equipment shall be thoroughly cleaned and inspected jointly by the Owner / Consultant and Contractor for correctness and

completeness of installation and acceptability for initial trials of the equipment by the Contractor & Owner. During the above joint walk down, the list of equipment deficiency & defects shall be prepared and for such a punch list, action shall be initiated by the Contractor in agreed time frame. The list of tests to be performed prior to initial trials shall be mutually agreed and included in the Field Quality Plan by Contractor. The purpose of these trials is to ensure integrity of each individual equipment for its operation in the system for initial operation.

20.2 INITIAL OPERATION

After successful initial trials of all the individual equipment, all equipment shall be operated together as a system. The purpose of this initial operation is to ensure integrity of all the sub-systems which compose the total system. Based on the observations made during initial operation, necessary corrections shall be effected in the equipment / systems to ensure proper integrated operation of the system. After satisfactory completion of initial operation for each equipment & sub-system, the complete equipment shall be considered ready for trial operation. During initial operation, any adjustments/calibrations to the instruments fitted in the new system shall be done in the presence of testing staff of Owner so as to enable them to familiarize themselves with its adjustments and maintenance. The Contractor has also to ensure that he trains Owner's Engineers at site dealing with this system in proper way.

20.3 TRIAL OPERATION

- a) After satisfactory initial operation, the plant shall be put on trial operation. The period of trial operation shall be Thirty (30) days of which minimum continuous seventy two (72) hours shall be at full load. During the period of trial operation, all the necessary adjustments in the plant / equipment shall be made by the Contractor to establish that the complete system as a whole with all sub-systems and with all standby equipment is ready for continuous operation. During these trials, all the standby equipment also shall be run alternatively and continuously for 14 days to prove their performance. During this period, the Contractor shall demonstrate capabilities of his supplied equipment as indicated in the specification or in subsequent discussions. Duration of Breakdown due to grid disturbances will not be reckoned as interruption.
- b) A trial operation report comprising of dates and duration of trial, observations and recordings of various parameters to be measured shall be prepared by the Contractor and signed jointly by the Owner and the Contractor. The report shall have sheets, recording all the details of interruptions occurred, adjustments made and any minor repairs done during the trial operation. If the trial operation is established to be satisfactory, except for some minor adjustments, if any, the plant shall be taken over by the Owner for day to day operation and maintenance from the date of conclusion of trial operation. If the trial operation is not satisfactory, then based on the observations during trial operation, necessary modification / repairs to the plant / equipment shall be carried out by the Contractor and on completion of

such works, the trial operation shall be repeated again on a date and for a period for 28 days as per clause no. 20.3 (a) mentioned above.

- c) After the trial operation is carried out successfully, to declare it as such, a joint protocol should be signed between TANGEDCO and the Contractor
- d) The goods supplied under the contract shall be fully insured up to 3 months from the date of taking over of the plant. However in case the trial operation is extended due to reasons attributable to the Owner, then the insurance policy shall be extended by the Contractor till successful completion of trial operation / taking over of the plant and the actual premium charges towards this extension of insurance policy shall be reimbursed by the Owner to the Contractor without any handling charges.

21.0 PERFORMANCE GUARANTEE TEST

- 21.1 After satisfactory completion of the trial operation, the performance test shall be conducted at site by the Contractor. Any preparations required for this test shall be carried out by the Contractor for which Owner will provide required shutdown. The duration of the Performance Guarantee Test of the Plant at the rated capacity shall be mutually agreed. However, a stability period of 2 hours before commencement of test and 2 hours test period followed by another 2 hours stable period shall be maintained. The PG test procedure should be submitted to the owner well in advance and got approved before the commencement of PG test. Performance Guarantee Test shall be conducted within 30 days of intimation from the Contractor about his readiness for conducting Performance Guarantee Test. These tests shall be binding on both the Owner and the Contractor to determine performance of the equipment/system with the performance guarantee data.
- 21.2 The tests shall be conducted at the specified load conditions or as near the specified conditions as practicable. The Owner/Contractor will apply agreed factors to compensate for deviation from the designed parameters. The suitable correction curves mutually agreed by the Owner and the Contractor shall be used.
- 21.3 All test instrumentation as required for the Performance Guarantee Test shall be arranged by the Contractor at free of cost. Precision instruments required for Performance Guarantee Test shall, however, be arranged by the contractor. Calibration before and after test and installation of the test instrumentation for the test shall be the Contractor's responsibility. All test instrumentation shall be in accordance with the applicable code. All test instruments and calibration procedures shall be duly approved by the Owner. Batch calibration shall not be accepted. The test shall be commenced only after clearance of owner on the above vital issues.

- 21.4** Any special equipment, tools and tackles required for the successful completion of the performance tests shall be provided by the Contractor at free of cost.
- 21.5** The performance guarantee figures of the equipment shall be proved by the Contractor during the Performance Guarantee Test.
- 21.6** Should the results of these tests show any decrease from guaranteed values, the Contractor shall modify the equipment within 90 days from the date of intimation by the owner as required to bring it to meet the guarantees. In such cases, the performance tests shall be repeated within one month from the date on which the equipment is made ready again for tests subject to grid requirements at that time. All costs of modifications including labour, material and the cost of additional testing to prove that equipment meets the guarantee shall be borne by the Contractor.
- 21.7** The provisions outlined in the ASME performance test code or other International and Indian approved equivalents shall generally be used as a guide for all the above test procedures unless specified otherwise in the specification. The details of all measuring/recording meters, test instrumentation such as class of accuracy, make etc. shall be covered in the trial operation/ performance test reports. All the list of equipment, accuracy class and test certificates to be submitted and got approved by the owner before the commencement of trial operation.
- 21.8** PG test to be witnessed by the consultant and the owner.
- 22.0** **PERFORMANCE GUARANTEES, PENALTIES AND CAPABILITY**
- 22.1** The Contractor shall meet the Performance Guarantees as have been indicated in the Specifications and Schedule thereof.
- 22.2** The penalty for not meeting the performance guarantees during the Performance Guarantee Test shall be assessed and recovered from the Contractor. Such penalty shall be levied without limitations, in accordance with stipulations made in Technical Specification and shall be without prejudice to all the other conditions of the contract.
- 22.3** If the guarantees specified are not achieved by the Contractor within 90 days of notification by the Owner, he may at his discretion reject the equipment or accept it after levying and recovering suitable penalties.
- 22.4** In case there is shortfall in capability of equipment while demonstrating capability tests, the Contractor shall forth-with rectify his equipment within 90 days and re-perform the capability tests to Owner's satisfaction.

- 22.5** Any recoveries by the Owner from the Contractor due to shortfall in guaranteed performance shall be independent of provisions of clause no. 6.0 “Liquidated damages of Special Conditions of the Contract “

23.0 PENALTY FOR POOR PERFORMANCE

The contractor shall furnish performance guarantee as have been specified in Guarantee Schedule under Technical Specification Vol-II. This guarantee shall be met by the Contractor.

The penalty for not meeting the performance guarantees during the Performance Guarantee Tests shall be assessed and recovered from the Contractor as under.

24.0 EVALUATION / LOADING CRITERIA & PENALTY TOWARDS SHORTFALL IN PERFORMANCE PARAMETERS

S.No	Variation Factor	Loading for evaluation	Penalty for shortfall in performance
1.	2.	3.	4.
1.	HEAT RATE:- Minimum Gross Turbine Cycle heat rate at 105% TMCR after subtracting excitation power and power of TG integral Auxiliaries with following conditions: 1.Cycle make-up : 0% makeup 2.Cooling water inlet temperature of 32.5 Deg. C 3.TDBFP's in operation 4.Generator power factor of 0.85 (Gross Turbine cycle heat rate at 105% TMCR condition is guaranteed after accounting for pressure drop in main steam piping, Reheater system and all extraction steam piping from steam turbine to feed water heaters & deaerator)	Rs.112.74 lakhs per kCal / kWh increase in heat rate over lowest quoted Heat Rate as base.	Rs.112.74 lakhs Per kcal/kWh or part thereof increase in heat rate from guaranteed value

2.	HEAT RATE:- Minimum Gross Turbine Cycle heat rate at 100% TMCR after subtracting excitation power and power of TG integral Auxiliaries with following conditions: 1.Cycle make-up : 0% makeup 2.Cooling water inlet temperature of 32.5 Deg. C 3.TDBFP's in operation 4.Generator power factor of 0.85 (Gross Turbine cycle heat rate at 100% TMCR condition is guaranteed after accounting for pressure drop in main steam piping, Reheater system and all extraction steam piping from steam turbine to feed water heaters & deaerator)	Rs.428.41 lakhs per kCal / kWh increase in heat rate over lowest quoted Heat Rate as base.	Rs.428.41 lakhs Per kcal/kWh or part thereof increase in heat rate from guaranteed value .
3.	Steam Generator Efficiency with following conditions: i) 100% TMCR ii) Firing design coal iii) On Gross Calorific value (GCV) basis iv) Excess air at Eco outlet at 100% TMCR load 20%(min.) v) At 30 deg C DBT and 75% RH ambient air conditions. Vi) Corrected Flue gas temperature at Air preheater outlet.125 deg. C or as predicted by the bidder whichever is higher. Vii) unburnt fuel at all guaranteed efficiency load i.e 1.0% minimum or actual whichever is higher Vii) without any heat credit.	Rs 9,33,52,000/- For every 0.1% shortfall in efficiency considering highest quoted steam generator efficiency as base	Rs 9,33,52,000/- for every 0.1% short fall in steam generator efficiency from guaranteed value

4.	Steam Generator Efficiency with following conditions: i) 105% TMCR ii) Firing design coal iii) On Gross Calorific value (GCV) basis iv) Excess air at Eco outlet at 105% TMCR load 20%(min.) v) At 30 deg C DBT and 75% RH ambient air conditions. Vi) Corrected Flue gas temperature at Air preheater outlet. 125 deg. C or as predicted by the bidder whichever is higher. Vii) unburnt fuel at all guaranteed efficiency load i.e 1.0% minimum or actual whichever is higher Vii) without any heat credit.	Rs 2,33,28,000/- For every 0.1% shortfall in efficiency considering highest quoted steam generator efficiency as base	Rs 2,33,28,000/- for every 0.1% short fall in steam generator efficiency from guaranteed value
5.	Total Auxiliary power consumption for the plant (800 MW) including balance of plant at 100% TMCR condition after subtracting excitation power and power of TG integral auxiliaries with following conditions: 1.Cycle make-up : 0% makeup 2.Cooling water inlet temperature of 32.5 Deg. C 3.TDBFP's in operation 4.Generator power factor of 0.85	Rs.4,70,72,094/- for every 0.01% increase (considering 5.5% Auxiliary Power Consumption as base)	Rs.4,70,72,094/- for every 0.01% increase or part thereof from guaranteed value
6.	Capitalisation of losses of Transformers a) Generator Transformer b) Unit Transformer c) Station Transformer d) Standby / Maintenance Transformer Iron losses Copper losses Cooler pump/fan losses	Rs.3,49,880/kW Rs.2,89,701/kW Rs.2,79,904/kW	Rs.3,49,880 /kW Rs.2,89,701 /kW Rs.2,79,904 / kW

		(considering lowest quoted values as base)	for Increase per kW or part thereof from guaranteed value
7.	Condenser Pressure in mmHg(abs) for dual pressure condenser measured at 300 mm above the top row of condenser tubes at 105% TMCR with following conditions • Cycle makeup: 1% • Cooling Water inlet temperature 32.5 Deg. C	--	INR 97,755,231/- for every per mmHg(abs) increase in vacuum beyond the guaranteed figure.
8.	Deficiency in capacity of TG power output at 105% TMCR (840MW) after subtracting excitation power and power of TG integral auxiliaries with following conditions: 1.Cycle make-up : 0% makeup 2.Cooling water inlet temperature of 32.5 Deg. C 3.TDBFP's in operation 4. Generator power factor of 0.85	--	INR 10,55,668 for every kW or part thereof by which output determined by the tests fall short of guaranteed figure
9.	Boiler Maximum Continuous rating in TPH of Steam at rated steam parameters at superheater outlet and rated steam parameters at reheater outlet with following conditions. a) Any combination of mill working as per owner's choice. b) With range of coal specified.	--	INR 22,000,000/- for every 1 T/hr short fall in steam output from the guaranteed value.
10	Life of Coal pulveriser wear parts, in hours of operation, for the		To Calculated as indicated in Volume

	entire range of coal characteristics specified. (To be demonstrated as indicated in Volume II Section 1 Chapter 5		II, Section 1, Chapter 5
--	---	--	--------------------------

Note: All above loadings & penalties as mentioned in Col. 3 & 4 shall be calculated on prorata basis. The penalty indicated above is in addition to the liquidated damages as stipulated in clause no.6.0 of this Section.

** The guaranteed auxiliary power consumption shall be furnished as per list enclosed in Schedule 15 A. Bidder shall list out any additional continuous working equipment in addition to the item listed , which are required for the plant to operate at 100% TMCR load.

The Bidders are advised to quote practical and realistic performance guarantee values in the bid, failing which the bid is liable for rejection.

25.0 FINAL ACCEPTANCE TEST

- 25.1** In case Performance Guarantee Test cannot be carried out at specified time due to reasons attributable to Owner, the Plant shall be taken over 180 days after the intimation from the Contractor provided the Owner is satisfied about his readiness for conducting the Performance Guarantee Test. In such case, the Owner shall give an adhoc final acceptance certificate for the purpose of triggering the Guarantee/Defect Liability period which will be subject to revision based on actual PG test results. In such an eventuality, the Owner shall give a notice to the Contractor of his readiness to give necessary inputs to enable the Contractor to do the Performance Guarantee Test, in which case the Contractor shall arrange the Performance Guarantee Test within 30 days on receipt of such notice without any additional financial implication to the Owner.
- 25.2** On conducting the Performance Guarantee Test, if it is established to the satisfaction of the Owner that the equipment is performing as specified in the Technical Specifications, the Owner shall issue to the Contractor a final acceptance certificate indicating the date from which the equipment has been taken over
- 25.3** Such a certificate shall be given within 30 days after satisfactory completion of the performance guarantee test and PG test results are furnished by the Contractor to prove the achievement of the assured PG values. Owner shall not delay the issuance thereof on account of minor omissions or defects which do not affect the safe and reliable operation and/or cause any risk to the equipment. Such certificate shall, however, not relieve the Contractor of any of his obligations which otherwise survive by the terms and conditions of the contract.

**TITLE**

**1X800 MW NORTH CHENNAI TPP STAGE III
MILL REJECT SYSTEM (PNEUMATIC TYPE)**

SPECIFIC TECHNICAL REQUIREMENTS

SPECIFICATION NO. PE-TS-423-160-A001

SECTION - I

REV 00

Sub Section -IA

Date: MAY 2017

ANNEXURE-H**GENERAL TECHNICAL REQUIREMENT**

ANNEXURE-H
GENERAL TECHNICAL REQUIREMENTS (AS APPLICABLE)

1.0 INTRODUCTION

This part covers technical requirements, which will form an integral part of the Contract. The following provisions shall supplement all the detailed technical requirements brought out in the Technical Specifications and the Technical Data Sheets.

2.0 BRAND NAME

Whenever a material or article is specified or described by the name of a particular brand, manufacturer or vendor, the specific item mentioned shall be understood to be indicative of the function and quality desired, and not restrictive; other manufacturer's products may be considered provided sufficient information is furnished to enable the Owner to determine that the products proposed are equivalent to those named.

3.0 BASE OFFER & ALTERNATE PROPOSALS

The Bidder's proposal shall be based upon the use of equipment and material complying fully with the requirements specified herein. It is recognized that the Bidder may have standardized on the use of certain components, materials, processes or procedures different than those specified herein. Alternate proposals offering similar equipment based on the manufacturer's standard practice may also be considered, provided the base offer is in line with technical specifications and such proposals meet the specified design standards and performance requirement and are acceptable to the Owner. Sufficient amount of information for justifying such proposals shall be furnished to Owner along with the bid to enable the Owner to determine the acceptability of these proposals.

4.0 COMPLETENESS OF FACILITIES

4.1 Bidders may note that this is a contract inclusive of the scope as indicated elsewhere in the specification. Each of the plant shall be engineered and designed in accordance with the specification requirement. All engineering and associated services are required to ensure that a completely engineered plant is provided.

4.2 All equipment furnished by the Bidder shall be complete in every respect, with all mountings, fittings, fixtures and standard accessories normally provided with such equipment and/or those needed for erection, completion and safe operation & maintenance of the equipment and for the safety of the operating personnel, as required by applicable codes, though they may not have been specifically detailed in the respective specifications, unless included in the list of exclusions.

All similar standard components/ parts of similar standard equipment provided, shall be interchangeable with one another.

5.0 CODES & STANDARDS

5.1 In addition to the codes and standards specifically mentioned in the relevant technical specifications for the equipment / plant / system, all equipment parts, systems and works covered under this specification shall comply with all currently applicable statutory regulations and safety

codes of the Republic of India as well as of the locality where they will be installed, including the following:

- a. Bureau of Indian Standards (BIS)
- b. Indian electricity act
- c. Indian electricity rules
- d. Indian Explosives Act
- e. Indian Factories Act and State Factories Act
- f. Indian Boiler Regulations (IBR)
- g. Regulations of the Central Pollution Control Board, India
- h. Regulations of the Ministry of Environment & Forest (MoEF), Government of India
- i. Pollution Control Regulations of Department of Environment, Government of India
- j. State Pollution Control Board.
- k. Rules for Electrical installation by Tariff Advisory Committee (TAC).
- l. Any other statutory codes / standards / regulations, as may be applicable.

5.2 Unless covered otherwise by Indian codes & standards and in case nothing to the contrary is specifically mentioned elsewhere in the specifications, the latest editions (as applicable as on date of bid opening), of the codes and standards given below shall also apply:

- a. Japanese Industrial Standards (JIS)
- b. American National Standards Institute (ANSI)
- c. American Society of Testing and Materials (ASTM)
- d. American Society of Mechanical Engineers (ASME)
- e. American Petroleum Institute (API)
- f. Standards of the Hydraulic Institute, U.S.A.
- g. International Organisation for Standardization (ISO)
- h. Tubular Exchanger Manufacturer's Association (TEMA)
- i. American Welding Society (AWS)
- j. National Electrical Manufacturers Association (NEMA)
- k. National Fire Protection Association (NFPA)
- l. International Electro-Technical Commission (IEC)
- m. Expansion Joint Manufacturers Association (EJMA)
- n. Heat Exchange Institute (HEI)

5.3 Other International/ National standards such as DIN, VDI, BS, etc. shall also be accepted for only material codes and manufacturing standards, subject to the Owner's approval, for which the Bidder shall furnish, along with the offer, adequate information to justify that these standards are equivalent or superior to the standards mentioned above. In all such cases the Bidder shall furnish specifically the variations and deviations from the standards mentioned elsewhere in the specification together with the complete word to word translation of the standard that is normally not published in English.

5.4 As regards highly standardized equipment such as Steam Turbine and Generator, National /International standards such as JIS, DIN, VDI, ISO, SEL, SEW, VDE, IEC & VGB shall also be considered as far as applicable for Design, Manufacturing and Testing of the respective equipment.

In addition, these standards shall be referred for the design of machine foundations, wherever specifically mentioned in the specifications. However, for those of the above equipment not covered by these National / International standards, established and proven standards of manufacturers shall also be considered.

5.5 In the event of any conflict between the codes and standards referred to in the above clauses and the requirement of this specification, the requirement of Technical Specification shall govern.

5.6 Two (2) English language copies of all-national and international codes and/or standards used in the design of the plant, equipment, civil and structural works shall be provided by the Bidder to the Owner within two calendar months from the date of the Notification of Award.

5.7 In case of any change in codes, standards & regulations between the date of bid opening and the date when vendors proceed with fabrication, the Owner shall have the option to incorporate the changed requirements or to retain the original standard. It shall be the responsibility of the Bidder to bring to the notice of the Owner such changes and advise Owner of the resulting effect.

6.0 EQUIPMENT FUNCTIONAL GUARANTEE

6.1 The Equipment and Auxiliaries shall be capable of continuous operation in frequency range of 47.5 to 51.5 Hz.

6.2 The functional guarantees of the equipment under the scope of the Contract is given elsewhere in the technical specification. These guarantees shall supplement the general functional guarantee provisions covered under General Conditions of Contract.

6.3 Liquidated damages for shortfall in meeting functional guarantee(s) during the performance and guarantee tests shall be assessed and recovered from the Bidder as specified elsewhere in this specification.

7.0 DESIGN OF FACILITIES/ MAINTENANCE & AVAILABILITY CONSIDERATIONS

7.1 Design of Facilities

All the design procedures, systems and components proposed shall have already been adequately developed and shall have demonstrated good reliability under similar conditions elsewhere.

The Bidder shall be responsible for the selection and design of appropriate equipment to provide the best co-ordinate performance of the entire system. The basic requirements are detailed out in various clauses of the Technical Specifications. The design of various components, assemblies and subassemblies shall be done so that it facilitates easy field assembly and dismantling. All the rotating components shall be so selected that the natural frequency of the complete unit is not critical or close to the operating range of the unit.

7.2 Maintenance and Availability Considerations

Equipment/facilities offered shall be designed for high availability, low maintenance and ease of maintenance. The Bidder shall specifically state the design features incorporated to achieve high

degree of reliability/ availability and ease of maintenance. The Bidder shall also furnish details of availability records in the reference plants stated in his experience list.

Bidder shall state in his offer the various maintenance intervals, spare parts and man-hour requirement during such operation. The intervals for each type of maintenance namely inspection of the furnace, inspection of the entire hot gas path and the minor and major overhauls shall be specified in terms of fired hours, clearly defining the spare parts and man-hour requirement for each stage.

Lifting devices i.e. hoists and chain pulley jacks, etc. shall be provided by the Bidder for handling of any equipment or any of its part having weight in excess of 500 Kgs during erection and maintenance activities. Lifting devices like lifting tackles, slings, etc. to be connected to hook of the hoist / crane shall be provided by the Bidder for lifting the equipment and accessories covered under the specification.

8.0 DOCUMENTS, DATA AND DRAWINGS TO BE FURNISHED BY BIDDER

8.1 Bidders may note that this is a contract inclusive of the scope as indicated elsewhere in the specification. Each of the plant and equipment shall be fully integrated, engineered and designed to perform in accordance with the technical specification. All engineering and technical services required ensuring a completely engineered plant shall be provided in respect of mechanical, electrical, control & instrumentation, civil & structural works as per the scope. The Bidder shall furnish engineering data/drawings in accordance with the schedule of information as specified in Technical Specification and data sheets.

8.2 The number of copies/prints/CD-ROMs/manuals to be furnished for various types of documents is given in Annexure-I of this chapter.

8.3 The documentation that shall be provided by the Bidder is indicated in various sections of specification. The documentation shall include but not be limited to the following:

a. Basic Engineering Documentation

Prior to commencement of the detailed engineering work, the Bidder shall furnish a Plant Definition Manual within 4-6 weeks from the date of the Notification of Award. This manual shall contain the following as a minimum:

- i. System description of all the mechanical, electrical, control & instrumentation & civil systems.
- ii. Technology scan for each system / sub-system & equipment.
- iii. Selection of appropriate technology / schemes for various systems/ Selection subsystems including techno-economic studies between various options.
- iv. Optimization studies including thermal cycle optimization.

- v. Sizing criteria of all the systems, sub-systems including various piping systems/ equipment/ structures/ equipment foundations along with all calculations justifying and identifying the sizing and the design margins.
- vi. Schemes and Process & Instrumentation diagrams for the various systems/ sub-system with functional write-ups.
- vii. Operation Philosophy and the control philosophy of the Main Plant and other plants.
- viii. General Layout plan of the power station incorporating all facilities General in Bidder's as well as those in the Owner's scope. This drawing shall also be furnished in the form of floppy discs to the Owner for engineering of areas not included in Bidder's scope.
- ix. Basic layouts and cross sections of the main plant building (various floor elevations), boiler, fuel oil area and other areas included in the scope of the Bidder.
- x. Documentation in respect of Quality Assurance System as listed out elsewhere in this specification.
- xi. The successful bidder shall furnish within three (3) weeks from the date of Notification of Award, a list of contents of the Plant Definition Manual (PDMs) including techno-economic studies, which shall then be mutually discussed & finalised with the Owner.
- xii. After approval of Plant Definition Manual / Design Basis Report, Bidder shall furnish detailed technical specification of all system / packages of the Plant.

b. Detail Engineering Documentation

- i. Layouts, general arrangements, elevations and cross-sections drawings for all the equipment and facilities of the plant.
- ii. Flow diagrams, Process & Instrumentation Diagrams along with write-up and system description.
- iii. Start-up curves for turbine, boiler and both turbine and boiler combined together as a unit for various start-ups, viz. cold, warm and hot start-up.
- iv. Piping isometric, composite layout and fabrication drawings.
- v. Piping engineering diagrams, pipe and fittings schedules, valve schedules, hanger and support schedules, insulation schedules.
- vi. Technical data sheets for all bought out and manufactured items. Bidder shall use the specifications as a base for placement of orders on their sub-vendors.

- vii. Detailed design calculations for components, system/sub-system, piping etc., wherever applicable including sizing calculations for all auxiliaries as per criteria specified elsewhere in specification.
- viii. Boiler pressure part schedule and sizing calculations. Boiler performance data and boiler design dossier.
- ix. Transient, hydraulic and thermal stress analysis of piping and Transient, system wherever applicable & input and output data along with stress analysis isometrics showing nodes
- x. Thermal cycle information (heat balance diagrams, boiler performance calculations, condenser and heat exchanger thermal calculations etc.).
- xi. Characteristic Curves / Performance Correction Curves. Hydraulic & Mechanical design calculations for condensers & heaters.
- xii. Comprehensive list of all terminal points which interface with Owner's facilities giving details of location, terminal pressure, and temperature, fluid handled & end connection details, forces, moments etc.
- xiii. Power Supply single line diagram, block logics, control schematics, electrical schematics, etc.
- xiv. Protection system diagrams and relay settings.
- xv. Interconnection diagrams.
- xvi. Cable routing plan.
- xvii. Instrument schedule, measuring point list, I/O list, Interconnection & wiring diagram, functional write-ups, and installation drawings for field mounted instruments, logic diagrams, control schematics, wiring and tubing diagrams of panels and enclosures etc. Drawings for open loop and close loop controls (both hardware and software). Motor list and valve schedule including type of actuator etc.
- xviii. Alarm and annunciation list and alarms & trip set points.
- xix. Sequence and protection interlock schemes.
- xx. Type test reports and power system stability study report.
- xxi. Control system configuration diagrams and card circuit diagrams and maintenance details.
- xxii. Detailed software manuals & source software listing.
- xxiii. Detailed flow chart for digital control system.

- xxiv. Mimic diagram layout.
- xxv. Civil Task drawings (for the Engineering by Owner), Design and Drawings for the Civil & Structural works in the scope of the Bidder.
- xxvi. Model study reports wherever applicable.
- xxvii. Functional & guarantee test procedures and test reports.
- xxviii. Documentation in respect of Quality Assurance System as listed out elsewhere in this specification.
- xxix. Documentation in respect of commissioning as listed out elsewhere in this specification.
- xxx. The Bidder while submitting the above documents / drawings for approval / reference as the case may be, shall mark on each copy of submission the reference letter along with the date vide which the submissions are made.

8.3.1 **Instruction Manuals**

The Bidder shall submit to the Owner, draft Instruction Manuals for all the equipment covered under the Contract by the end of one year from the date of his acceptance of the Letter of Award. The Instruction manuals shall contain full details required for erection, commissioning, operation and maintenance of each equipment. The manual shall be specifically compiled for this project. After finalization and approval of the Owner the Instruction Manuals shall be submitted as indicated in Annexure-I of this chapter. The Contract shall not be considered to be completed for purposes of taking over until the final Instructions manuals have been supplied to the Owner. The Instruction Manuals shall comprise of the following.

8.3.2 **Erection Manuals**

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

- a) Erection strategy.
- b) Sequence of erection.
- c) Erection instructions.
- d) Critical checks and permissible deviation/tolerances.
- e) List of tool, tackles, heavy equipment like cranes, dozers, etc.
- f) Bill of Materials
- g) Procedure for erection.
- h) General safety procedures to be followed during erection/installation.
- i) Procedure for initial checking after erection.
- j) Procedure for testing and acceptance norms.
- k) Procedure / Check list for pre-commissioning activities.
- l) Procedure / Check list for commissioning of the system.

- m) Safety precautions to be followed in electrical supply distribution during erection

8.3.3 **Operation & Maintenance Manuals**

- i. The operating and maintenance instructions together with drawings (other than shop 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 give a step by step procedure for all operations likely to be carried out during the life of the plant / equipment including, operation, maintenance, dismantling and repair including periodical activities such as chemical cleaning of the generator. Each manual shall also include a complete set of drawings together with performance/rating curves of the equipment and test certificates wherever applicable. The contract shall not be considered to be completed for purposes for taking over until these manuals have been supplied to the Owner.
- ii. If after the commissioning and initial operation of the plant, the manuals require any modification / additions / changes, the same shall be incorporated and the updated final instruction manuals shall be submitted to the Owner for records.
- iii. A separate section of the manual shall be for each size/ type of equipment and shall contain a detailed description of construction and operation, together with all relevant pamphlets and drawings.
- iv. The manuals shall include the following :
 - a) List of spare parts along with their drawing and catalogues and procedure for ordering spares.
 - b) Lubrication Schedule including charts showing lubrication checking, testing and replacement procedure to be carried daily, weekly, monthly & at longer intervals to ensure trouble free operation.
 - c) Where applicable, fault location charts shall be included to facilitate finding the cause of mal-operation or break down.
- v. Detailed specifications for all the consumables including lubricant oils, greases, chemicals etc. system/equipment/assembly/sub- assembly - wise required for the complete plant.
- vi. On completion of erection, a complete list of bearings / equipment giving their location, and identification marks etc. shall also be furnished to the Owner indicating lubrication method for each type/category of bearing.

8.3.4 **Plant Handbook**

The Bidder shall submit to the Owner a preliminary plant hand book preferably in A-4 size sheets which shall contain the design and performance data of various plants, equipment and systems covering the complete project including

- 1. Design and performance data.

2. Process & Instrumentation diagrams.
3. Single line diagrams.
4. Sequence & Protection Interlock Schemes.
5. Alarm and trip values.
6. Performance Curves.
7. General layout plan and layout of main plant building and auxiliary buildings.
8. Important Do's & Don't's
9. The plant handbook shall be submitted within twelve (12) months from the date of award of contract. After the incorporation of Owner's comments, the final plant handbook complete in all respects shall be submitted three (3) months before start-up and commissioning activities.

8.3.5 **Project Completion Report**

The Bidder shall submit a Project Completion Report at the time of handing over the plant.

8.3.6 **Drawings**

- a. All the plant layouts shall be made in computerized 3D modeling system. The Purchaser reserves the right to review the 3D model at different stages during the progress of engineering. The layout drawings submitted for Purchaser's review shall be fully dimensioned and extracted from 3D model after interference check.
- b. All documents submitted by the Bidder for Owner's review shall be in electronic form (soft copies) along with the desired number of hard copies as per Annexure-I. The soft copies to be supplied shall be either in CDs, or through direct transfer via E-mail, etc. depending upon the nature/volume/size of the document. The drawings submitted for approval could be in the Image form.
- c. Final copies of the approved drawings shall be submitted on CD-ROM along with the requisite number of hard copies as per Annexure-I.
- d. The completed plant documentation including integrated 3-D model with equipment drawings, data sheets, P&ID, BOQ, schematics, logic diagrams, test reports and quality plan, etc. attached to the respective equipment's / systems in the 3D model shall be furnished to Purchaser, along with the design review software which shall include interference check and walk-through animation, loaded on suitable hardware (server and work station). The software shall include facility for obtaining hard copies of all the drawings/documents on standard plotter / printer. The requisite hardware and software shall be supplied and commissioned by the Contractor at Purchaser's Engineering Office Complex as per mutually agreed schedule.
- e. All documents/text information shall be in latest version of MS Office.
- f. All drawings submitted by the Bidder including those submitted at the time of bid shall be in sufficient detail indicating the type, size, arrangement, weight of each component for packing and shipment, the external connection, fixing arrangement required, the dimensions

required for installation and interconnections with other equipment and materials, clearance and spaces required between various portions of equipment and any other information specifically requested in the drawing schedules.

- g. Each drawing submitted by the Bidder (including those of sub-vendors) shall bear a title block at the right hand bottom corner with clear mention of the name of the Owner, Consultant, name of the Project, system designation, the specifications title, the specification number, drawing/document number and revisions. If standard catalogue pages are submitted the applicable items shall be indicated therein. All titles, noting, markings and writings on the drawing shall be in English. All the dimensions should be in metric units.
- h. The drawings submitted by the Contractor (or their sub-vendors) shall bear Purchaser's drawing number in addition to contractor's (their sub-vendor's) own drawing number. Purchaser's drawing numbering system shall be made available to the successful bidder so as to enable him to assign Purchaser's drawing numbers to the drawings to be submitted by him during the course of execution of the Contract
- i. The Bidder shall also furnish a "Master Drawing List" which shall be a comprehensive list of all drawings/ documents/ calculations envisaged to be furnished by him during the detailed engineering to the Owner. Such list should clearly indicate the purpose of submission of these drawings i.e. "FOR APPROVAL" or "FOR INFORMATION ONLY".
- j. Similarly, all the drawings/ documents submitted by the Bidder during detailed engineering stage shall be stamped "FOR APPROVAL" or "FOR INFORMATION" prior to submission.
- k. The furnishing of detailed engineering data and drawings by the Bidder shall be in accordance with the time schedule for the project. The review of these documents/ data/ drawings by the Owner will cover only general conformance of the data/ drawings/ documents to the specifications and contract, interfaces with the equipment provided by others and external connections & dimensions which might affect plant layout. The review by the Owner should not be construed to be a thorough review of all dimensions, quantities and details of the equipment, materials, any devices or items indicated or the accuracy of the information submitted. The review and/ or approval by the Owner / Project Manager shall not relieve the Bidder of any of his responsibilities and liabilities under this contract.
- l. After the approval of the drawings, further work by the Bidder shall be in strict accordance with these approved drawings and no deviation shall be permitted without the written approval of the Owner.
- m. All manufacturing, fabrication and execution of work in connection with the equipment / system, prior to the approval of the drawings, shall be at the Bidder's risk. The Bidder is expected not to make any changes in the design of the equipment /system, once they are approved by the Owner. However, if some changes are necessitated in the design of the equipment/system at a later date, the Bidder may do so, but such changes shall promptly be brought to the notice of the Owner indicating the reasons for the change and get the revised

drawing approved again in strict conformance to the provisions of the Technical Specification.

- n. Drawings shall include all installations and detailed piping layout drawings. Layout drawings for all piping of 65 mm and larger diameter shall be submitted for review/ approval of Owner prior to erection. Small diameter pipes shall however be routed as per site conditions in consultation with site authority/representative of Owner based on requirements of such piping indicated in approved / finalized Flow Scheme / Process & Instrumentation Diagrams and/or the requirements cropping up for draining & venting of larger diameter piping or otherwise after their erection as per actual physical condition for the entire scope of work of this package.
- o. Assessing & anticipating the requirement and supply of all piping and equipment shall be done by the Bidder well in advance so as not to hinder the progress of piping & equipment erection, subsequent system charging and its effective draining & venting arrangement as per site suitability.
- p. As Built Drawings After final acceptance of individual equipment/system by the Owner, the Bidder will update all original drawings and documents for the equipment/ system to “as built” conditions.
- q. Drawings must be checked by the Bidder in terms of its completeness, data adequacy and relevance with respect to engineering schedule prior to submission to the Owner. In case drawings are found to be submitted without proper endorsement for checking by the Bidder, the same shall not be reviewed and returned to the Bidder for re- submission. The Bidder shall make a visit to site to see the existing facilities and understand the layout completely and collect all necessary data/drawings at site which are needed as an input to the engineering. The Bidder shall do the complete engineering including interfacing and integration of all his equipment, systems & facilities within his scope of work as well as interface engineering & integration of systems, facilities, equipment & works under Owner’s scope and submit all necessary drawings/ documents for the same.
- r. The Bidder shall submit adequate prints of drawing/data/document for Owner’s review and approval. The Owner shall review the drawings and return one (1) copy to the Bidder authorizing either to proceed with manufacture or fabrication, or marked to show changes desired. When changes are required, drawings shall be re-submitted promptly, with revisions clearly marked, for final review. Any delays arising out of the failure of the Bidder to submit/rectify and resubmit in time shall not be accepted as a reason for delay in the contract schedule.
- s. All engineering data submitted by the Bidder after final process including review and approval by the Owner shall form part of the contract documents and the entire works covered under these specification shall be performed in strict conformity with technical specifications unless otherwise expressly requested by the Owner in writing.

8.4 Engineering Information Submission Schedule

Prior to the award of Contract, a Detailed Engineering Information Submission Schedule shall be tied up with the Owner. For this, the bidder shall furnish a detailed list of engineering information along with the proposed submission schedule. This list would be a comprehensive one including all engineering data / drawings / information for all bought out items and manufactured items. The information shall be categorised into the following parts.

- (a.) Information that shall be submitted for the approval of the Owner before proceeding further, and
- (b.) Information that would be submitted for Owner's information only.

The Engineering Information Schedule shall be updated month wise.

The schedule should allow adequate time for proper review and incorporation of changes/modifications, if any, to meet the contract without affecting the equipment delivery schedule and overall project schedule. The early submission of drawings and data is as important as the manufacture and delivery of equipment and hardware and this shall be duly considered while determining the overall performance and progress.

8.5 Engineering Progress and Exception Report

8.5.1 Report giving the status of each engineering information including

- (a.) A list of drawings/engineering information which remains unapproved for more than four (4) weeks after the date of first submission
- (b.) Drawings which were not submitted as per agreed schedule.

8.5.2 The draft format for this report shall be furnished to the Owner within four (4) weeks of the award of the contract, which shall then be discussed and finalized with the Owner.

8.6 Technical Co-Ordination Meetings(TCM)

8.6.1 The Bidder shall be called upon to organize and attend monthly Design/ Co- ordination Meetings with the Owner/Owner's representatives, Project Consultant during the period of contract. The Bidder shall attend such meetings at his own cost at mutually agreed venue as and when required and fully co-operate with such persons and agencies involved during the discussions.

8.6.2 The Bidder should note that Time is the essence of the contract. In order to expedite the early completion of engineering activities, the Bidder shall submit all drawings as per the agreed Engineering Information Submission Schedule. The drawings submitted by the Bidder will be reviewed by the Owner as far as practicable within three (3) weeks from the date of receipt of the drawing .The comments of the Owner shall then be discussed across the table during the above co-ordination Meetings wherein best efforts shall be made by both sides to ensure the approval of the drawing.

8.6.3 The Bidder shall ensure availability of the concerned experts / consultants/ personnel who are empowered to take necessary decisions during these meetings. The Bidder shall be equipped with necessary tools and facilities so that the drawings/documents can be resubmitted after incorporating necessary changes and approved during the meeting itself.

8.6.4 Should any drawing remain unapproved for more than six (6) weeks after it's first submission, this shall be brought out in the monthly Engineering Progress and Exception Report with reasons thereof.

8.6.5 Any delays arising out of failure by the Bidder to incorporate Owner's comments and resubmit the same during the TCM shall be considered as a default and in no case shall entitle the Bidder to alter the Contract completion date.

8.7 Design Improvements

The Owner or the Bidder may propose changes in the specification of the equipment or quality thereof and if the parties agree upon any such changes the specification shall be modified accordingly.

If any such agreed upon change is such that it affects the price and schedule of completion, the parties shall agree in writing as to the extent of any changing the price and/or schedule of completion before the Bidder proceeds with the change. Following such agreement, the provision thereof, shall be deemed to have been amended accordingly.

8.8 Equipment Bases

A cast iron or welded steel base plate shall be provided for all rotating equipment which is to be installed on a concrete base, unless otherwise specifically agreed to by the Owner. Each base plate which support the unit and its drive assembly, shall be of a neat design with pads for anchoring the units, shall have a raised lip all around, and shall have threaded drain connections.

8.9 Protective Guards

Suitable guards shall be provided for protection of personnel on all exposed rotating and/or moving machine parts. All such guards shall be designed for easy installation and removal for maintenance purpose.

8.10 Lubricants, Servo Fluids and Chemicals

8.10.1. The Bidder's scope includes all the first fill and one year's topping, requirements of consumables such as oils, lubricants including grease, servo fluids, gases and essential chemicals etc. Consumption of all these consumables during the initial operation and final filling after the initial operation shall also be included in the scope of the Bidder. Bidder shall also supply a quantity not less than 10% of the full charge of each variety of lubricants, servo fluids, gases, chemicals etc. used which is expected to be utilised during the first year of operation. This additional quantity shall be supplied in separate Containers.

8.10.2. As far as possible lubricants marketed by the Indian Oil Corporation shall be used. The variety of lubricants shall be kept to a minimum possible.

Detailed specifications for the lubricating oil, grease, gases, servo fluids, control fluids, chemicals etc. required for the complete plant covered herein shall be furnished. On completion of erection, a complete list of bearings/ equipment giving their location and identification marks shall be furnished to the Owner along with lubrication requirements.

8.11 Lubrication

Equipment shall be lubricated by systems designed for continuous operation. Lubricant level indicators shall be furnished and marked to indicate proper levels under both standstill and operating conditions.

8.12 Material of Construction

All materials used for the construction of the equipment shall be new and shall be in accordance with the requirements of this specification. Materials utilized for various components shall be those which have established themselves for use in such applications.

8.13 Rating Plates, Name Plates & Labels

8.13.1 Each main and auxiliary item of plant including instruments shall have permanently attached to it in a conspicuous position, a rating plate of non- corrosive material upon which shall be engraved manufacturer's name, equipment, type or serial number together with details of the ratings, service conditions under which the item of plant in question has been designed to operate, and such diagram plates as may be required by the Owner.

8.13.2 Each item of plant shall be provided with nameplate or label designating the service of the particular equipment. The inscriptions shall be approved by the Owner or as detailed in appropriate section of the technical specifications.

8.13.3 Such nameplates or labels shall be of white non-hygroscopic material with engraved black lettering or alternately, in the case of indoor circuit breakers, starters, etc. of transparent plastic material with suitably coloured lettering engraved on the back. The name plates shall be suitably fixed on both front and rear sides.

8.13.4 Items of plant such as valves, which are subject to handling, shall be provided with an engraved chromium plated nameplate or label with engraving filled with epoxy. The name plates for valves shall be marked in accordance with MSS standard SP-25 and ANSI B 16.34 as a minimum.

8.13.5 Hanger/ support numbers shall be marked on all pipe supports, anchors, hangers, snubbers and restraint assemblies. Each constant and variable spring support shall also have stamped upon it the designed hot and cold load which it is intended to support. Suitable scale shall also be provided to indicate load on support/hanger.

8.13.6 Valves, steam traps and strainers shall be identified by Owner's tag number of a metal tap permanently attached to non-pressure parts such as the yoke by a stainless steel wire. The direction of flow shall also be marked on the body.

8.13.7 Safety and relief valves shall be provided with the following :

- (a.) Manufacturer's identification.
- (b.) Nominal inlet and outlet sizes in mm.
- (c.) Set pressure in Kg/cm² (abs).
- (d.) Blowdown and accumulation as percentage of set pressure.
- (e.) Certified capacity in Kg of saturated steam per hour or in case of liquid certified capacity in litres of water per minute.

8.13.8 All such plates, instruction plates, etc. shall be bilingual with Hindi inscription first, followed by English. Alternatively, two separate plates one with Hindi and the other with English inscriptions may be provided.

8.13.9 All segregated phases of conductors or bus ducts, indoor or outdoor, shall be provided with coloured phase plates to clearly identify the phase of the system

8.14 Tools and Tackles

The Bidder shall supply with the equipment one complete set of all special tools and tackles and other instruments required for the erection, assembly, disassembly and proper maintenance of the plant and equipment and systems (including software). These special tools will also include special material handling equipment, jigs and fixtures for maintenance and calibration / readjustment, checking and measurement aids etc. A list of such tools and tackles shall be submitted by the Bidder along with the offer.

The price of each tool / tackle shall be deemed to have been included in the total bid price. These tools and tackles shall be separately packed and sent to site. The Bidder shall also ensure that these tools and tackles are not used by him during erection, commissioning and initial operation. For this period the Bidder should bring his own tools and tackles. All the tools and tackles shall be of reputed make acceptable to the Owner.

8.15 Welding

If the manufacturer has special requirements relating to the welding procedures for welds at the terminals of the equipment to be performed by others the requirements shall be submitted to the Owner in advance of commencement of erection work.

8.16 Colour Code for all Equipment/ Piping/ Pipe Services

All equipment/ piping/ pipe services are to be painted by the Bidder in accordance with Owner's standard colour coding scheme, which will be furnished to the Bidder during detailed engineering stage.

8.17 Protection and Preservative Shop Coating

8.17.1 Protection

All coated surfaces shall be protected against abrasion, impact, discoloration and any other damages. All exposed threaded portions shall be suitably protected with either metallic or a non-metallic protection device. All ends of all valves and piping and conduit equipment connections shall be properly sealed with suitable devices to protect them from damage. The parts which are likely to get rusted, due to exposure to weather, should also be properly treated and protected in a suitable manner. All primers/paints/coatings shall take into account the hot humid, corrosive & alkaline, subsoil or over ground environment as the case may be.

8.17.2 Preservative Shop Coating

All exposed metallic surfaces subject to corrosion shall be protected by shop application of suitable coatings. All surfaces which will not be easily accessible after the shop assembly, shall be treated beforehand and protected for the life of the equipment. All surfaces shall be thoroughly cleaned of all mill scales, oxides and other coatings and prepared in the shop. The surfaces that are to be

finish-painted after installation or require corrosion protection until installation, shall be shop painted with at least two coats of primer. Transformers and other electrical equipment if included shall be shop finished with one or more coats of primer and two coats of high grade epoxy. The finished colours shall be as per manufacturer's standards, to be selected and specified by the Owner at a later date.

- 8.17.3 Shop primer for all steel surfaces which will be exposed to operating temperature below 95 degrees Celsius shall be selected by the Bidder after obtaining specific approval of the Owner regarding the quality of primer proposed to be applied. Special high temperature primer shall be used on surfaces exposed to temperature higher than 95 degrees Celsius and such primer shall also be subject to the approval of the Owner.
- 8.17.4 All other steel surfaces which are not to be painted shall be coated with suitable rust preventive compound subject to the approval of the Owner.
- 8.17.5 All piping shall be cleaned after shop assembly by shot blasting or other means approved by the Owner. Lube oil piping or carbon steel shall be pickled.
- 8.17.6 Painting for Civil structures shall be done as per relevant part of technical specification.

9.0 CENTRAL DOCUMENTATION FACILITY

Bidder shall provide a Central Documentation Facility in the room identified at TANGEDCO / Headquarters, which shall be designed to store all the technical documents, drawings, manuals, data sheets etc., as given in respective chapters of Technical Specifications. All the documents, data and manuals that are approved by TANGEDCO as well as other documents shall be sent to this facility, from where it is shall be further distributed to all the concerned departments of the project including contractor's authorized personnel. Complete computerized records shall be maintained in this facility for all the incoming and outgoing drawings as per the procedure to be mutually discussed and agreed between the Owner (TANGEDCO) and the contractor at the time of award of EPC contract. This room shall be equipped with adequate facilities for reading as well as duplication of the drawings, data sheets etc. these facilities shall include but not limited to the following for carrying out works related to this project exclusively at **TANGEDCO / HQ**:

- i. Three (3) Nos. work stations
- ii. Three (3) Nos. Laser Printer A4 Size Coloured
- iii. Two (2) Nos. Nos Laser Colour Plotters of A0 Size,
- iv. Two (2) Nos of Heavy Duty Photo Copier of A4 Size,
- v. Two (2) Nos of Heavy Duty Photo Copier of A4 Size with sorting facility

Specification for above Hardware shall be furnished in line with the specification considered in Control & Instrumentation Volume II Section 2 Part 2.3

Complete consumables for the above, with necessary racks (Min. 06 nos), Special Cabinets (Min. 06 nos made of 18 SWG sheet thickness) for Storage. Modular furniture, tables, chairs etc., shall be provided.

10.0 QUALITY ASSURANCE PROGRAMME

10.1. The Bidder shall adopt suitable quality assurance programme to ensure that the equipment and services under the scope of contract whether manufactured or performed within the Bidder's works or at his sub-Bidder's premises or at the Owner's site or at any other place of work are in accordance with the specifications. Such programs shall be outlined by the Bidder and shall be finally accepted by the Owner/authorized representative after discussions before the award of the contract. The QA programme shall be generally in line with IS/ISO-9001. A quality assurance programme of the Bidder shall generally cover the following:

- (a.) His organization structure for the management and implementation of the proposed quality assurance programme
- (b.) Quality System Manual
- (c.) Design Control System
- (d.) Documentation and Data Control System
- (e.) Qualification data for bidder's key personnel.
- (f.) The procedure for purchase of materials, parts, components and selection of sub-Bidder's services including vendor analysis, source inspection, incoming raw-material inspection, verification of materials purchased etc.
- (g.) System for shop manufacturing and site erection controls including process, fabrication and assembly.
- (h.) Control of non-conforming items and system for corrective actions and resolution of deviations.
- (i.) Inspection and test procedure both for manufacture and field activities.
- (j.) Control of calibration and testing of measuring testing equipment.
- (k.) System for Quality Audits.
- (l.) System for identification and appraisal of inspection status.
- (m.) System for authorising release of manufactured product to the Owner.
- (n.) System for handling, storage and delivery.
- (o.) System for maintenance of records, and
- (p.) 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.

10.2. General Requirements - Quality Assurance

10.2.1 All materials, components and equipment covered under this specification shall be procured, manufactured, erected, commissioned and tested at all the stages, 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 duly approved by the Owner. The detailed Quality Plans for manufacturing and field activities shall be drawn up by the Bidder and will be submitted to Owner for approval. Schedule of finalisation of such quality plans will be finalised before award. Monthly progress reports on MQP/FQP submission/approval shall be furnished.

10.2.2 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/ Sub-Bidder's/ sub-supplier'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. The Quality Plan shall be submitted on electronic media e.g. Compact Disc or E-mail in addition to hard copy, for review and approval. After approval the same shall be submitted in compiled form on CD-ROM.

- 10.2.3 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 starting from receipt of materials/equipment at site.
- 10.2.4 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 Owner's approval without which manufacturer shall not proceed. These approved documents shall form a part of the contract. In these approved Quality Plans, Owner shall identify customer hold points (CHP), i.e. test/checks which shall be carried out in presence of the Owner's Project Manager or his authorised representative and beyond which the work will not proceed without consent of Owner in writing. All deviations to this specification, approved quality plans and applicable standards must be documented and referred to Owner along with technical justification for approval and dispositioning.
- 10.2.5 No material shall be despatched from the manufacturer's works before the same is accepted, subsequent to pre-dispatch final inspection including verification of records of all previous tests/inspections by Owner's Project Manager/Authorised representative and duly authorised for despatch by issuance of Material Despatch Clearance Certificate (MDCC).
- 10.2.6 All material used for equipment manufacture including casting and forging etc. shall be of tested quality as per relevant codes/standards. Details of results of the tests conducted to determine the mechanical properties; chemical analysis and details of heat treatment procedure recommended and actually followed shall be recorded on certificates and time temperature chart. Tests shall be carried out as per applicable material standards and/or agreed details.
- 10.2.7 The Bidder shall submit to the Owner Field Welding Schedule for field welding activities in the enclosed format. The field welding schedule shall be submitted to the Owner along with all supporting documents, like welding procedures, heat treatment procedures, NDT procedures etc. at least ninety days before schedule start of erection work at site.
- 10.2.8 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 welding/brazing procedures shall be submitted to the Owner or its authorised representative for approval prior to carrying out the welding/brazing.
- 10.2.9 All brazers, welders and welding operators employed on any part of the contract either in Bidder's/sub-Bidder works or at site or elsewhere shall be qualified as per ASME Section-IX or BS-4871 or other equivalent International Standards acceptable to the Owner.

- 10.2.10 Welding procedure qualification & Welder qualification test results shall be furnished to the Owner for approval. However, where required by the Owner, tests shall be conducted in presence of Owner/authorised representative.
- 10.2.11 For all pressure parts and high pressure piping welding, the latest applicable requirements of the IBR (Indian Boiler Regulations) shall also be essentially complied with. Similarly, any other statutory requirements for the equipment/systems shall also be complied with. On all back-gauged welds MPI/LPI shall be carried before seal welding.
- 10.2.12 Unless otherwise proven and specifically agreed with the Owner, welding of dissimilar materials and high alloy materials shall be carried out at shop only.
- 10.2.13 No welding shall be carried out on cast iron components for repair.
- 10.2.14 All the heat treatment results shall be recorded on time temperature charts and verified with recommended regimes.
- 10.2.15 All non-destructive examination shall be performed in accordance with written procedures as per International Standards, The NDT operator shall be qualified as per SNT-TC-IA (of the American Society of non-destructive examination). NDT shall be recorded in a report, which includes details of methods and equipment used, result/evaluation, job data and identification of personnel employed and details of co-relation of the test report with the job.
- All plates of thickness above 40mm & all bar stock/Forging above 40mm dia shall be ultrasonically tested. For pressure parts, plate of thickness equal to or above 25mm shall be ultrasonically tested.
- 10.2.16 The Bidder shall list out all major items/ equipment/ components to be manufactured in house as well as procured from sub-contractors bought out items (BOI). All the sub-Bidder proposed by the Bidder for procurement of major bought out items including castings, forging, semi-finished and finished components/equipment etc., list of which shall be drawn up by the Bidder and finalised with the Owner, shall be subject to Owner's approval. The Bidder's proposal shall include vendor's facilities established at the respective works, the process capability, process stabilization, QC systems followed, experience list, etc. along with his own technical evaluation for identified sub-contractors enclosed and shall be submitted to the Owner for approval within the period agreed at the time of pre-awards discussion and identified in review category prior to any procurement. Monthly progress reports on sub- Bidder detail submission / approval shall be furnished. Such vendor approval shall not relieve the Bidder from any obligation, duty or responsibility under the contract.
- 10.2.17 For components/equipment procured by the contractors for the purpose of the contract, after obtaining the written approval of the Owner, the Bidder's purchase specifications and inquiries shall call for quality plans to be submitted by the suppliers. The quality plans called for from the sub-Bidder shall set out, during the various stages of manufacture and installation, the quality practices and procedures followed by the vendor's quality control organisation, the relevant reference documents/standards used, acceptance level, inspection of documentation raised, etc. Such quality plans of the successful vendors shall be finalised with the Owner and such approved

Quality Plans shall form a part of the purchase order/contract between the Bidder and sub-Bidder. Within three weeks of the release of the purchase orders /contracts for such bought out items /components, a copy of the same without price details but together with the detailed purchase specifications, quality plans and delivery conditions shall be furnished to the Owner on the monthly basis by the Bidder along with a report of the Purchase Order placed so far for the contract.

- 10.2.18 Owner reserves the right to carry out quality audit and quality surveillance of the systems and procedures of the Bidder's or their sub-Bidder's quality management and control activities. The Bidder shall provide all necessary assistance to enable the Owner carry out such audit and surveillance.
- 10.2.19 The Bidder shall carry out an inspection and testing programme during manufacture in his work and that of his sub-Bidder's and at site to ensure the mechanical accuracy of components, compliance with drawings, conformance to functional and performance requirements, identity and acceptability of all materials parts and equipment. Bidder shall carry out all tests/inspection required to establish that the items/equipment conform to requirements of the specification and the relevant codes/standards specified in the specification, in addition to carrying out tests as per the approved quality plan.
- 10.2.20 Quality audit/surveillance/approval of the results of the tests and inspection will not, however, prejudice the right of the Owner to reject the equipment if it does not comply with the specification when erected or does not give complete satisfaction in service and the above shall in no way limit the liabilities and responsibilities of the Bidder in ensuring complete conformance of the materials/equipment supplied to relevant specification, standard, data sheets, drawings, etc.
- 10.2.21 For all spares and replacement items, the quality requirements as agreed for the main equipment supply shall be applicable.
- 10.2.22 Repair/rectification procedures to be adopted to make the job acceptable shall be subject to the approval of the Owner/ authorised representative.
- 10.2.23 **Burn in and Elevated Temperature Test Requirement for Electronics Solid State Equipment**
All solid state electronic systems/equipment shall be tested as a complete system/equipment with all devices connected for a minimum of 168 hours (7 Days) continuously under energized conditions prior to shipment from manufacturing works, as per the following cycle.

Elevated Temperature Test Cycle

During the elevated temperature test which shall be for 48 hours of the total 168 hours of testing, the ambient temperature shall be maintained at 50 deg.C. The equipment shall be interconnected with devices which will cause it to repeatedly perform all operations it is expected to perform in actual service with load on various components being equal to those which will be experienced in actual service.

During the elevated temperature test the cubicle doors shall be closed (or shall be in the position same as they are supposed to be in the field) and inside temperature in the zone of highest heat

dissipating components/modules shall be monitored. The temperature rise inside the cubicle should not exceed 10 deg.C above the ambient temp. at 50 deg.C.

Burn in Test Cycle

The 48 hours elevated temperature test shall be followed by 120 hours of burn in test as above except that the temperature shall be reduced to the ambient temperature prevalent at that time. During the above tests, the process I/O and other load on the system shall be simulated by simulated inputs and in the case of control systems, the process which is to be controlled shall also be simulated. Testing of individual components or modules shall not be acceptable.

In case the Bidder/ sub-Bidder is having any alternate established procedure of eliminating infant mortile components, the detail procedures followed by the Bidder/ sub- Bidder along with the statistical figures to validate the alternate procedure to be forwarded.

The Bidder/Sub-Bidder shall carry out routine test on 100% item at Bidder/sub-Bidder's works. The quantum of check/test for routine & acceptance test by Owner shall be generally as per criteria/sampling plan defined in referred standards. Wherever standards have not been mentioned quantum of check/test for routine / acceptance test shall be as agreed during detailed engineering stage.

10.3. QA Documentation Package

The Bidder shall be required to submit the QA Documentation in two hard copies and two CD ROMs, as identified in respective quality plan with tick mark.

- 10.3.1 Each QA Documentation shall have a project specific Cover Sheet bearing name & identification number of equipment and including an index of its contents with page control on each document. The QA Documentation file shall be progressively completed by the Supplier's sub- supplier to allow regular reviews by all parties during the manufacturing.

The final quality document will be compiled and issued at the final assembly place of equipment before despatch. However CD-ROM may be issued not later than three weeks.

- 10.3.2 Typical contents of QA Documentation is as below:-

- a. Quality Plan
- b. Material mill test reports on components as specified by the specification and approved Quality Plans.
- c. Manufacturer / works test reports/results for testing required as per applicable codes and standard referred in the specification and approved Quality Plans.
- d. Non-destructive examination results /reports including radiography interpretation reports. Sketches/drawings used for indicating the method of traceability of the radiographs to the location on the equipment.
- e. Heat Treatment Certificate/Record (Time- temperature Chart)
- f. All the accepted Non-conformance Reports (Major/Minor) / deviation, including complete technical details / repair procedure).

- g. CHP / Inspection reports duly signed by the Inspector of the Owner and Bidder for the agreed Customer Hold Points.
 - h. Certificate of Conformance (COC) wherever applicable.
 - i. MDCC
- 10.3.3 Similarly, the Bidder shall be required to submit two sets (two hard copies and two CD ROMs), containing QA Documentation pertaining to field activities as per Approved Field Quality Plans and other agreed manuals/ procedures, prior to commissioning of individual system.
- 10.3.4 Before despatch / commissioning of any equipment, the Supplier shall make sure that the corresponding quality document or in the case of protracted phased deliveries, the applicable section of the quality document file is completed. The supplier will then notify the Inspector regarding the readiness of the quality document (or applicable section) for review.
- (a.) If the result of the review carried out by the Inspector is satisfactory, the Inspector shall stamp the quality document (or applicable section) for release.
 - (b.) If the quality document is unsatisfactory, the Supplier shall endeavour to correct the incompleteness, thus allowing to finalize the quality document (or applicable section) by time compatible with the requirements as per contract documents. When it is done, the quality document (or applicable section) is stamped by the Inspector.
 - (c.) If a decision is made despatch, whereas all outstanding actions cannot be readily cleared for the release of the quality document by that time. The supplier shall immediately, upon shipment of the equipment, send a copy of the quality document Review Status signed by the Supplier Representative to the Inspector and notify of the committed date for the completion of all outstanding actions & submission. The Inspector shall stamp the quality document for applicable section when it is effectively completed. The submission of QA documentation package shall not be later than 3 weeks after the despatch of equipment.
- 10.3.5 **Transmission of QA Documentation**
- On release of QA Documentation by Inspector, one set of quality document shall be forwarded to Corporate Quality Assurance Department and other set to respective Project Site of Owner. For the particular case of phased deliveries, the complete quality document to the Owner shall be issued not later than 3 weeks after the date of the last delivery of equipment.
- 10.4. Project Manager's Supervision**
- 10.4.1 To eliminate delays and avoid disputes and litigation, it is agreed between the parties to the Contract that all matters and questions shall be referred to the Project Manager and without prejudice to the provisions of 'Arbitration' clause in Section General Conditions of Contract, the Bidder shall proceed to comply with the Project Manager's decision.
- 10.4.2 The work shall be performed under the supervision of the Project Manager. The scope of the duties of the Project Manager pursuant to the Contract, will include but not be limited to the following:
- (a.) Interpretation of all the terms and conditions of these documents and specifications.

- (b.) Review and interpretation of all the Bidder's drawing, engineering data, etc:
- (c.) Witness or his authorised representative to witness tests and trials either at the manufacturer's works or at site, or at any place where work is performed under the contract.
- (d.) Inspect, accept or reject any equipment, material and work under the contract.
- (e.) Issue certificate of acceptance and/or progressive payment and final payment certificates
- (f.) Review and suggest modifications and improvement in completion schedules from time to time, and
- (g.) Supervise Quality Assurance Programme implementation at all stages of the works.

10.5. Inspection, Testing And Inspection Certificates

- 10.5.1 The word 'Inspector' shall mean the Project Manager and/or his authorized representative and/or an outside inspection agency acting on behalf of the Owner to inspect and examine the materials and workmanship of the works during its manufacture or erection.
- 10.5.2 The Project Manager or his duly authorized representative and/or an outside inspection agency acting on behalf of the Owner shall have access at all reasonable times to inspect and examine the materials and workmanship of the works during its manufacture or erection and if part of the works is being manufactured or assembled on other premises or works, the Bidder shall obtain for the Project Manager and for his duly authorized representative permission to inspect as if the works were manufactured or assembled on the Bidder's own premises or works.
- 10.5.3 The Bidder shall give the Project Manager/Inspector fifteen (15) days written notice of any material being ready for testing. Such tests shall be to the Bidder's account except for the expenses of the Inspector's. The Project Manager/Inspector, unless the witnessing of the tests is virtually waived and confirmed in writing, will attend such tests within fifteen (15) days of the date on which the equipment is noticed as being ready for test/inspection failing which the 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 two (2) copies.
- 10.5.4 The Project Manager or Inspector shall within fifteen (15) days from the date of inspection as defined herein give notice in writing to the 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 Bidder shall give due consideration to such objections and shall either make modifications that may be necessary to meet the said objections or shall inform in writing to the Project Manager/Inspector giving reasons therein, that no modifications are necessary to comply with the contract.
- 10.5.5 When the factory tests have been completed at the Bidder's or sub-Bidder's works, the Project Manager/Inspector shall issue a certificate to this effect fifteen (15) days after completion of tests but if the tests are not witnessed by the Project Manager /Inspectors, the certificate shall be issued within fifteen (15) days of the receipt of the Bidder's test certificate by the Project Manager /Inspector. Project Manager /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.

- 10.5.6 In all cases where the contract provides for tests whether at the premises or works of the Bidder or any sub-Bidder, the Bidder, except where otherwise specified shall provide free of charge such items as labour, material, electricity, fuel, water, stores, apparatus and instruments as may be reasonably demanded by the Project Manager /Inspector or his authorized representatives to carry out effectively such tests on the equipment in accordance with the Bidder and shall give facilities to the Project Manager/Inspector or to his authorized representative to accomplish testing.
- 10.5.7 The inspection by Project Manager / Inspector and issue of Inspection Certificate thereon shall in no way limit the liabilities and responsibilities of the Bidder in respect of the agreed Quality Assurance Programme forming a part of the contract.
- 10.5.8 To facilitate advance planning of inspection in addition to giving inspection notice as specified at clause no 10.5.3- of this chapter, 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.
- 10.5.9 All inspection, measuring and test equipment used by Bidder shall be calibrated periodically depending on its use and criticality of the test/measurement to be done. The Bidder shall maintain all the relevant records of periodic calibration and instrument identification, and shall produce the same for inspection by the Owner. Wherever asked specifically, the Bidder shall re-calibrate the measuring/test equipment in the presence of Project Manager/Inspector.
- 10.6. Associated document for quality assurance programme:**
- I. List of items requiring quality plan and sub supplier approval. (Annexure-III).
 - II. Status of items requiring Quality Plan and sub supplier approval. (Annexure- IV).
 - III. Field Welding Schedule (Annexure-V).
 - IV. Manufacturing Quality Plan (Annexure-VI).
 - V. Field Quality Plan (Annexure-VII).

11.0 PRE-COMMISSIONING AND COMMISSIONING FACILITIES

- (a.) As soon as the facilities or part thereof has been completed operationally and structurally and before start-up, each item of the equipment and systems forming part of facilities shall be thoroughly cleaned and then inspected jointly by the Owner and the Bidder for correctness of and completeness of facility or part thereof and acceptability for initial pre-commissioning tests, commissioning and start-up at Site. The list of pre-commissioning tests to be performed shall be as mutually agreed and included in the Bidder's quality assurance programme as well as those included elsewhere in the Technical Specifications.
- (b.) The Bidder's pre-commissioning/ commissioning/start-up engineers, specially identified as far as possible, shall be responsible for carrying out all the pre-commissioning tests at Site. On completion of inspection, checking and after the pre-commissioning tests are satisfactorily over, the commissioning of the complete facilities shall be commenced during which period the complete facilities, equipment shall be operated integral with sub-systems and supporting equipment as a complete plant. It will be the responsibility of the Bidder to assess and furnish a list of all commissioning spares required for successful commissioning

of all the equipment covered under the contract. Such a list shall be furnished by the Bidder within 12 months from the date of LOA, separately for each equipment and shall be reviewed by the Owner and discussed for mutual agreement. The commissioning spares will be so identified as not to allow the trial operation to suffer for want of such commissioning spares. The identification of commissioning spares will not in any way relieve the Bidder of any of his responsibilities of satisfactory performance under the provisions of other conditions of contract. All the commissioning spares shall be deemed to be included in scope of the Bidder as a part of the respective equipment package at no extra cost to the Owner.

- (c.) All piping system shall be flushed, steam blown, air blown as required and cleanliness demonstrated using acceptable industry standards. Procedures to accomplish this work shall be submitted for approval to the Owner six months prior to the respective implementations. The Owner will approve final verification of cleanliness.
- (d.) The time consumed in the inspection and checking of the units shall be considered as a part of the erection and installation period.
- (e.) The check outs during the pre - commissioning period should be programmed to follow the construction completion schedule. Each equipment/system, as it is completed in construction and turned over to Owner's commissioning (start-up) Engineer(s), should be checked out and cleaned. The checking and inspection of individual systems should then follow a prescribed commissioning documentation [SLs (Standard Check List) / TS (Testing Schedule) / CS (Commissioning Schedule)] approved by the Owner.
- (f.) The Bidder during initial operation and performance testing shall conduct vibration testing to determine the 'base line' of performance of all plant rotating equipment. These tests shall be conducted when the equipment is running at the base load, peak load as well as lowest sustained operating condition as far as practicable.
- (g.) Bidder shall furnish the commissioning organization chart for review & acceptance of Owner at least eighteen months prior to the schedule date of synchronization. The chart should contain :
 - 1. Bio data including experience of the Commissioning Engineers.
 - 2. Role and responsibilities of the Commissioning Organisation members.
 - 3. Expected duration of posting of the above Commissioning Engineers at site.

11.1 Initial Operation

- a) On completion of all pre-commissioning activities / tests and as a part of commissioning the complete facilities shall be put on 'Initial Operation' during which period all necessary adjustments shall be made while operating over the full load range enabling the facilities to be made ready for the Guarantee Tests.
- b) The 'Initial Operation' of the complete facility as an integral unit shall be conducted for 720 continuous hours. During the period of initial operation of 720 hours, the unit shall operate continuously at full rated load for a period not less than 72 hours.

- c) The Initial Operation shall be considered successful, provided that each item/ part of the facility can operate continuously at the specified operating characteristics, for the period of Initial Operation with all operating parameters within the specified limits and at or near the predicted performance of the equipment/ facility.
- d) The Bidder shall intimate the Owner about the commencement of initial operation and shall furnish adequate notice to the Owner in this respect.
- e) Any loss of generation due to constraints attributable to the Owner shall be construed as Deemed Generation.
- f) An Initial Operation report comprising of observations and recordings of various parameters to be measured in respect of the above Initial Operation shall be prepared by the Bidder. This report, besides recording the details of the various observations during initial operation shall also include the dates of start and finish of the Initial Operation and shall be signed by the representatives of both the parties. The report shall have sheets, recording all the details of interruptions occurred, adjustments made and any minor repairs done during the Initial Operation. Based on the observations, necessary modifications/repairs to the plant shall be carried out by the Bidder to the full satisfaction of the Owner to enable the latter to accord permission to carry out the Guarantee tests on the facilities. However, minor defects which do not endanger the safe operation of the equipment, shall not be considered as reasons for withholding the aforesaid permission.

11.2 Guarantee Tests

- a) The final test as to prove the Performance Guarantees shall be conducted at Site by the Bidder in presence of the Owner. The Bidder's Commissioning, Start-up, Purchaser shall make the unit ready to conduct such test. Such test will be commenced within a period of three (3) months after the successful completion of Initial Operations. Any extension of time beyond the above three (3) months shall be mutually agreed upon. These tests shall be binding on both the parties of the Contract to determine compliance of the equipment with the functional guarantee
- b) For performance/ demonstration tests instrumentations, of accuracy class, to the approval of the Owner shall be used. The numbers and location of the instruments shall be as per the specified test codes. In addition the values of parameters shall be logged from the information system provided under Owner's Distributed Digital Control Monitoring and Information system. Test will be conducted at specified load points.
- c) Any special equipment, tools and tackles required for the successful completion of the Guarantee Tests shall be provided by the Bidder, free of cost.
- d) The Guarantee tests and specific tests to be conducted on equipment have been brought out in detail elsewhere in the specification.

12.0 TAKING OVER

Upon successful completion of Initial Operations and all the tests other than guarantee tests conducted to the Owner's satisfaction, the Owner shall issue to the Bidder a Taking over Certificate as a proof of the final acceptance of the equipment. Such certificate shall not unreasonably be withheld nor will the Owner delay the issuance thereof, on account of minor omissions or defects which do not affect the commercial operation and/or cause any serious risk to the equipment. Such certificate shall not relieve the Bidder of any of his obligations which otherwise survive, by the terms and conditions of the Contract after issuance of such certificate.

13.0 TRAINING OF OWNER'S PERSONNEL

13.1 The scope of service under training of Owner shall include a training module in the areas of Operation & Maintenance.

Such training should cover the following areas as a minimum in order to enable these personnel to individually take the responsibility of operating and maintaining the power station in a manner acceptable to the Owner:

- (a.) Training for Steam Generator Equipment
- (b.) Training for TG and related equipment.
- (c.) DDCMIS
- (d.) Training for Electric Power Supply systems
- (e.) Training for HT motor
- (f.) Training for power cycle piping/critical piping.

The above training shall be provided taken by the EPC Bidder in one of the reference power plant.

13.2 The scope of services under training shall also necessarily include training of Owner's Engineering personnel covering a training module of upto 52 man months. This shall cover all disciplines viz, Mechanical, Electrical, C&I, & QA etc. and shall include all the related areas like Design familiarization, training on product design features and product design softwares of major equipment and systems, engineering, manufacturing, erection, commissioning, training on operating features of equipment, quality assurance and testing, plant visits and visits to manufacturer's works, exposure to various kinds of problems which may be encountered in fabrication, manufacturing, erection, welding etc. An indicative module of the training requirement of Owner's Engineering personnel is attached as Annexure-II.

Four (4) man month and two (2) man month training for Purchasers Engineering Personnel on the offered CFD modelling code for SG & ESP including alternative geometry modelling technique to be provided.

13.3 Bidder shall furnish in his offer, details of training module(s) covering above requirements which shall be subject to Owner's approval. Consolidated training period included above (i.e. 35 and 52 man months respectively for O&M and Engineering) is indicative only. Owner reserves the right to

re-appropriate the training period between O&M and engineering depending upon the details of training module proposed by the Bidder.

- 13.4 Clause 13.2 & 13.3 shall be applicable for domestic bidders. For foreign bidders refer Vol I, Section 2, GCC.
- 13.5 Exact details, extent of training and the training schedule shall be finalised based on the Bidder's proposal within two (2) months from placement of award.
- 13.6 In all the above cases, wherever the training of Owner's personnel is arranged at the works of the manufacturer's it shall be noted that the lodging and boarding of the Owner's personnel shall be at the cost of Bidder. The Bidder shall make all necessary arrangements towards the same.
- 13.7 Take off prices (product wise) should be indicated by the Bidder in the Bid Proposal Sheets. Owner reserves the right to include or exclude these item(s) during place of Award. All expenses except travelling expenses shall be borne by the contractor.

14.0 SAFETY ASPECTS DURING CONSTRUCTION AND ERECTION

In addition to the requirements given in Erection Conditions of Contract (ECC) the following shall also cover:

- a. Working platforms should be fenced and shall have means of access.
- b. Ladders in accordance with Owner's safety rules for construction and erection shall be used. Rungs shall not be welded on columns. All the stairs shall be provided with handrails immediately after its erection.

15.0 NOISE LEVEL

The equivalent 'A' weighted sound pressure level measured at a height of 1.0 m above floor level in elevation and at a distance of one (1) meter horizontally from the nearest surface of any equipment / machine, furnished and installed under these specifications, expressed in decibels to a reference of 0.0002 microbar, shall not exceed 85 dBA except for

- (a.) Safety valves and associated vent pipes for which it shall not exceed 105 dBA.
- (b.) Regulating drain valves in which case it shall be limited to 90 dBA.
- (c.) TG unit in which case it shall not exceed 90 dBA.
- (d.) For HP-LP bypass valves and other intermittently operating control valves, the noise level shall be within the limit of 85 dBA.

16.0 PACKAGING AND TRANSPORTATION

All the equipment & spares 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. Each spare shall be clearly marked or labelled on the outside of the packing with its description. When more than one spare part is packaged in a single case, a general description of the contents shall be shown on the outside of such a case and other packages must be suitably marked and numbered for the purpose of identification. All cases, containers or packages, are liable to be opened for such examination as may be considered reasonable by the Engineer. In case of

equipment supplied with grease/lubricants from imported origin, the supplied shall clearly indicate the indigenous equivalent of the grease/lubricant and source of supply so as to enable the Owner to procure these items from indigenous sources. While packing all the materials, the limitation from the point of view of the sizes of railway wagons available in India should be taken account of. The Bidder shall be responsible for any loss or damage during transportation, handling and storage due to improper packing. The Bidder shall ascertain the availability of Railway wagon sizes from the Indian Railways or any other agency concerned in India well before effecting dispatch of equipment. Before dispatch it shall be ensured that complete processing and manufacturing of the components is carried out at shop, only restricted by transport limitation, in order to ensure that site works like grinding, welding, cutting & pre-assembly to bare minimum. The Owner's Inspector shall have right to insist for completion of works in shops before dispatch of materials for transportation.

17.0 ELECTRICAL ENCLOSURE

All electrical equipment and devices, including insulation, heating and ventilation devices shall be designed for ambient temperature and a maximum relative humidity as specified elsewhere in the specification.

18.0 INSTRUMENTATION AND CONTROL

All instrumentation and control systems/ equipment/ devices/ components, furnished under this contract shall be in accordance with the requirements stated herein, unless otherwise specified in the detailed specifications.

18.1 All instrument scales and charts shall be calibrated and printed in metric units and shall have linear graduation. The ranges shall be selected to have the normal reading at 75% of full scale. All scales and charts shall be calibrated and printed in Metric Units as follows:

a)	Temperature	Degree centigrade (deg C)
b)	Pressure	Kilograms per square centimeter (Kg/cm ²). Pressure instrument shall have the unit suffixed with 'a' to indicate absolute pressure. If nothing is there, that will mean that the indicated pressure is gauge pressure.
c)	Draught	Millimeters of water column (mm wc).
d)	Vacuum	Millimeters of mercury column (mm Hg) or water column (mm Wcl).
e)	Flow (Gas)	Tonnes/ hour
f)	Flow (Steam)	Tonnes/ hour
g)	Flow (Liquid)	Tonnes/ hour
h)	Flow base	760 mm Hg. 15 deg.C
i)	Density	Grams per cubic centimeter.

18.2 All instruments and control devices provided on panels shall be of miniaturized design, suitable for modular flush mounting on panels with front draw out facility and flexible plug-in connection at rear.

18.3 All electronic modules shall have gold plated connector fingers and further all input and output modules shall be short circuit proof. These shall also be tropicalized & components shall be of industrial grade or better.

19.0 ELECTRICAL NOISE CONTROL

The equipment furnished by the Bidder shall incorporate necessary techniques to eliminate measurement and control problems caused by electrical noise. Areas in Bidder's equipment, which are vulnerable to electrical noise shall be hardened to eliminate possible problems. Any additional equipment, services required for effectively eliminating the noise problems shall be included in the proposal. The equipment shall be protected against ESD as per IEC-801- 2. Radio Frequency interference (RFI) and Electro Magnetic Interference (EMI) protection against hardware damage and control system mal-operations/errors shall be provided for all systems.

20.0 INSTRUMENT AIR SYSTEM

The instrument air supply system as supplied by the Bidder for various pneumatic control & instrumentation devices like pneumatic actuators, power cylinders, E/P converters, piping / tubing etc. shall be as per the details furnished elsewhere.

Each pneumatic instrument shall have an individual air shut - off valve. The pressure-regulating valve shall be equipped with an internal filter, a 50 mm pressure gauge and a built-in filter housing blow down valve.

21.0 TAPPING POINTS FOR MEASUREMENTS

Tapping points shall include probes, wherever applicable, for analytical measurements and sampling.

For direct temperature measurement of all working media, one stub with internal threading of approved pattern shall be provided along with suitable plug and washer. The Bidder will be intimated about thread standard to be adopted. The following shall be provided on equipment by the Bidder. The standard which is to be adopted, will be intimated to the Bidder.

- (a.) Temperature test pockets with stub and thermowell
- (b.) Pressure test pockets

22.0 ELECTRONIC MODULE/COMPONENT DETAILS

The Bidder shall have to furnish all technical details including circuit diagrams, specifications of components, etc., in respect of each and every electronic card/module as employed on the various solid state as well as microprocessor based systems and equipment including conventional instruments, peripherals etc. It is mandatory for the Bidder to identify clearly the custom built ICs used in the package. The Bidder shall also furnish the details of any equivalents of the same.

23.0 ENVIRONMENTAL MONITORING & CONTROL MEASURES

Bidder to note that MOEF has declared Manali area as critically polluted area and also imposed certain restrictions on consideration of development of projects.

Concerned authorities have been addressed to have self-monitoring system (for Air, Water & Land) so as to ascertain the level of compliance of standards prescribed by MOEF and also to furnish the action plan ie., for the establishment of self-monitoring system. It is also directed to undertake

Environmental Audit (EA) to ascertain the compliance level of standards notified by MOEF. In this context it is to be noted that our proposed project is also located in the said critically polluted cluster. Though environmental clearance for the said project has been obtained the Controlling Authorities will be highly keen and keep a tight vigil on the availability/provision of self monitoring system (for Air, Water & Land) so as to ascertain the level of compliance of standards prescribed by MOEF.

Environmental Clearance:

For Compliance of conditions stipulated by TNPCB under section 21 of the Air (Prevention and control of Pollution) Act 1981 as amended in 1987, the following are included in the specification:

- (a.) RCC chimney with designed height of 275mtrs included in the specification.
- (b.) High efficiency ESPs (99.9% efficiency) have been proposed to ensure emission of particulate matter within 50 mg/Nm³.
- (c.) Equipment for continuous monitoring of Ambient Air Quality has been proposed.
- (d.) On line / automatic continuous stack monitor has been proposed.
- (e.) Port holes in the chimney and sampling facilities for the stack for the proposed Boiler, as per the Central Pollution Control Board guide lines.
- (f.) The unit shall have suitable sufficient acoustic measures for Generator, Turbine, Coal crusher and other sources including special anti-vibration Foundation for which all the heavy rotating equipment / machines shall be erected over the Anti vibration foundations to reduce noise, vibration etc.,
- (g.) The unit shall have separate energy meter for the operation of the Electro Static Precipitator, the Air pollution control equipment for the proposed Boiler.
- (h.) Alternate power source will come into effect in case of power failure for
- (i.) the operation of Air Pollution Control measures laboratory for analysis of gaseous / particulate emissions
- (j.) The coal shall be stored in a completely paved area with the provisions for leach ate collection. The coal storage yard shall be provided with wind barriers of sufficient height. The height of the coal piles shall be lower than that of the wind barrier.
- (k.) The location of wind barriers shall be based on the predominant wind direction and shall be in consultation with TNPCB so as to avoid fugitive dust emission.
- (l.) Closed conveyors for coal transport and Bag filters in all the transfer points to control dust emission have been proposed
- (m.) Dust suppression system / water sprinklers to keep the stock pile sufficiently wet all the time to avoid carryover of dust.
- (n.) All the internal roads shall be well paved and be provided with water sprinkling arrangement to avoid fugitive dust emission during vehicle movement. The unit shall limit the speed of the vehicle to 10KM/hr. for heavy vehicles within the plant premises to prevent the road dust emission.
- (o.) Burners have been designed for low NO_x.
- (p.) Space provision made for installation of FGD of requisite efficiency of removal of SO₂, if required at a later stage for which adequate space is provided near the chimney.
- (q.) The unit shall ensure that the velocity of the exit gas from the stack shall be greater than 25 m/sec and the ratio of the exit gas to wind velocity shall not be less than 1.5 to eliminate or reduce pollutant down wash.

- (r.) The unit shall have on line/automatic continuous stack monitors with computer recording arrangement for monitoring SPM, Sox and Nox in the boiler emission.
- (s.) Sewage Treatment Plant & Effluent Treatment Plant has been proposed.
- (t.) Natural draft cooling tower has been included in the specification.
- (u.) 100% Dry fly ash collection system and conventional wet bottom ash disposal is included. However ash water recovery system is included in this scope if ash slurry is disposed in the ash pond in emergencies.
- (v.) Ash slurry pipe lines and ash water recovery pipe lines of adequate capacity and strength are proposed to be provided. However these pipe lines will be used only during emergency, since 100% dry fly ash collection is proposed.

Hence, it is stated that the implementation of Environmental measures including self-monitoring system (for air, Water and land) as per the EC granted, especially in the following areas have to be ensured by the bidder without any exception:

Continuous Air quality monitoring stations

Online monitoring system

Effluent Treatment plant

Sewage treatment plant

Optimum use of land area

100% Ash collection & utilisation

Green Belt Development.

ANNEXURE-I

S. NO.	DESCRIPTION OF MANUALS	NO OF PRINTS (sets)	NO. OF CD-ROMs (sets)
1	PLANT DEFINITION MANUAL-	-	3 CD-ROMs
2	Drawings "FOR APPROVAL"	10	Soft Copy
3	Drawings "FOR INFORMATION"	10	Soft Copy
4	Drawings "FINAL APPROVED DRAWING"	8	Soft Copy
5	Drawings "AS BUILT "	8	3 CD-ROMs
6	DATASHEETS,DESIGNCALCULATIONS,PURCHASE SPECIFICATIONS, etc. and Other type of documents		
	i) For Approval	10	Soft Copy
	ii) FINAL	8	3 CD-ROMs
	iii) Analysis reports of equipment/ piping/ structures components/ systems employing software packages as detailed in the specifications		
	a) Input	10	Soft Copy
	b) Output	10	Soft Copy
	c) Drawings/ Sketches	10	Soft Copy
7	Erection manual "FINAL"	8	3CD ROMS
8	Operation & Maintenance manual	10	3CD ROMS
9	Plant Hand Book "DRAFT"	6	SOFT COPY
10	Plant Hand Book "FINAL"	15	3CD ROMS
11	Commissioning and Performance Procedure manual	10	3CD ROMS
12	Performance and Functional Guarantees test report	6	3CD ROMS
13	Progress Reports	6	3CD ROMS
14	Project completion report	10	3CD ROMS
15	QA programme including Organization for implementation and QA system manual (with revision-servicing)	1	3CD ROMS
16	Vendor details in respect of proposed vendors including Bidder's evaluation report.		
17	Manufacturing QPs, Field QPs, Field welding schedules and their reference documents like test procedures, WPS, POR etc.		
	i) For review/comment	3	
	ii) For final approval	4	1 set CD ROMS
18	Welding Manual, Heat Treatment Manuals	4	
	Storage & preservation manuals Final Final	4	2 CD ROMS
19	Monthly Vendor Approval and QP approval status	2	1 CD ROM
20	QA Documentation Package for items / equipment manufactured and dispatched to site	2	2 CD ROMS
21	QA Documentation Package for field activities on equipment/systems at site	2	2 CD ROMS

ANNEXURE-II

(Total within 52 man months)

PRODUCT		AREAS OF TRAINING REQUIREMENT			Operation & Maintenance Of Plant
STEAM GENERATOR		Product Design	Plant Visit	Visit To Manufacturer's Work	
		Thermal design and hydraulic circulation balance	Familiarization with various system and equipment	Manufacturing processes of pressure parts, and equipment	Control philosophy operation, notices, logic & protection schemes, O&M manual familiarization O&M issues
		Combustion air calculation			
		Pressure part c	Operational history of various equipment and system Failure analysis	Product development in process Future plan for technology induction R&D work inprogress	Special tool and techniques familiarization
		Pressure part and strengthening calculation			
		Tube metal temp. calculation and selection.			
		Performance calculation			
		Duct design.			
		Pressure part			
		Equipment and system sizing and selection of mills,fans,airpreheater, soot blowers, dampers, valves heater, soot blowers, dampers, valves, feeders, burners startup system, fuel firing system, draft plant Flow scheme develop- ment of air & flue gas, fuel oil, auxiliary steam, main and reheat steam feed water.			

PRODUCT	AREAS OF TRAINING REQUIREMENT			
	Product Design	Plant Visit	Visit To Manufacturer's Work	Operation & Maintenance Of Plant
MANDAYS CFD model development and validation for Steam Generator	Layout of over all plant, steam generator area, pressure part arrangements,platforms,equipment, piping and duct, coal pipe, flue gas ducts, bunker arrangement, valves and damper, ESP area, cable & piping tressels etc.			
	Erection strategies, erection procedures			
	Performance and demonstration tests.			
	120	20	20	20
	Familiarisation of fundamentals and basis for the development of the CFD models.			
	Solving of set of simple problems by Employer's engineers with the help of trainer.			
	Hands on experience on the development of detailed/realistic CFD models for the steam generator and ESP. The Bidder/trainer shall develop CFD models for SG & ESPas per the Contract requirement with complete association of the Owner's engineers.			

PRODUCT	AREAS OF TRAINING REQUIREMENT			Plant Visit	Visit To Manufacturer's Work	Operation & Maintenance Of Plant
	Product Design					
MANDAYS	Validation of the above CFD model for SG & ESPby Bidder in association with the Owner's Engineers.			-	-	
	120 for SG and 60 for ESP					
TURBINE GENERATOR AND IT'S INTEGRAL AUXILIARIES	Turbine cycle optimization and turbine performance in off design condition.	Familiarization of power plants of various makes of turbines for super critical units	Manufacturing processes of turbine			
	Rotor design and strength calculation	Collection of data for analysis of availability of turbines	Assembly of turbine			
	Rotor dynamic behavior studies wrt natural frequency, critical speed, vibration etc.	Comparative studies for integral systems of turbine	Testing of turbines			
	Blade profile/root design and blade strength design, blade vibration analysis	O&M history/problems related to turbine	Product development in process			
	Casing & diaphragm design	Failure analysis	Future plan for technology induction			
	Labyrinth seal selection & design for different turbine configurations		R&D work in progress			
	Selection of turbine type (i.e. Tandem vs cross compounding, separate HP/IP vs combined HP/IP, material of construction etc.)					
	Design principle for Up rating/down rating of existing design/ modules for the specific project.					

PRODUCT	AREAS OF TRAINING REQUIREMENT			
	Product Design	Plant Visit	Visit To Manufacturer's Work	Operation & Maintenance Of Plant
	Selection of nos., type and arrangement of bearings, load calculation on bearings, bearing oil flow calculation Selection, design and control principle for Turbine governing system Performance calculation Steam path audit Layout principle of various equipment's of TG and its integral system Latest technological advancements			
MANDAYS	45	10	10	
Boiler Feed Pumps	Techno-economic syudies for Selection of BFP Configuration and its drive Criteria for selection of boiler Feed Pump parameters Rotor design, strength calculation and rotor dynamic behavior studies wrt critical speed, vibration etc	Familiarization of power plants of various makes of feed pumps Data collection of BFP parameters and configur ation Collection of data for analysis of availability of BFP	Manufacturing process of various components of BFP Assembly of BFP Testing, capabilities of BFP at works wrt performance, NPSH, thermal shock, dry run, visual cavitation, string test, axial thrust measurement	
	Impeller design and its hydraulic behavior	O&M history/problems related to BFP	Product development in process	

PRODUCT	AREAS OF TRAINING REQUIREMENT				Visit To Manufacturer's Work	Operation & Maintenance Of Plant
	Product Design	Plant Visit				
MANDAYS Condenser	Role of critical para- meters such as NPSH(R), Suction specific speed, running clearances, speed etc. in design of feed pumps	Comparative studies for various types of BFP& its features			Future plan for technology induction	
	Material selection of BFP components Guiding factors for selection of BFP seals Computation of axial thrust under various flows Performance calculation Transient analysis in pump suction piping wrt NPSH margin Latest technological trends in BFP design				R&D work in progress	
	20	5			10	
	Selection of condenser type and its optimization wrt temp rise across condenser, pressure drop in condenser, surface area etc	Comparative studies of salient features			Manufacturing process of various components of condenser Assembly	
	Techno economic studies for Selection of condenser tube material and other parts depending on water quality Condenser support selection & design	Collection of data for analysis of availability of Condenser O&M history/problems related to condenser			Testing capability at works Product development in process	

PRODUCT	AREAS OF TRAINING REQUIREMENT				Visit To Manufacturer's Work	Operation & Maintenance Of Plant
	Product Design	Plant Visit				
MANDAYS Feed Regenerative Equipment's	Sizing of condenser w.r.t. super critical units				Future plan for technology induction	
	Latest technological trends in condenser arrangement and design				R&D work in progress	
	Condenser vacuum system design					
	10	5	Comparative studies of salient features	Assembly	Manufacturing process of various components of heaters	
MANDAYS Feed Regenerative Equipment's	Thermal and mechanical design calculation of heaters		Analysis of data	Testing capability at works		
	Basis of selecting horizontal/vertical heaters					
	Selection of TTD and DCAs for various heaters, and their effect on turbine heat rate		O&M history/problems related to heaters			
	Configuration of HP heaters (2x50% v/s100% capacity)			Product development in process		
MANDAYS 3-dimensional CFD modeling	Sizing criteria for Deaerator/Heaters			Future plan for technology induction		
	Selection of tube & tube sheet material of heaters			R&D work in progress		
	Latest technological trends in heaters design					
MANDAYS	15	10		10		
MANDAYS	CFD model develop ment and validation of design data for steam turbine, BFP, CEP , condenser, heaters etc.					

PRODUCT		AREAS OF TRAINING REQUIREMENT				Visit To Manufacturer's Work	Operation & Maintenance Of Plant
MANDAYS	Compressors	Product Design	Plant Visit				
		20					
		Equipment Theory & Maintenance Practice					
		16	-			4	
		Equipment Theory & Maintenance Practice					
		15	5			5	
							</

PRODUCT	AREAS OF TRAINING REQUIREMENT				Plant Visit	Visit To Manufacturer's Work	Operation & Maintenance Of Plant
	Product Design						
MANDAYS	Development of mimics						
	Other application like calculations, logs historical storage functionalities & use						
	40	6				8	
DDCMIS - Control System Hardware	Basic design features for system & its modules	Operation feedback			Manufacturing processes special attention to handling of the modules		
	System capabilities & system design techniques				Maintenance facilities		
	Communication with MMI & other system						
MANDAYS	24	5			10		
DDCMIS-Control system Application Software	Database structure Organisation & inter- face between application program & database	Operational feedback			System integration & System capabilities testing		
	Application for implementation of Control functions						
	Study of standard algorithms & development of new algorithms						
MANDAYS	18	4			4		
DDCMIS - Control Loop Study	General description of closed loop controls of thermal power plant	Specific operational feedback					

PRODUCT	AREAS OF TRAINING REQUIREMENT				
	Product Design	Plant Visit	Visit To Manufacturer's Work	Operation & Maintenance Of Plant	
	Critical analysis of few control loops e.g., TSCS Stress Control boiler startup control etc.				
MANDAYS	12	4			
DDCMIS-Burner Management System	Hardware logic, NFPA/ VDE requirements other safety standard	Operational feedback	Manufacturing procedure & precautions for handling the system		
	Flame scanner location		System testing facilities		
MANDAYS	16	6	6	12	
DDCMIS - EHTC, Turbine stress control system, Turbine protection system & ATRS	Basic design concept & features	Operational feedback	Manufacturing procedure & precautions for handling the system		
	Logics of turbine stress control system Implementation of failsafe philosophy in turbine protection system		System testing facilities		
MANDAYS	16	6	6	12	
Furnace and Flame Viewing System.	Theory & principle of operation	Operational feedback			
	Details of software & methods of modification/ customisation				
Misc. systems for SG/TG C&I					
MANDAYS	6	3			
VMS					

PRODUCT	AREAS OF TRAINING REQUIREMENT				Plant Visit	Visit To Manufacturer's Work	Operation & Maintenance Of Plant
	Product Design						
1) Hardware	Equipment Theory & Maintenance Practice						
MANDAYS	12	-			6		
2)Vibration Analysis	Equipment Theory & Maintenance Practice						
MANDAYS	12	-			6		
Analyser							
Water & Gas	Equipment Theory & Maintenance Practice						
MANDAYS	20	-			8		
PADO: System Engineering	Equipment Theory & Maintenance Practice						
MANDAYS	6	3			3		
PADO: Operation & Analysis	Equipment Theory & Maintenance Practice						
MANDAYS	18	6			-		
Actuators	Equipment Theory & Maintenance Practice						
MANDAYS	18	-			6		
Simulator	Equipment Theory & Maintenance Practice						
MANDAYS	16	-			4		
Networking / MIS	Equipment Theory & Maintenance Practice						

PRODUCT		AREAS OF TRAINING REQUIREMENT				Visit To Manufacturer's Work	Operation & Maintenance Of Plant
Product Design		Plant Visit					
MANDAYS	12		-		4		
Electric Power Supply System	Theory & design features				Manufacturing/assembly process		
					Testing methodology		
	5	2					
	(a) Design aspects of the following areas	Operational feed back Familiarisation with different sub-systems		(a) Manufacturing process for			
	Insulation system			Core			
Cooling medium & arrangement			Winding bars				
Winding & core support systems			Assembly				
(ELECTRICAL) GENERATOR	b) Design aspects of other auxiliary systems			Testing facilities			
	30	15		15			
MANDAYS	Design features of various sub-systems	Operational feed back Familiarisation with various equipment functioning at reference plants		Manufacturing process& testing facilities for various equipment of excitation system			
	Excitor						
	PMG						
	Controllers & different limiters etc.						
	PSS & associated system studies						
MANDAYS	30	15		15			

PRODUCT	AREAS OF TRAINING REQUIREMENT				Visit To Manufacturer's Work	Operation & Maintenance Of Plant
	Product Design	Plant Visit				
Boiler Feed pump H.T. Motor	Design Criteria for the	Operational feed back		Manufacturing process & test facilities		
	Stator core & wdg					
	Rotor core & wdg					
	Insulation system					
	Cooling arrangement					
MANDAYS	20			5		
POWER TRANSFORMER	Equipment Theory & Maintenance Practice					
MANDAYS	12	-		4	4	
UPS/BATTERY CHARGER	Equipment Theory & Maintenance Practice					
MANDAYS	8	-		4	4	
CRITICAL PIPING & POWER CYCLE PIPING	Design familiarization for critical piping of supercritical Plant	Familiarization with feed back (in super critical plant) on failure analysis and vibration analysis of piping.		Cold Setting of spring hanger		
	Optimization study for sizing including pressure drop calculation and selection of single or double lead together with Owner's engineers	Study of Feed back regarding hanger setting strategies and practice		Cyclic tests carried on spring hangers.		
	Design and stress analysis of lines with Expansion Joints together with Owner's engineers			Cyclic tests carried on expansion joints		

PRODUCT	AREAS OF TRAINING REQUIREMENT			
	Product Design	Plant Visit	Visit To Manufacturer's Work	Operation & Maintenance Of Plant
	Design and stress analysis of piping systems with two phase flow involving Owner's engineers Transient analysis and optimum sizing of feed suction piping together with Owner's engineers. Static and dynamic analysis of critical piping including seismic and other occasional load analysis (safety valve blowing condition). A joint activity together with Owner's engineers. Study and collection of data pertaining to special welding requirements (pre and post weld heat treat ment and electrode selection criteria etc.) of materials used in high temp piping system. Study and collection of data on special requirements in case of welding dissimilar metals and electrode selection criteria		Manufacturing process of critical piping components and appreciation of their testing facilities at shop	
MANDAYS	5	2		

ANNEXURE-III

Project :		LIST OF ITEMS REQUIRING QUALITY PLAN AND SUB-SUPPLIER APPROVAL					DOC. NO.:			
Stage :							REV. NO. :			
Package :							DATE :			
Supplier :		SUB-SYSTEM:					PAGE : OF			
Bidder No :										
Sl. No.	Item	QP/ Insp. Cat.	QP No.	QP Sub. Schedule	QP approval schedule	Proposed sub-supplier	Place	Sub-suppliers approval status/ category	Sub-supplier Details submission schedule	Remarks

LEGENDS

1. SYSTEM SUPPLIER/SUB-SUPPLIER APPROVAL STATUS CATEGORY (SHALL BE FILLED BY the Owner)

A – For these items proposed vendor is acceptable to the Owner. To be indicated with letter “A” in the list alongwith the condition of approval, if any.

DR – For these items “Detailed required” for the Owner review. To be identified with letter “DR” in the list.

NOTED – For these items vendors are approved by Main Supplier and accepted by the Owner without specific vendor approval from the Owner. To be identified with “NOTED.”

2. QP/INSPN CATEGORY:

CAT-I: For these items the Quality Plans are approved by the Owner and the final acceptance will be on physical inspection witness by the Owner.

CAT-II: For these items the Quality Plans approved by the Owner. However no physical inspection shall be done by the Owner. The final acceptance by the Owner shall be on the basis review of documents as per approved QP.

CAT-III: For these items Main Supplier approves the Quality Plans. The final acceptance by the Owner shall be on the basis certificate of conformance by the main supplier.

UNITS/WORKS: Place of manufacturing Place of Main Supplier of multi units/works.

[illegible]

ANNEXURE-V

Project :		FIELD WELDING SCHEDULE										DOC. NO.:				
Stage :												REV. NO. :				
system:												DATE :				
Bidder :												PAGE : OF				
Bidder No :		Welding Code:														
Sl. No.	DRG No. for Weld Location and Identification mark	Description of parts to welded	Dimensions	Process of welding	Type of Weld	WPS. No.	Min. pre-heat	Heat treatment		NDT method/Quantum	REF		Sub-suppliers approval status/category	Sub-supplier Details submission schedule	Remarks	
								Temp.	Holding time		Spec. No.	ACC Norm Ref.				
Notes:																
SIGNATURE																

[illegible]

[illegible]

**TITLE**

**1X800 MW NORTH CHENNAI TPP STAGE III
MILL REJECT SYSTEM (PNEUMATIC TYPE)**

SPECIFIC TECHNICAL REQUIREMENTS

SPECIFICATION NO. PE-TS-423-160-A001

SECTION - I

REV 00

Sub Section -IA

Date: MAY 2017

ANNEXURE-J
LOW PRESSURE PIPING

ANNEXURE-J

2.1.6 LP PIPING, VALVES & SPECIALITIES

2.1.6.1 Equipment sizing Criteria

- a. All the piping systems and equipment supplied under this package shall be designed to operate without replacement and with normal maintenance for a plant service life of 30 years, and shall withstand the operating parameter fluctuations and cycling which can be normally expected during this period.
- b. For all LP piping system covered under this specification, sizing and system design shall be to the requirements of relevant codes and standard indicated elsewhere. In addition to this, requirements of any statutory code as applicable shall also be taken into consideration.
- c. Inside diameters of piping shall be calculated for the flow requirements of various systems. The velocities for calculating the inside diameters shall be limited to the following.
 - i. Water Application

Sl.No.	Pipe Size	Below 50mm	50-150 mm	200 mm & above
1	Pump suction	-	1.2-1.5	1.2-1.8
2	Pump discharge and recirculation	1.2-1.8	1.8-2.4	2.1-2.5
3	Header	-	1.5-2.4	2.1-2.4

The pipes in CW, ACW & DMCW system shall be designed to maintain a maximum velocity of 2 m/s inside the pipelines at pump discharge. Pipe line under gravity flow shall be restricted to a flow velocity of 1 m/sec generally Channels under gravity flow shall be sized for a maximum flow velocity of 0.6 m/sec.

- ii. WILLIAM & HAZEN formula shall be used for calculating the friction loss in piping systems with the following “C” value.

1	Carbon steel pipe	100
2	CI Pipe/Ductile Iron	100
3	Rubber lined steel pipe	120
4	Stainless steel pipe	100

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

- iii. Compressed Air Application
Compressed air – 15.0 m/sec. (under Average Pressure & Temp. conditions)

- d. The pipes shall be sized for the worst (i.e. maximum flow, temp. and pressure values) operating conditions.
- e. Based on the inside dia. so established, thickness calculation shall be made as per ANSI B 31.1 OD and thickness of pipes shall than be selected as per ANSI B 36.10/IS-1239 Heavy grade/IS-3589/ASTM-A-53/API-5L/ANSI B 36.19 as the case may be.
- f. Corrosion allowance of 1.6 mm will be added to the calculated thickness being considered.
- g. Bend thinning allowance/manufacturing allowance etc. shall be as per the requirement of the design code provision.
- h. High points in piping system shall be provided with vents along with valves as per the system requirement. Low points shall be provided with drains along with drain valves as per the system requirement. Drain lines shall be adequately sized so as to clear condensate in the lines. Material for drain and vent lines shall be compatible with that of the parent pipe material.
- i. Material of construction for pipes carrying various fluids shall be as specified elsewhere.
- j. Compressed air pipe work shall be adequately drained to prevent internal moisture accumulation and moisture traps shall be provided at strategic locations in the piping systems.
- k. Depending upon the size and system pressure, joints in compressed air pipe work shall be screwed or flanged. The flange shall be welded with the parent pipe at shop and shall be hot dip galvanized before dispatch to site. Alternatively, the flanges on GI pipes may be screwed-on flanges also.
- l. Threaded joints shall be provided with Teflon sealant tapes.
- m. Following types of valves shall be used for the system/service indicated.

System	Type of Valves					
	Butterfly	Gate	Globe	Check	Ball	Plug
Water	x	x	x	x	x	
Air		x	x	x	x	
Drains & Vents		x	x	x		
Fuel oil		x	x	x	x	x

In water service, valves above 200 NB size shall be butterfly valves.

- n. Recirculation pipes along with valves, breakdown orifices etc. shall be provided for important pumping systems as indicated in respective process and instrumentation diagrams (P&IDs). The recirculation pipe shall be sized for minimum 30% design flow of single pump operation or the recommended flow of the pump manufacturer whichever is higher.

- o. All Piping 450 NB & Above shall be designated as Large dia Piping.

2.1.6.2 Technical Specification

2.1.6.2.1 General

Specific technical requirements of low-pressure piping, fittings, supports, valves, specialties and tanks etc. have been covered under this Sub-section. It includes details pertaining to design and material of construction for piping, fittings, valves, equipment, etc. cleaning/surface preparation application of primer and painting on over ground piping. It also includes detailed technical requirement of laying underground/buried piping including water proofing/anti corrosive protection. It also covers design, engineering, manufacturing, fabrication, technical details of piping, valves, specialties, piping hangers/supports, tanks etc.

2.1.6.2.2 Pipes and fittings

- a. All low pressure piping systems shall be capable of withstanding the maximum pressure in the corresponding lines at the relevant temperatures. However, the minimum thickness as adhered to. The bidder shall furnish the pipe sizing / thickness calculation as per the criteria mentioned above under LP piping equipment sizing criteria of this Technical Specification.
- b. Piping and fittings coming under the purview of IBR shall be designed satisfying the requirements of IBR as a minimum.
- c. Supporting arrangement of piping systems shall be properly designed for systems where hydraulic shocks and pressure surges may arise in the system during operation. Bidder should provide necessary protective arrangement like anchor blocks/anchor bolt etc. for the safeguard of the piping systems under above mentioned conditions. The requirement will be, however, worked out by the Bidder and he will submit the detailed drawings for thrust/anchor block to the Employer. External, and internal, attachments to piping shall be designed so as not to cause flattening of pipes and excessive localized bending stresses.
- d. Bends, loops, off sets, expansion or flexible joints shall be used as required in order to prevent overstressing the piping system and to provide adequate flexibility. Flexibility analysis (using software packages such as Caesar-II etc.) shall be carried out for sufficiently long piping (straight run more than 300M).
- e. Wherever Bidder's piping coming under this specification, terminates at an equipments or terminal point not included in this specification, the reaction and the thermal movement imposed by bidder's piping on equipment terminal point shall be within limits to be approved by the Employer.
- f. The hot lines shall be supported with flexible connections to permit axial and lateral movements. Flexibility analysis shall be carried out for pipelines which have considerable straight run as indicated above and necessary loops/expansion joint etc. shall be provided as may be necessary depending on layout.

- g. Piping and fittings shall be manufactured by an approved manufacturer of repute. They should be truly cylindrical of clear internal diameter, of uniform thickness, smooth and strong, free from dents, cracks and holes and other defects.
- h. For rubber lined ERW pipes, beads shall be removed.
- i. Inspection holes shall be provided at suitable locations for pipes 800 NB and above as required for periodic observations and inspection purposes.
- j. At all intersection joints, it is Bidder's responsibility to design and provide suitable reinforcements as per the applicable codes and standards.
- k. For large size pipes/duct, at high point and bends/change of direction of flow, air release valves shall be provided as dictated by the system requirement and operation philosophy & tripping conditions of pumping system. Sizing criteria for air release valves shall be generally on the basis of valve size to pipe diameter ratio of 1:8. Requirement shall be decided as per relevant code. Transient analysis / surge analysis wherever specified and required shall be conducted in order to determine the location, number and size of the Air-Release valve on certain long distance/high volume piping systems such as CW/ ACW/ Raw Water etc.

2.1.6.2.3 Material

- a. Alternate materials offered by Bidder against those specified shall either be equal to or superior to those specified, the responsibility for establishing equality or superiority of the alternate materials offered rests entirely with the Bidder and any standard code required for establishing the same shall be in English language.
- b. No extra credit would be given to offers containing materials superior to those specified. Likewise no extra credit would be given to offers containing pipe thickness more than specified.
- c. All materials shall be new and procured directly from the manufacturers. Materials procured from traders or stockiest are not acceptable.
- d. All materials shall be certified by proper material test certificates. All material test certificates shall carry proper heat number or other acceptable reference to enable identification of the certificate that certifies the material.
- e. Material of construction for pipes carrying various fluids shall be as follows:

1	Circulating Water (CW) – Pump Discharge, condenser risers including header near condenser and cooling tower rise	IS 3589 FABRICATED FROM IS 2062 PLATES –INTERNALLY LINED WITH CORROCOAT OR POLYUREA COATING OF 1500 MICRONS DFT /GRP/ FRP
---	--	---

2	ACW	UPTO 150 NB - ASTM A 312 TP 316 L (ERW)/ DUPLEX SS 200 NB & ABOVE - ERW IS 1978 (OR) API5L (OR) IS 3589 FABRICATED FROM IS 2062- Internally lined with Corrocoat or polyureA Coating inside of 1500 microns DFT
3	RO Stage II Permeate, Dematerialized water, (condenser Make up water, Boiler fill and Deaerator Fill water) & DMCW overhead tank make-up water	Stainless steel to ASTM A-312, Gr. 304 welded for sizes above 50mm NB Stainless steel to ASTM A312, Gr. 304 sch. 40 Seamless for sizes 50 mm and below
4	Drinking water	ASTM A-53 type E Gr. B galvanized /IS 1239 heavy galvanized/IS 3589 Gr 410 Galvanized to SI-4736 or equivalent.
5	Instrument air & plant air.	ASTM A-53 type E Gr. B galvanized /IS 1239 heavy galvanized/IS 3589 Gr 410 Galvanized to SI-4736 or equivalent.
6	Fuel Oil piping	API5L
7	FUEL OIL PUMP DISCHARGE LINES	ASTM A 106 GR B
8	Sodium Hypochlorite (pipes & Fittings)	CPVC Sch 80 ASTM

- f. In water lines, pipes upto 150 mm NB shall conform to ANSI B36.10/ASTM-A-53, Type-E Gr. B/IS:1239 Gr. Heavy and minimum selected thickness shall not be less than IS: 1239 Grade heavy except for dematerialized water and condensate spill lines.
- g. Pipes of above 150 mm NB shall be to AWWA-C200/ANSI B 36.10/ASTM A-53/IS 3589 Gr. 410. Pipe to be fabricated by the bidder shall be rolled and butt welded from plates conforming to ASTM A-53 type 'E' Gr. B/IS 2062 Gr. B/ASTM-A-36. However, larger pipes, i.e. 1000 mm NB and above shall be made from plates conforming to ASTM A 36/IS 2062 Gr. B and shall meet the requirements of AWWA-M-11(for deflection & buckling criteria considering water filled pipe as well as vacuum condition that may prevail during transient/ surge conditions, truck- load, rail-load and weight density for compacted soil or any other load as the case may be).
- h. In dematerialized water service, the pipes up to 50 NB shall be of stainless steel ASTM A 312, Gr. 304 sch. 40 Seamless. The size for these pipes shall be to ANSI B 36.19. These shall be socket welded. The material for pipe from 65 mm NB up to and including 400 NB shall be to ASTM A 312, Gr. 304 (welded). In no case the thickness of fittings shall be less than parent pipe thickness.
- i. Bidder shall note that pipes offered as per a particular code shall conform to that code in all respects i.e. Dimension, tolerances, manufacturing methods, material, heat treatment, testing requirements, etc. unless otherwise mentioned elsewhere in the specification.

- j. Instrument air, Plant (service) air lines and Drinking water lines shall be to ASTM A 53 type E grade B/ANSI B 36. 10/IS 3589, Gr. 410/IS: 1239 Heavy (in case thickness calculated is more than gr. Heavy, ANSI B 36.10 Schedule numbers shall be followed) and galvanized to IS 4736 or any equivalent internationally reputed standard. The material of the pipes shall be to ASTM A 53 type 'E' Gr. B/IS: 3589, Gr. 410/IS: 1239 Gr. Heavy. The fittings shall be of either same as parent material or malleable iron to IS-1879 (galvanized).
- k. Spiral welded pipes as per API-5L/IS-3589 are also acceptable for pipe of size above 150 NB. However minimum thickness of the pipes shall be as elaborated in above clauses.
- l. Condensate lines shall be to ASTM A 106 Gr. B and dimension to ANSI B 36.10 schedule "standard" as minimum to be maintained.
- m. If carbon steel plates of thickness more than 12 mm are used for manufacture of pipes, fittings and other appurtenances, then the same shall be control-cooled or normalized as the case may be following the guidelines of the governing code.

2.1.6.2.4 Piping Wall Thickness

- a. The calculation of wall thickness required for pipelines subject to internal and/or external pressure shall be based on the formulae and recommendations as given in the applicable codes. Adequate allowances shall be made towards thinning due to bending, weakening at branch connections, threading, commercial tolerances on pipe wall thickness, corrosion and erosion, etc., and the same shall be subject to approval by Purchaser. In any case a minimum corrosion allowance of 1.0 mm shall be considered while selecting the thickness.
- b. In case of carbon steel materials, the nominal wall thickness of pipeline shall not be less than the minimum acceptable values given below:

NB mm (inch)	15 (1/2)	30 (3/4)	25 (1)	32 (1¼)	40 (1.5)	50 (2)	65 (2.5)	80 (3)	100 (4)	125 (5)
Min. thickness, mm	3.2	3.2	3.6	3.6	3.6	3.6	3.6	4	4.5	5.4
NB mm (inch)	150 (6)	200 (8)	250 (10)	300 (12)	350 (14)	400 (16)	450 (18)	500 (20)	600 (24)	600 (24)
Min. thickness, mm	5.4	6.35	6.35	6.35	7.1	7.1	7.1	8	8	8

- > NB 600 mm to NB 900 mm - 8.0 mm
- > NB 900 mm to NB 1200 mm - 10.0 mm
- > NB 1200 mm to 1400 mm - 12.0 mm
- > NB 1400 mm to 1600 mm - 14.0 mm
- > NB 1600 mm to NB 2200 mm - 16.0 mm

> NB 2200 mm - 18.0 mm

2.1.6.2.5 Piping Layout

- a. Piping shall be grouped together where practicable and routed to present a neat appearance.
- b. Piping routing shall be such as to provide sufficient clearance for removal and maintenance of equipment, easy access to valves, instruments and other accessories. The piping shall not encroach on the withdrawal space of various equipment.
- c. Over head piping shall have a normal minimum vertical clearance of 2.5 meters above walkways and working areas and 8 m above roadways/railways. When several pipelines are laid parallel, flanged joints must be staggered. Welded and flanged joints should as far as possible be located at one third span from supports. If the support is situated right under the welded joints this joint must be reinforced with a strap. Flanged and welded joints must be avoided in the middle of the span. Valves should be located in such a manner so as to ensure their convenient operation from the floor or the nearest platform.
- d. Pipelines of NB 50 size and below are regarded as field run piping. It is Bidder's responsibility to plan suitable layouts for these system insitu. Bidder shall prepare drawings indicating the layout of field run pipe work. These drawings shall be approved by Project Manager to the installation of the field run pipe work. Based on these approved layouts the Bidder shall prepare the BOQ of field run-pipe and submit to Employer for approval.
- e. All piping shall be routed so as to avoid interference with other pipes and their hangers and supports, electrical cable trays, ventilation ducting, structural members, equipment etc.
- f. Adequate clearance shall be ensured with respect to the above to accommodate insulation and pipe movements, if any.
- g. Piping shall generally be routed above ground but where specifically indicated / approved by the project Manager the pipes may be arranged in trenches or buried. Pipes at working temperature above the ambient shall however not be buried.
- h. Sufficient upstream and downstream lengths shall be provided for flow measuring devices, control valves and other specialties.
- i. All local instruments shall be located on pipelines as to render them observable from the nearest available platforms.
- j. Openings provided in the wall for pipelines must be closed with bricks and mortar with 10-12 mm clearance between brick work and pipe after taking care of insulation and thermal movement, if any. The clear space must be filled with felt or asbestos or approved filling compound.

2.1.6.2.6 Slope/Drains and Vents

- a. Suitable slope shall be provided for all pipelines towards drain points. It is Bidder responsibility to identify the requirements of drains and vents, and supply the necessary pipe work, valves, fittings, hangers and supports etc. As per the system requirement low points in the pipelines shall be provided with suitable draining arrangement and high points shall be provided with vent connections where air or gas pockets may occur. Vent shall not be less than 15 mm size. Drains shall be provided at low points and at pockets in piping such that complete drainage of all systems is possible. Drain shall not be less than 15 mm for line size up to 150 mm, not less than 20 mm up to 300 mm and not less than 25 mm for 350 mm to 600 mm pipes and not less than 50 mm for 600 mm and above pipes.
- b. Air piping shall be sloped so that any part of the system can be drained through the shut-off drain valve or drain plugs.

2.1.6.2.7 Pipe Joints

In general all water lines 65 mm NB and above, are to be joined generally by butt welding except the locations where valves/fittings are to be installed with flanged connections and 50 mm and below by socket welding unless mentioned otherwise specifically. All air lines shall be of screwed connection and rubber lined pipes of flanged connections.

- a. Screwed
 - i. Threading of pipes shall be carried out after bending, heat treatment etc. If not possible, threading may be done prior to these operations but proper care should be taken to protect them from damage. Threads shall be to ANSI B 2.1 (taper) NPT/IS:554 unless specified otherwise.
 - ii. Galvanized pipe shall generally be joined by screwing into sockets. The exposed threaded portion on the outside of the pipes shall be given a zinc silicate coating. Galvanized pipes shall not be joined by welding. Screwed ends of GI pipes shall be thoroughly cleaned and painted with a mixture of red and white lead before jointing. For galvanized pipe sizes above 150 mm NB, screw & socket jointing as per ASTM-A-865 shall be employed for both pipe-to-pipe and pipe-to-fitting jointing. For pipe to fitting connection since no direct threading can be done on the fittings (supplied as per ASTM-A-234 Gr. WPB and ANSI B-16.9) necessary straight pipe lengths acting as match pieces shall be welded to the fitting at both ends and subsequently the free ends of the straight lengths shall be threaded as per ASTM A-865 for jointing with main pipe. Once welding of fittings with match pieces and threading of free ends of match pieces are over, the entire fabricated piece shall be galvanized, or in case match pipes and fittings are already galvanized before the above mentioned fabrication then suitable application of Zinc-Silicate paste adequately at the welded surface (both in side & out side) after welding with zinc rich electrode, along with the nascent threaded metal portion at both free ends given the same application of Zinc Silicate paste. Alternatively flanged jointing may be employed for pipe sizes 100 NB and above. However, the bidder shall ensure the galvanized pipe joints do not fail during hydro test.
 - iii. Teflon tapes shall be used to seal out screwed joints and shall be applied to the male threads only. Threaded parts shall be wiped clean of oil or grease with appropriate solvent if necessary and allowing proper time for drying before applying the sealant. Pipe ends shall be reamed and

all chips shall be removed. Screwed flanges shall be attached by screwing the pipe through the flange and the pipe and flange shall be refaced accurately.

- iv. For pipe sizes from 350 mm NB to 550 mm NB (including 350 NB & 550 NB) the GI pipes shall be of flanged connection. However, the pipes after welding of flanges shall be completely galvanized. Any site welding done on galvanized pipes shall be done with zinc-rich special electrodes and the welded surfaces whether inside or outside shall be coated with zinc-silicate pasts. Seal welding of flanges with zinc-rich electrode will be permitted only when any flange is leak-prone during hydro testing.
- v. For pipe sizes 600 mm NB and above, the GI pipes shall be of welded connection (with zinc-rich special electrodes) followed by application of zinc silicate coating at welded surfaces both inside and outside the pipe, except for the last blank/blind flange, or, equipment connection where application of zinc-silicate paste after welding cannot be done due to inaccessibility of the inside welded surface and where galvanic protection has been impaired due to welding of pipe-to-pipe joint. Thus the last erection joint shall be flanged joint.

b. Welded

- i. For making up welded joints (butt weld or socket weld) the welding shall be performed by manual shielded metal arc process in accordance with the requirements specified elsewhere in the spec. Any welder employed for carrying butt welding shall be qualified as per ASME section IX for the type of joints he is going to weld. Jointing by butt weld, or socket weld shall depend upon the respective piping material specifications.

c. Flanged

- i. Flanged connections for pipes are to be kept to the minimum and used only for connections to vessel, equipments, flanged valves and other fittings like strainer/traps/orifices etc. for ease of connection and maintenance etc. Rubber lined pipes shall be flange joined only.
- ii. All flanged valves intended for installation on steel piping system, shall have their flanges drilled to ANSI B 16.5 (or equivalent) and according to the pressure class stated in their respective piping material specification.
- iii. Drilling on flanges of flanged valves must correspond to the drilling of flanges on the piping system on which the valves are installed.

2.1.6.2.8 Bends/elbows/mitre bends/Tees/Reducers & other fittings

- a. Unless otherwise specified elbows shall be of long radius type.
- b. For pipe sizes up to 65 Nb, long radius forged elbows or seamless pipe bends shall be used. Pipe bends, if used, shall be cold bent to a radius measured to the centre line of pipe of 3 to 5 times the pipe diameter.
- c. For steel pipes 80 Nb and above, seamless long radius forged elbows shall be used. For pipe size 250 Nb and above mitre bends may be used for all pipes except rubber lined pipes. The bend radius

shall be 1½ times the nominal pipe diameter. 90 deg. Bends (mitre) shall be in 4 pieces (3 cuts) and 45 deg. mitre bends shall be in 3 pieces 22½ deg. Fabrication of mitre bends shall be as detailed in BS 2633/BS534.

- d. Mitre bends are not acceptable in case of rubber lined mild steel pipes.
- e. For pipe fittings such as reducers and tees, the material shall be to ASTM-A-234 Gr. WPB up to 300 NB. For pipe reducers and tees above 300 NB, the fittings may be fabricated conforming to parent pipe material. Provision of compensation pads shall be kept as per ANSI B 31.1. The fittings shall conform to the dimensional standard of ANSI B-16.9. However, for pipes up to 150 NB, pipe fittings may be supplied with material and dimension conforming to IS 1239 in case parent pipes also conform to IS 1239. For pipes, above 1200 NB, reducer and tees shall be to dimensional standard of AWWA-C-208.
- f. Stainless steel fittings shall conform to either ASTM-A-182, Gr. 304 (316 for Sea water application, if any) or ASTM-A-403, Gr. WP 304 (316 for Sea Water application, if any) Class-S, for sizes up to and including 50 mm NB, i.e. the fitting shall be of seamless construction. However, for stainless steel fittings above 50mm NB, the same shall conform to ASTM-A-403, Gr. WP 304 (316 for Sea water application, if any), Class W i.e. the fittings shall be of welded construction strictly in accordance with ASTM-A-403.
- g. In no case, the thickness of fittings shall be less than the thickness of parent pipe, irrespective of material of construction.

2.1.6.2.9 Flanges

- a. Flanges shall be slip on type. Welding of flanges in tension is not permitted.
- b. All flanges and-flanged drilling shall be to ANSI B 16.5/BS EN-1092 of relevant pressure/temperature class. Flanges shall be fabricated from steel plates conforming to ASTM A 105/IS 2062 Gr. B. However stainless steel flanges shall be fabricated from SS plates to ASTM-A-240, Gr. 304 (316 for Sea water application, if any) or equivalent. For all Sea Water applications including guard pond, reject sump, CW, ACW, CT make Up, Sea Water Intake, RO Stage I Reject, RO Stage II Reject, Ash water (Sea water) etc flanges & bolts & nuts shall be SS 316 L construction.

2.1.6.2.10 Specific technical requirement of laying buried pipe with anti corrosive treatment

The pipe in general shall be laid with the top of the pipe minimum 1.0 (one) meter below finished general ground level.

- a. Trenching
 - i. The trench shall be cut true to the line and level and shall follow the gradient of the pipeline. The width of the trench shall be sufficient to give free working space on each side of the pipe. Trenches shall conform to IS 5822.
 - ii. Free access shall be provided for the welding of the circumferential joints by increasing the width and depth of the trench at these points. There should be no obstruction to the welder from any side so that good welded joint is obtained.

- iii. The free working space shall conform to IS: 5822. The trench shall be excavated so as to provide minimum cover of 1000 mm between the top of the pipe and finished grade.
 - iv. Prior to lowering and laying pipe in any trench, the bidder shall backfill and compact the bottom of the trench or excavation in accordance with IS: 5822 to provide an acceptable bed for placing the pipe.
 - v. Coating and Wrapping shall be done as under.
- b. Preparation and cleaning of piping
- i. The pipeline shall be thoroughly cleaned of all rust, grease, dirt, weld scales and weld burrs etc. moisture or other foreign matter by power cleaning method such as sand blasting, power tool cleaning, etc. Grease or heavy oil shall be removed by washing with a volatile solvent such as gasoline. Kerosene will not be permitted for cleaning. This cleaning operation shall be immediately followed by priming with the mechanical priming machine.
 - ii. Certain inaccessible portions of the pipeline (which otherwise not possible to be cleaned by power cleaning methods) may be scrubbed manually with a stiff wire brush and scrapped where necessary with specific permission of the Project Manager.
 - iii. The cleaning and priming operation shall be carried out at site. The entire pipe length shall be cleaned but the ends of the pipes shall be left without coating for a distance of 230 mm for joints, which shall be coating manually at site after laying, welding and testing the pipe.
- c. Trench bed preparation and back filling
- Prior to lowering and laying pipe in any excavated trench, the bottom of the trench may require to be back filled and compacted (or as the case may be) to provide an acceptable bed for placing the pipe. Bed preparation in general shall be as per IS: 5822.
- d. Laying of galvanized steel (GI) pipes
- All the joints shall be screwed with socket or flanged. Screwed ends of GI pipes shall be thoroughly cleaned and painted with a mixture of red and white lead before jointing Threaded portion on either side of the socket joints shall be applied with Zinc silicate paste.
- All the provisions for trenching' bed preparation' laying the pipe application of primer' coating' wrapping with tapes and back filling etc. as indicated for "laying of buried piping" and "anti corrosive protection for buried piping" are applicable for buried galvanized steel (GI) pipes also.

2.1.6.2.11 Cleaning and Flushing

- a. All piping shall be cleaned by the Bidder before and after erection to remove grease, dirt, dust, scale and welding slag.
- b. Before erection all pipe work, assemblies, sub-assemblies, fittings, and components, etc. shall be thoroughly cleaned internally and externally by blast cleaning or by power driven wire brushes and

followed by air-blowing. The brushes shall be of the same or similar material as the metal being cleaned. Cleaning of Galvanized pipes shall be done in such a manner that the coating on MS pipe is not affected.

- c. After erection, all water lines shall be 1.2-1.5 times the operating velocities in the pipelines.
- d. All compressed air pipe work shall be cleaned by blowing compressed air.

2.1.6.2.12 Painting of Pipes

a. Buried Piping

Internal surfaces

- i. Surface cleaning by sand blasting.
- ii. Two (2) coats of epoxy primer coats. The minimum DFT of each coat shall be 35 microns.
- iii. Finish coat-Two (2) coats of high build epoxy paint. The minimum DFT of each coat shall be 35 microns. The total dry film thickness of 150 microns. Tests to be carried out after application : Bond/ Adhesion test, Holiday test

External surfaces

- i. Surface cleaning by Sand Blasting.
- ii. Coal tar primer compatible with coal tar enamel grade. The number of coats shall be two with a DFT of 35 microns each.
- iii. Coal tar enamel shall be applied. A single spiral inner wrap of glass fibre tissues shall be applied overlapping at least 25 mm ensuring impregnation of glass fibre tissues in the first coat. The second coat of enamel and second outer wrap of glass fibre felt, Type – I to IS: 7193-1974 will be applied in the same way conforming to Table – 10 of IS – 10221 – 1982The total thickness of the coating will not be less than 4.0 mm
- iv. Alternatively Wrapping with coal tar based anticorrosion tape conforming to IS 15337: 2003 is also acceptable in lieu of s.no. (iii) above. Wrapping thickness shall be 4.0 mm. Tests to be carried out after application : Bond/ Adhesion test, Holiday test

b. Overground Piping

Internal surfaces

- i. Surface cleaning by sand blasting.
- ii. Two (2) coats of epoxy primer coats. The minimum DFT of each coat shall be 35 microns.
- iii. Finish coat-Two (2) coats of high build epoxy paint. The minimum DFT of each coat shall be 35 microns. The total dry film thickness of 150 microns.

External surfaces

- i. Surface cleaning by Sand Blasting.

- ii. Two (2) coats of epoxy primer coats. The minimum DFT of each coat shall be 35 microns.
- iii. Finish coat-Two (2) coats of high build epoxy paint. The minimum DFT of each coat shall be 35 microns.
- c. **Other requirements**
 - i. Paint manufacturers instructions shall be followed in method of application, handling, drying time etc.
 - ii. The color of the finish paint shall be as per approved color-coding.
 - iii. If finish paint was applied in shop, one coat of finish paint shall be applied at site.
 - iv. The dry film thickness of paint shall not be less than 0.15 mm.
- d. **Colour code for identification**
The pipes shall be color painted/banded for identification as per the approved color-coding scheme and shall be generally as per IS-9404.

2.1.6.2.13 Specification for hangers and supports

- a. All supports and parts shall conform to the requirement of power piping code ANSI B 31.1 or approved equivalent.
- b. While designing supports for rubber lined pipes special consideration should be given. Any kind of welding on these pipes is not allowed after rubber lining
- c. Hanger for piping 65 mm Nb and larger and all spring support assemblies regardless of size shall be completely engineered in conformance with the provisions of power piping code ANSI B 31.1.
- d. Hangers, saddles, supports etc. shall be fabricated from plates/pipes sections conforming to ASTM A 53/IS: 2062/IS:226/ or equivalent. They shall be designed to provide the required supporting effects and allow pipeline movements as necessary. The structural steel work shall be as per IS: 800/BS:4360. Insulation protection saddles shall be used at support point of all insulated piping.
- e. The support shall be so interspaced as to minimize sagging of the pipes and to keep them within permissible limits where pipes are full with the conveying media.
- f. The maximum spans of the supports of straight length shall not exceed the recommended values indicated in ANSI B 31.1.
- g. All pipe supports shall be designed to provide an absolute minimum head room of 2.5 m from floor in passages/walkways.
- h. At all sliding surfaces of supports suitable arrangement is to be provided to minimize sliding friction.

- i. All components of hangers/support shall be provided with two coats of primer (red oxide paint) at shop before dispatch to site. After erection they shall be given finish coat of Long Oil Synthetic enamel to IS: 2932 of total DFT 100 to 140 microns. CLH & VLH will be primed with Epoxy Zinc rich primer of 50 micron followed by finish painting of Aliphatic Acrylic Polyurethane or equivalent of DFT 65 microns.

2.1.6.2.14 Design/Construction/Material Particulars of Gate/Globe/Check Valves/Globe Stop Valve/Butterfly Valve

a. General

- i. All valves shall be suitable for the service conditions i.e. flow, temperature and pressure, at which they are required to operate.
- ii. The valves as well as all accessories shall be designed for easy disassembly and maintenance.
- iii. Valves to be installed outside shall be required to have the stem properly protected against atmospheric corrosion.
- iv. All rising stem valves shall be provided with back seat to permit repacking (of glands) with valves in operation. All valves shall preferably be of outside screw and yoke type.
- v. All valves shall be closed by rotating the hand wheel in the clockwise direction when looking at the face of the hand wheel. In case where the hand wheel is not directly attached to the valve spindle suitable gearing shall be introduced.
- vi. All valves shall have indicators or direction clearly marked on the hand- wheel so that the valves opening/closing can be readily determined.
- vii. Special attention shall be given to operating mechanism for large size valves with a view to obtaining quick and easy operation ensuring that a minimum of maintenance is required. For valves of size 350 mm and above either bevel or spur gearing shall be provided to facilitate manual operation. (h) The valves coming in vacuum lines shall be of extended gland type and / or water sealed.
- viii. The actuator-operated valves shall be designed on the basis of the following:
 - 1. The internal parts shall be suitable to support the pressure caused by the actuators.
 - 2. The valve-actuator unit shall be suitably stiff so as not to cause vibrations, misalignments, etc.
 - 3. All actuator-operated valves shall be provided with hand operated gearing mechanism also.
 - 4. All actuators operated valves shall open/close fully within time required by the process.
- ix. Valves coming under the purview of IBR shall meet IBR requirements.
- x. Gate/sluice valves shall be used for isolation of flow. Gate valves shall be provided with the following accessories in addition to other standard items:
 - 1. Hand wheel
 - 2. Position indicator (for above 50 mm NB valve size)
 - 3. Draining arrangement wherever required.
- xi. Globe valves shall be used for regulation purposes. They shall be provided with hand wheel, position indicator, draining arrangement (wherever required) and arrow indicating flow direction.
- xii. Check valves shall be used for non-return service. They shall be swing check type or double door (Dual plate) check type with a permanent arrow inscription on the valve body indicating the fluid flow direction. In long distance pipes lines with possibility of surge-occurrence, dual plate

check valves are preferable for its spring controlled opening/closing of flaps/doors against flow reversals. However, dual plate check valves shall not be used for sizes more than 600 mm NB.

- xiii. All gate and globe valves shall be provided with back seating arrangement to enable on line changing of gland packing.
 - xiv. All gate and globe valves shall be rising stem type and shall have limit switches for full OPEN and full CLOSED indication wherever required. This will include motor-operated valves also wherever required. In such cases the limit switches shall form an integral part of the valve. Stop-gap arrangement in this respect is not acceptable.
 - xv. All valves shall be provided with embossed name plate giving details such as tag number, type, size etc.
 - xvi. Wherever required valves shall be provided with chain operator, extension spindles and floor stands or any other arrangement approved by employer so that they can be operated with ease from the nearest operating floor. Wherever necessary for safety purpose locking device shall be provided. Further, necessary small platforms for facilitating easy valve operation shall be provided by the Bidder wherever necessary in consultation with project manager within the bid price at no extra cost to employer.
 - xvii. All valves except those with rising stems shall be provided with continuous mechanical position indicator; rising stem valves shall have only visual indication through plastic/metallic stem cover for sizes above 50 mm nominal bore.
 - xviii. For CI gate, globe and check valves wherever thickness of body/bonnet is not mentioned in the valves standards, thickness mentioned in IS-1538 for fitting shall be applicable.
- b. Valve Body Material

Valve body material for various services shall be as follows: Valve body material for water application like DM Cooling Water (Passivated DM Water) (DMCW), RO Stage I Permeate, AHP Seal Water, APH/ ESP Wash, Service Water, Potable Water, HVAC Make UP shall be cast iron for sizes 65 NB and above; gun-metal/ Forged Carbon Steel for sizes 50 Nb and below.

Valve body material for sea water application like Circulating Water. Auxiliary Cooling water, Blowdown, CT make up, sea water Intake, Guard pond inlet & Discharge, Ash Water using sea water, RO Stage II reject, RO Stage I reject, Reject Sump discharge and all other sea water applications shall be SS 316 L for all sizes.

For compressed air application, valve body material shall be cast carbon steel or forged carbon steel for sizes 65 mm NB & above and Gun metal for sizes 50 NB and below. DM water: SS body and disc along with SS internals. Condensate: Cast Carbon Steel/Forged Carbon Steel.

- i. The design, material, construction, manufacture, inspection, testing and performance of valves shall comply with all currently applicable statutes, regulations and safety codes in the locality where the valves will be installed. The valves shall conform to the latest editions of applicable codes and standards as mentioned elsewhere. Nothing in this specification shall be construed to relieve the Bidder of his responsibility. Valves in general shall conform to the requirements of the following standards.

AWWA-C-504	Rubber seated butterfly valves
BS-5155/EN-593	Cast iron and steel body butterfly valves for general purpose.
IS-778	Gun-metal gate, globe and check valves for general purpose.

BS-5154	Copper alloy globe/globe stop and check and gate valves for general purpose.
IS-780	Sluice valves for water works purpose (50-300 mm size)
IS-2906	Sluice valves for water works purpose (350-1200 mm size)
IS-5150	Cast iron wedge and double disc gate for general purpose.
BS-5152	Specification for cast iron globe valve
BS-5153	Cast iron check valves for general purpose.
IS-5312	Swing check type reflux (non-return) valves
ANSI B 16.34	Standard for valves
API-594	Standard for Dual-check valves
API-600	Steel gate valves
ANSI-B-16.10	Valves face to face and other relevant dimension
API-598	Valves inspection test

ii. End Connections

The end connections, shall comply with the following:

Socket welding (SW) – ANSI B 16.11

Butt Welding (BW) – ANSI B 16.25

Threaded (SC) – ANSI B 2.1

Flanged (FL) – ANSI B 16.5 & AWWA-C-207 (steel flanges), ANSI B 16.1 (Cast Iron flanges)

- iii. All cast iron body valves (gate, globe and non-return) shall have flanged end connections; (screwed ends for Ductile D.2NI body valves are not acceptable).
- iv. All steel and stainless steel body valves of sizes 65 mm and above shall have flanged or butt welding ends. Valves of sizes below 65mm shall have flanged or socket welded ends. Compatibility of welding between valve body material and connecting pipe material is a prerequisite in case of butt-welded joints.
- v. All gun metal body valves shall have screwed ends.
- vi. All flanged end valves/specialties shall be furnished along with matching counter flanges, fasteners, gaskets etc. as required to complete the joints

2.1.6.2.15 Check Valves

- a. Check valves shall comply with the following characteristics:
 - i. For bore greater than 2" the valves must be swing check type or dual plate check type suitable for installation in all positions (vertical and horizontal);
 - ii. For bore smaller than or equal to 2" the valves must be of the piston type to be installed, in horizontal position.
 - iii. In the case of swing check valves, the body seat shall be inclined at such an angle from the vertical as will facilitate closing and prevent chatter.
- b. Drilling on flanges of flanged valves must correspond to the drilling on flanges of the piping system on which the valves are to be installed.
- c. All flanged valves intended for installation in steel piping systems shall have their flanges drilled to ANSI B 16.5 (or equivalent) and according to the pressure class.
- d. Counter flanges to be installed on air pipes shall be screwed-on type irrespective of size.

2.1.6.2.16 Globe Valves

- a. The globe valves shall have the following characteristics; Straight conveyed flow Right angle
Preferably, the valves shall be of the vertical stem type.
- b. Globe valves shall preferably have radiused or spherical seating and discs shall be free to revolve on the spindle.
- c. The pressure shall preferably be under the disc of the valve. However, globe valves, with pressure over the disc shall also be accepted provided
 - i. No possibility exists that flow from above the disc can remove either the disc from stem or component from disc
 - ii. Manual globe valves can easily be operated by hand. If the fluid load on the top of the disc is higher than 40-60 KN, bypass valve shall be provided which permits the downstream system to be pressurized before the globe valve is opened.
- d. For the regulating valves, valves with regulating plug & parabolic outline disc type is preferred.
- e. All motorized globe valves with regulating plug for which indication of percentage (%) opening are required in the control room shall be provided with necessary position transmitter.

2.1.6.2.17 Gate valves

All gate valves shall be of the full-way type, and when in the full open position the bore of the valve shall not be constricted by any part of the gate Gate valves shall be of the solid/elastic or articulated wedge disc and rising stem type.

2.1.6.2.18 Air Release Valve

- a. The air release valves shall be of automatic double air valve with two orifices and two floats. The float shall not close the valve at higher air velocities. The orifice contact joint with the float shall be leak tight joint.
- b. The valve shall efficiently discharge the displaced air automatically from ducts/pipes while filling them and admit air automatically into the ducts/pipes while they are being emptied. The valve shall also automatically release trapped air from ducts/pipes during operation at the normal working pressure.
- c. Body material of automatic air release valves shall comply generally with BS 1452 Gr. 14/IS: 210 Gr. FG 260 and spindle shall conform to high tensile brass.
- d. Air release valves shall not have any integral isolation device within them. Each Air release valve shall be mounted, preceded by a separate isolation gate/butterfly valve.

2.1.6.2.19 Butterfly Valves

- a. Design/Construction
 - (a) The valves shall be designed for the design pressure/temperature of the system on which it is installed and in accordance with AWWA-C-504, EN- 593 or any other approved equivalent standard latest edition. Fabricated steel (IS: 2062 GR. B) butterfly valves instead of cast iron body valves are also acceptable for size above 300 mm diameter. In such a case, however, the bidder will have to necessarily submit thickness calculations, in order to establish the integrity of the fabricated valve body under the system operating pressure condition.
 - i. The valves shall be suitable for installation in any position (horizontal/vertical etc.) and shall be generally of double-flanged construction. However for sizes 600 NB and below the valves of Wafer construction are also acceptable.

- ii. The seals, both on the body (sleeve) and on the disc shall be of the material specified. Necessary shaft seal shall be provided and adequately designed to ensure no leakage across the seal. This seal shall be designed so that they will allow replacement without removal of the valve shaft. The sealing ring on the disc shall be continuous type and easily replaceable.
 - iii. For all types of valves, the design with shaft eccentric to the disc is preferred. The shaft shall be solid type and shall pivot on bushings. Bushings/sleeve type bearings shall be contained in the hub of valve body. The bearing shall be self-lubricated type with low coefficient of friction and should not have any harmful effect on water and on valve components.
 - iv. The design of the shaft shall be such that it will safely sustain maximum differential pressure across the closed valve. The shaft and any key (taper pin etc.) for transmitting the torque between shaft and disc shall be capable of withstanding the maximum torque required to operate the valve. However, the shaft diameter shall not be less than the minimum shaft diameter specified in relevant code. Necessary Torque Calculation and the torque class selected on the basis of the same shall be furnished to the Employer for information.
 - v. The disc shall rotate from the full open to the tight shut position. The disc shall be contoured to ensure the least possible resistance to flow and shall be suitable for throttling operation. While the disc is in the throttled position, valve shall not create any noise or vibration.
 - vi. The operating mechanism shall be mounted directly on or supported from the valve body.
 - vii. All valves shall be complete with: Position indicator (located in a visible place) Arrow indicating the flow direction; Adjustable mechanical stop limiting devices to prevent over Travel of valve disc in open/close position. All valves shall be "tight shut off"
 - viii. Hand operated valves shall have the following Local hand controls the hand controls shall close the valve with clockwise rotation. The hand controls shall be dimensioned to guarantee an easy maneuver under most severe conditions. The hand controls shall be provided with locking systems suitable to avoid the disc assuming a non-desirable position during the operation. Hand wheel shall be made of malleable iron with arms and rims of adequate strength. The hand wheel of diameters 300 mm or less shall be provided with handles for ease of operation. The pulling force required on the hand wheel rim shall not exceed 25 Kgf when operating the valve under full flow and operating pressure. Valves-350 Nb and above shall have pressure equalizing bypass valves, wherever system parameters warrant the same. Valves-350 Nb and above shall also be provided with gear operator arrangement suitable for manual operation. Manual operation of valve shall be through worm and gear arrangement having totally enclosed gearing with hand wheel diameter and gear ratio designed to meet the required operating torque It shall be designed to hold the valve disc in intermediate position between full open and full closed position without creeping or fluttering. Adjustable stops shall be provided to prevent over travel in either direction. Limit and torque switches (if applicable) shall be enclosed in water tight enclosures along with suitable space heaters for motor actuated valves, which may be either for On-Off operation or inching operation with position transmitter.
- b. Material of Construction (Butterfly Valves)
- Materials and other design details shall be as indicated below:
- i. Cast Iron Butterfly valves

Body & Disc	ASTM A48, Gr. 40 with 2% Ni/IS: 210. Gr. FG-260, with 2% Ni and epoxy coated
-------------	---

Shaft	BS 970 431 S: 291/EN 57, or AISI-410 or AWWA-permitted shaft material equivalent to EN-57/AISI-410 or better.
Seat ring	18-8 Stainless steel
Seal	Nitrile Rubber
Companion Flanges	IS 2062
External hardware	SS 316
Internal hardware	SS 316

- ii. Duplex Stainless Steel Butterfly valves (All Sea Water applications including guard pond, reject sump, CW, ACW, CT make Up, Sea Water Intake, RO Stage I Reject, RO Stage II Reject, Ash water (Sea water) etc.)

Body & Disc	SS 316 L
Shaft	SS 316 L.
Seat ring	SS 316 L
Seal	Nitrile Rubber
Companion Flanges	SS 316 L
External hardware	SS 316 L
Internal hardware	SS 316 L

- iii. Stainless Steel Butterfly Valves

Body & Disc	ASTM A 351, Gr. CF8M/ASTM-A-182-Gr. 304
Shaft	ASTM A 182, Gr. 316/ASTM-A-479 Gr. 316/Equivalent
Disc & Seat ring	EPT/BUNA-N/Neoprene
Companion Flanges	SS 304
External hardware	SS 316
Internal hardware	SS 316

- iv. Carbon Steel Butterfly Valve

Body & Disc	ASTM A 216, Gr. WCB
Shaft	ASTM A 182, Gr. 304/ASTM-A-479 Gr. 304/Equivalent
Disc & Seat ring	EPT/BUNA-N/Neoprene

Companion Flanges	IS 2062
External hardware	SS 316
Internal hardware	SS 316

c. Proof of Design Test (Type Test) for Butterfly Valves

Proof of Design (POD) test certificates shall be furnished by the bidder for all applicable size-ranges and classes of Butterfly valves supplied by him, in the absence of which actual POD test shall be conducted by the bidder in the presence of Employer's representative. All valves that are designed and manufactured as per AWWA-C-504 shall be governed by the relevant clauses of POD test in AWWA-C-504. For Butterfly valves designed and manufactured to EN-593 or equivalent, the POD test methods and procedures shall generally follow the guidelines of AWWA-C-504 in all respect except that Body & seat hydro test and disc-strength test shall be conducted at the pressures specified in EN-593 or the applicable code. Actuators shall also meet requirements of POD test of AWWA-C-504.

2.1.6.2.20 MATERIAL OF CONSTRUCTION (GATE/GLOBE/CHECK VALVE)

a. The materials shall generally comply with the following:

i. Cast Steel Valves

Body & bonnet	ASTM A 216 Gr. WCB/ASTM A 105
Disc for non-return Valves	ASTM A 216 Gr. WCB/ASTM A 105
Trim.	ASTM A 182 Gr. F6 or Equivalent
Companion Flanges	IS 2062
External hardware	SS 316
Internal hardware	SS 316
Internal hardware	SS 316

ii. Stainless Steel Valves

Body & bonnet	ASTM A 351 Gr. CF 8M/ASTM A 182 Gr. 304
Disc	-
Trim.	ASTM 182 Gr. F. 316 /ASTM-A-479 Gr. 316 or Integral with body
Companion Flanges	SS 304
External hardware	SS 316
Internal hardware	SS 316

iii. Cast Iron Valves

Body & bonnet 260	BS 1452 Gr. 14/IS-210 Gr. FG
Seating surfaces and rings	13% chromium steel/13% Chrome overlay
Disc for non-return valves	BS 1452 Gr. 14/IS-210 Gr FG 260

Hinge pin for non-return valves	AISI 316
Stem for gate globe valves	13% chromium steel or Equivalent
Back Seat	13% chromium steel / 13% Chrome overlay
Companion Flanges	IS 2062
External hardware	SS 316
Internal hardware	SS 316

iv. Gun Metal Valves

v.

Body & bonnet	IS 318 Gr. 2/Equivalent Standard
Trim.	-
Companion Flanges	IS 2062
External hardware	SS 316
Internal hardware	SS 316

vi. Duplex Stainless Steel (All Sea Water applications including guard pond, reject sump, CW, ACW, CT make Up, Sea Water Intake, RO Stage I Reject, RO Stage II Reject, Ash water etc)

Body & bonnet	SS 316 L
Disc for non-return	SS 316 L
Stem	SS 316 L
Trim.	SS 316 L
Companion Flanges	SS 316 L
External hardware	SS 316 L
Internal hardware	SS 316 L

b. Cast iron body valves shall have high alloy steel stem and seat.

c. Material for counter flanges shall be the same as for the piping except for sea water application.

2.1.6.2.21 Float Operated Valves

a. Valve shall automatically control the rate of filling and will shut off when a predetermined level is reached and close to prevent over flow on pre-set maximum water level. Valve shall also open and close in direct proportion to rise or fall of water level.

b. Design and Construction Features

The following design and construction feature of the valve shall be the minimum acceptable.

- Valves shall be right-angled or globe pattern.
- Valves shall be balance piston type with float ball.
- Leather liner shall not be provided.
- The body and cover material shall be cast iron conforming to ASTM-A 126 Grade 'B' or Is: 210 Grade 200 or equivalent, and float shall be of copper with epoxy painting of two (2) coats. For all sea water applications the complete valve shall be SS 316 L construction.
- Valves shall be suitable for flow velocities of 2 to 2.5m/sec.

- vi. The valves shall have flanged connections.

2.1.6.2.22 Painting of valves

Two (2) coats of primer followed by three (3) coats of epoxy of approved colour code/shade (usually same as that of connected piping) shall be applied to all exposed surfaces except stainless steel surface, Galvanized steel surface and gun metal surface at shop as required to prevent corrosion, before dispatch. The use of grease/oil other than light grade mineral oil, for corrosion protection is prohibited. The total DFT of painting shall be 150 micron (minimum). If during transport, unloading/unpacking or erection at site any part of the painted surface gets damaged, the same shall be made good by the Bidder by repainting with compatible painting primer and enamel to the satisfaction of the project manager.

2.1.6.2.23 Rubber Expansion Joints

- a. All parts of expansion joints shall be suitably designed for all stresses that may occur during continuous operation and for any additional stresses that may occur during installation and also during transient condition.
- b. The expansion joints shall be single bellow rubber expansion joints. The arches of the expansion joints shall be filled with soft rubber.
- c. The tube (i.e. inner cover) and the cover (outer) shall be made of natural or synthetic rubber of adequate hardness. The shore hardness shall not be less than 60 deg. A for outer and 50 deg. A for inner cover.
- d. The carcass between the tube and the cover shall be made of high quality cotton duck, preferably, square woven to provide equal strength in both directions of the weave. The fabric plies shall be impregnated with age resistant rubber or synthetic compound and laminated into a unit.
- e. Reinforcement, consisting of solid metal rings embedded in carcass shall be provided.
- f. Expansion joints shall be complete with stretcher bolt assembly. The expansion joints shall be suitable to absorb piping movements and accommodate mismatch between pipelines.
- g. The expansion joints shall be of heavy duty construction made of high grade abrasion-resistant natural or synthetic rubber compound. The basic fabric for the 'duck' shall be either a superior quality braided cotton or synthetic fibre having maximum flexibility and non-set characteristic.
- h. The expansion joints shall be adequately reinforced, with solid steel rings, to meet the service conditions under which they are to operate.
- i. All expansion joints shall be provided with stainless steel retaining rings for DM water application and IS 2062 Gr. B galvanized steel retaining rings for ordinary water for use on the inner face of the rubber flanges, to prevent any possibility of damage to the rubber when the bolts are tightened. These rings shall be split and beveled type for easy installation and replacement and shall be drilled to match the drilling on the end rubber flanges and shall be in two or more pieces.
- j. The expansion joints shall have integral fabric reinforced full-face rubber flanges. The bolt on one flange shall have no eccentricity in relation to the corresponding bolt hole on the flange on the other face. The end rubber flanges shall be drilled to suit the companion pipe flanges.
- k. All exposed surfaces of the expansion joint shall be given a 3 mm thick coating of neoprene. This surface shall be reasonably uniform and free from any blisters, porosity and other surface defects.
- l. Each control unit shall consist of two (2) numbers of triangular stretcher bolt plates, a stretcher bolt with washers, nuts, and lock nuts. Each plate shall be drilled with three holes, two for fixing the plate on to the companion steel flange and the third for fixing the stretcher bolt.

- m. Each joint shall have a permanently attached brass or stainless steel metal tag indicating the tag numbers and other salient design features.
- n. Bidder to note that any metallic part which comes in contact with DM / Corrosive water shall be of stainless steel material.
- o. For all Sea Water applications including guard pond, reject sump, CW, ACW, CT make Up, Sea Water Intake, RO Stage I Reject, RO Stage II Reject, Ash water etc. the bolts & nuts, stretcher plates and companion flanges shall be SS 316 L.

2.1.6.2.24 STRAINERS

a. Simplex type

The strainers shall be basket type and of simplex construction. The strainer shall be provided with plugged drain/blow off and vent connections. The free area of the strainer element shall be at least four (4) times the internal area of the connecting pipe lines. The strainer element shall be 20 mesh. Pressure drop across the strainers in new condition fitted with a removable plug. The material of construction of various parts shall be as follows:

1	Body	IS: 318, Gr. 2 up to 50 mm Nb, and IS: 210 Gr. FG 260 above 50 mm Nb. (For DM water/ -Body: AISI 316 or equivalent) SS 316 L (all Sea Water applications including guard pond, reject sump, CW, ACW, CT make Up, Sea Water Intake, RO Stage I Reject, RO Stage II Reject, Ash water etc)
2	Strainer Element	Stainless steel (AISI 316) SS 316 L (all Sea Water applications including guard pond, reject sump, CW, ACW, CT make Up, Sea Water Intake, RO Stage I Reject, RO Stage II Reject, Ash water etc)
3	End connection	Screwed upto 50 mm Nb, and flanged above 50 mm Nb

b. Duplex type

- i. The strainers shall be basket type and of duplex construction. The strainer shall be provided with plugged drain/blow off and vent connections. The free area of the strainer element shall be at least four (4) times the internal area of the connecting pipe. The mesh of strainer element shall be commensurate with the actual service required. Pressure drop across the strainer in new condition shall not exceed 4.0 MWC at full flow.
- ii. Wire mesh (if applicable) of the strainers shall be suitably reinforced. The material of construction of various parts shall be as follows.

1	Body	IS: 318, Gr. 2 Up to 50 mm Nb, and IS:210, Gr. FG 260 of ASTM-A-515 Gr. 75/IS-2062 Gr. B and internally epoxy-painted above 50 NB.SS 316 L (all Sea Water applications including guard pond, reject sump, CW, ACW, CT make Up, Sea Water Intake, RO Stage I Reject, RO Stage II Reject, Ash water etc.)
---	------	--

2	Strainer element	Stainless steel (AISI 316)/ SS 316 L (all Sea Water applications including guard pond, reject sump, CW, ACW, CT make Up, Sea Water Intake, RO Stage I Reject, RO Stage II Reject, Ash water etc)
3	End connection	Screwed up to 50 mm NB, and Flanged above 50 NB. Gasket shall be of full face type

- iii. The strainer will have a permanent stainless steel tag fixed on the strainer body indicating the strainer tag number and service and other salient data.
 - iv. The size of the strainer and the flow direction will be indicated on the strainer body casting.
 - v. Thickness of the strainer element should be designed to withstand the pressure developed within the strainer due to 100% clogged condition exerting shut-off pressure on the element.
- c. Three shop coats of paint preceded by two coats of primer shall be applied to all exposed surfaces as required to prevent corrosion. All parts shall be adequately protected for rust prevention. The use of grease or oil other than light grade mineral oils for corrosion protection is prohibited.

**TITLE**

**1X800 MW NORTH CHENNAI TPP STAGE III
MILL REJECT SYSTEM (PNEUMATIC TYPE)**

SPECIFIC TECHNICAL REQUIREMENTS

SPECIFICATION NO. PE-TS-423-160-A001

SECTION - I

REV 00

Sub Section -IA

Date: MAY 2017

ANNEXURE-K
PAINTING SPECIFICATION



EPC TENDER SPECIFICATION FOR BTG PACKAGE

2.1.5.6.50 For the purpose of carrying out type tests: metallic bellows shall be grouped based on the parameters as give below. The bellows conforming to the same combination of these parameters shall constitute one group. Type test shall be carried out on one or specific above.

- a. Material of bellow: based on material of bellow, bellow shall be categorized in to three category namely carbon steel, stainless steel (Eg. SS304, 316,321 etc.) & high alloy steel (Eg. inconal).
- b. Profile of convolutions: each profile shall be considered as separate category (e.g. U profile, V profile & Lyra profile etc.)
- c. Dimension of bellows: based on the size, the categories shall be as under:
 - i. Nominal diameter of metallic expansion joint up to and including 800mm NB.
 - ii. Nominal diameter of metallic expansion joint greater than 800mm NB up to and including 1600mm NB.
 - iii. Each size above 1600mm NB shall be a separate category.
- b. Design pressure: based on the design pressure, bellows shall be categorized as under:
 - i. Deign pressure from full vacuum up to 5Kg/sq.cm (g).
 - ii. Design pressure above 5Kg/sq.cm (g) and up to 10Kg/sq.cm (g) with or without vacuum.

2.1.5.6.51 Number Of Cycles

For the life cycle test, the number of test cycles shall be minimum 10,000 cycles. Other tests for the metallic expansion joint shall be carried out as per the approval QP/QA section. Further, other terms and conditions for type test shall be as specified elsewhere in the specification.

2.1.5.6.52 Specification For Surface Preparation & Painting

- a. Surface preparation methods and paint/ primer materials shall be of the type specified herein. If the contractor desires to use any paint/primer materials other than that specified specific approval shall be obtained by the contractor in writing from the employer for using substitute material.
- b. All paints shall be delivered to job site in manufactures sealed containers, each container shall be labelled by the manufacture with the manufacture's name type of paint, batch no. and colour.
- c. unless specified otherwise paint shall not be applied to surface of insulation, surface of stainless /nickel/copper/brass/Monel/aluminium/hastelloy/lead/galvanized steel items, valve stem, pump rod, shaft gauges, bearing and contact surface, lined or clad surfaces.
- d. All pipelines shall be colour coded for identification as per the colour-coding scheme indicated in Volume II Section 1 Chapter 8 and which will be furnished to the contractor during detailed engineering.

2.1.5.6.53 Surface Preparation

- a. All surfaces to be paints shall be thoroughly cleaned of oil, grease and other foreign matter, surfaces shall be free of moisture and contamination from chemicals and solvents.
- b. the following surfaces scheme are envisaged here, depending upon requirement any one or a combination of these may be used for surface preparation before application of primer.



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

SP1	Solvent cleaning
SP2	Application of rust converter (Ruskil or equivalent grade)
SP3	Power tool cleaning
SP4*	Shot blasting (shot blasting shall be used as surface preparation method for hot worked pipes prior to application of primer)
SP5	Phosphating
SP6	Emery sheet cleaning/ manual wire brush cleaning.

2.1.5.6.54 Application Of Primer /Paint

- The paint /primer manufacturer's instructions covering thinning, mixing, method of application, handling and drying time shall be strictly followed and considered as part of this specification. The dry film thickness (DFT) of primer / paint shall be as specification herein.
- Surface prepared as per the surface preparation scheme indicated herein shall be applied with primer paint within 6 hours after preparation of surface
- Where primer coat has been applied in the shop, the primer coat shall be carefully delaminated, cleaned and spot primed with one coat of the primer before applying intermediate and finish coats. When the primer coat has not been applied in the shop, primer coat shall be applied by brushing, rolling or spraying on the same day as the surface is prepared, primer coat shall be applied prior to intermediate and finish coats. .
- Steel surface that will be concealed by building walls shall be primed and finish painted before the floor is erected. Tops of structural steel members that will be covered by grating shall be premed and finish painted before the grating is permanently secured.
- Following are the primer/painting schemes envisaged herein:

PS3	zinc chrome primer (Alkyd base) by brush/Spray to IS104.
PS3*	zinc chrome primer (Alkyd base) by dip coat.
PS4	synthetic Enamel (long oil alkyd) to IS2932.
PS5	red oxide zinc phosphate to IS-12744.
PS9	aluminum paint to IS 2339.
PS9*	heat resistant aluminium paint to IS-13183 Gr.-I (for temperature 400°C-600°C) , IS -13183 Gr.-II (for temperature 200°C-400°C) and IS-13183 Gr.-III (for temperature up to 200°C)
PS13	rust preventive fluid by spray, dip or brush.
PS14	wieldable primer-Deoxaluminat or equivalent.
PS16	high build Epoxy CDC mastic `15'
PS17	aliphatic acrylic polyurethane CDE134, %V=40.0 (min.)
PS18	Epoxy based TiO2 pigmented coa
PS19	Epoxy based zinc phosphate primer (92% zinc in dry film (min.)%VS=35.0 (min.)
PS20	Epoxy based finish paint.



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

- f. All weld edge preparation for site welding shall be applied with one coat of weldable.
- g. For internal protection of pipes/tubes, VCI pellets shall be used at both ends after sponge testing and ends capped. VCI pellets shall not be used for SS components and composite assemblies.



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

2.1.5.6.55 Primer/painting schedule

Sl.No.	Description	Surface preparation	Primer coat			Intermediate coat			Finish coat			Total min. (micron)	Colour shade
			System	Coat	Min. DFT/coat (microns)								
1	All insulated piping's. Fittings/ componentes, pipe clamps, vessels/tanks, equipments etc.	SP3/SP4	PS 9*	1	20	-	-	-	PS9*	1	20	40	as per NTPC colour shade/ coding scheme
2		SP3/SP4	PS 9*	2	25	-	-	-	PS4	3\$	35\$	155\$	
		SP3/SP4	PS 9*	1	20	-	-	-	PS9*	1	20	40	
		SP3/SP4	PS 9*	1	20	-	-	-	PS9*	1	20	40	
3	Constant load hanger (CLH). Variable load hanger (VLH) and other supports	SP4*	PS 19	1	40	-	-	-	PS17	1	30	70	
4	Valves												
	Cast/forged	SP1/SP2/SP3	PS 9	1	20	-	-	-	PS9	1	20	40	



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

		Design temperature 95°C-200°C	SP1/SP2/SP3	PS 9*	1	20	-	-	-	PS9*	1	20	40	
		Design temperature >200°C	SP1/SP2/SP3	PS 9*	1	20	-	-	-	PS9*	1	20	40	
5	All structural steel components	outside TG building and in SG envelope	SP4*	Inorganic Ethylene Zinc Silicate	1	75	PS18	1	75	a. epoxy coat	2	25	250	
										b.final coat of paint PS1	1	30		
										Within TG building	SP4*	-	1	35
										b.final coat of paint PS1	1	30		
6	Weld edges		SP6(hand cleaning by wire brushing)	PS13 (weldable primer)	1	25	-	-	-	-	-	-	-	
	\$ The first 2 finished coats (total min. DFT of 70 microns) shall be done at shop and the 3rd finish coat (min. DFT 35 microns) shall be applied at site.													

2.1.5.6.56 Testing requirements

**TITLE**

**1X800 MW NORTH CHENNAI TPP STAGE III
MILL REJECT SYSTEM (PNEUMATIC TYPE)**

SPECIFIC TECHNICAL REQUIREMENTS

SPECIFICATION NO. PE-TS-423-160-A001

SECTION - I

REV 00

Sub Section -IA

Date: MAY 2017

ANNEXURE-L

Drawings/documents to be submitted after award of contract



TITLE

**TECHNICAL SPECIFICATION FOR
MILL REJECT HANDLING SYSTEM
1X800 MW NCTPS TPP**

SPECIFICATION NO. PE-TS-423-160-A001

Section-I

SHEET 1 OF 3

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 DRGNO	DRG TITLE	SUBMISSION SCHEDULE - WEEK NUMBER FROM DATE OF LOI	CATEGORY
1	PE-V0-423-160-A002	GA OF WATER AND AIR LINE VALVES	12	A-CUST
2	PE-V0-423-160-A003	G.A., TECHNICAL DATA SHEET OF AIRCOMPRESSOR MOTOR	10	A-CUST
3	PE-V0-423-160-A004	DESIGN PHILOSOPHY AND SYSTEM SIZING CALCULATION OF MILL REJECT SYSTEM	4	A-CUST
4	PE-V0-423-160-A005	INSTRUMENT SCHEDULE	10	I-CUST
5	PE-V0-423-160-A006	P & I DIAGRAM OF MILL REJECT HANDLING SYSTEM	4	A-CUST
6	PE-V0-423-160-A007	DETAILED BOM	20	I-BHEL
7	PE-V0-423-160-A008	GA & DS OF SELF MFG. ITEMS (DENSVEYOR, HOPPER, BNKR DIS. GATE, PRV, ACI BEND, PNEU. PANEL, AIR RECVR, TER. BOX, ETC.)	6	I-CUST
8	PE-V0-423-160-A009	P G TEST PROCEDURE	20	A-CUST
9	PE-V0-423-160-A010	P & I DIAGRAM OF MRS COMPRESSOR	10	A-CUST
10	PE-V0-423-160-A011	SUB VENDOR LIST WITH INSPECTION CATEGORY	4	A-CUST
11	PE-V0-423-160-A012	WELDING PROCEDURE SPECIFICATION	6	A-CUST
12	PE-V0-423-160-A013	EQPT AND PIPING LAYOUT OF MILL REJECT SYSTEM AND PIPING LAYOUT FROM COMPRESSOR HOUSE	8	A-CUST
13	PE-V0-423-160-A014	LAYOUT OF COMPRESSOR HOUSE	10	A-CUST
14	PE-V0-423-160-A015	QAP OF MS STRUCTURAL STEEL/ PLATES	6	A-CUST
15	PE-V0-423-160-A016	CABLE TRAY, EARTHING LAYOUT	10	A-CUST
16	PE-V0-423-160-A017	QAP OF SELF MANUFACTURED- CONVEYING VESSEL , PYRITE HOPPER, BUNKER DISCHARGE GATE, PRESSURE RELIEF VALVE, TERMINAL BOX , ACI BEND, AIR RECEIVER , PNEUMATIC PANEL	8	A-CUST
17	PE-V0-423-160-A019	G.A OF MRS BUNKER	6	A-CUST
18	PE-V0-423-160-A020	QAP OF MS ERW PIPE	10	A-CUST
19	PE-V0-423-160-A021	QP FOR COMPRESSOR	10	A-CUST
20	PE-V0-423-160-A022	TRENCH AND INSERT DETAIL OF MRS	8	A-CUST
21	PE-V0-423-160-A023	QP FOR KNIFE GATE/PLATE VALVE	10	A-CUST
22	PE-V0-423-160-A024	DESIGN CALCULATION AND STRUCTURAL ARRANGEMENT OF BUNKER AND LOAD DATA OF BUNKER	10	A-CUST



TITLE

**TECHNICAL SPECIFICATION FOR
MILL REJECT HANDLING SYSTEM
1X800 MW NCTPS TPP**

SPECIFICATION NO. PE-TS-423-160-A001

Section-I

SHEET 2 OF 3

23	PE-V0-423-160-A025	GA OF KNIFE GATE/PLATE VALVE	8	I-CUST
24	PE-V0-423-160-A026	QP FOR BAG FILTER	10	A-CUST
25	PE-V0-423-160-A027	G.A OF BAG FILTER	8	I-CUST
26	PE-V0-423-160-A028	QP FOR METALLIC EXPANSION BELLOW	10	A-CUST
27	PE-V0-423-160-A030	QP FOR RUPTURE DISC	10	A-CUST
28	PE-V0-423-160-A031	QP FOR CHAIN PULLEY BLOCK	10	A-CUST
29	PE-V0-423-160-A032	QP FOR WATER AND AIR LINE VALVES	10	A-CUST
30	PE-V0-423-160-A033	QP FOR COMPRESSOR MOTOR	10	A-CUST
31	PE-V0-423-160-A034	G.A OF METALLIC EXPANSION BELLOW	8	I-CUST
32	PE-V0-423-160-A035	G.A. OF RUPTURE DISC.	8	I-CUST
33	PE-V0-423-160-A036	QAP of INSTRUMENTS (PG/PS/PT/TS/TG/SV)	12	A-CUST
34	PE-V0-423-160-A037	GA OF CHAIN PULLEY BLOCK	8	I-CUST
35	PE-V0-423-160-A040	TYPE TEST CERTIFICATE/PROCEDURE FOR MOTORS	10	A-CUST
36	PE-V0-423-160-A043	G.A., TECHNICAL DATA SHEET AND FOUNDATION DETAILS OF AIRCOMPRESSOR, GA AND WIRING DIAGRAM FOR LOCAL PANEL OF CONVEYING AIR COMPRESSOR	10	A-CUST
37	PE-V0-423-160-A044	QP FOR SUMP PUMP WITH MOTOR	12	A-CUST
38	PE-V0-423-160-A045	GA, TECHNICAL DATA SHEET AND WIRING DIAGRAM OF SUMP PUMP	10	I-CUST
39	PE-V0-423-160-A046	ELECTRICAL LOAD LIST	6	I-G-P
40	PE-V0-423-160-A047	TECHNICAL DATA SHEET OF TEMPERATURE SWITCH, TEMPERATURE GAUGE, PRESSURE SWITCH, PRESSURE GAUGE, SOLENOID VALVE , LEVEL SWITCH , AIR FILTER REGULATOR	10	I-CUST
41	PE-V0-423-160-A048	CONTROL WRITE-UP & INTERLOCK & PNEUMATIC CIRCUIT OF CONVEYING VESSEL, BLOCK LOGIC DIAGRAM/CONTROL SCHEME WITH HMI SCREEN & I/O List	10	A-CUST
42	PE-V0-423-160-A051	CABLE INTERCONNECTION DIAGRAM	14	I-CUST
43	PE-V0-423-160-A052	PAINTING SCHEDULE	8	I-CUST
44	PE-V0-423-160-A053	PIPING AND VALVE SCHEDULE	8	I-CUST
45	PE-V0-423-160-A054	CABLESCHEDULE -SIGNAL AND CONTROL	12	I-CUST
46	PE-V0-423-160-A055	OPERATION AND MAINTENANCE MANUAL	24	I-CUST

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.
2. Drawings shall be prepared in Auto-Cad latest edition. Required no. of hard and soft copies (editable) of the drawings shall be furnished as per requirement specified elsewhere in the specification.



TITLE

**TECHNICAL SPECIFICATION FOR
MILL REJECT HANDLING SYSTEM
1X800 MW NCTPS TPP**

SPECIFICATION NO. PE-TS-423-160-A001

Section-I

SHEET 3 OF 3

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.
 - 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, 3etc.
 - 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 7 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.

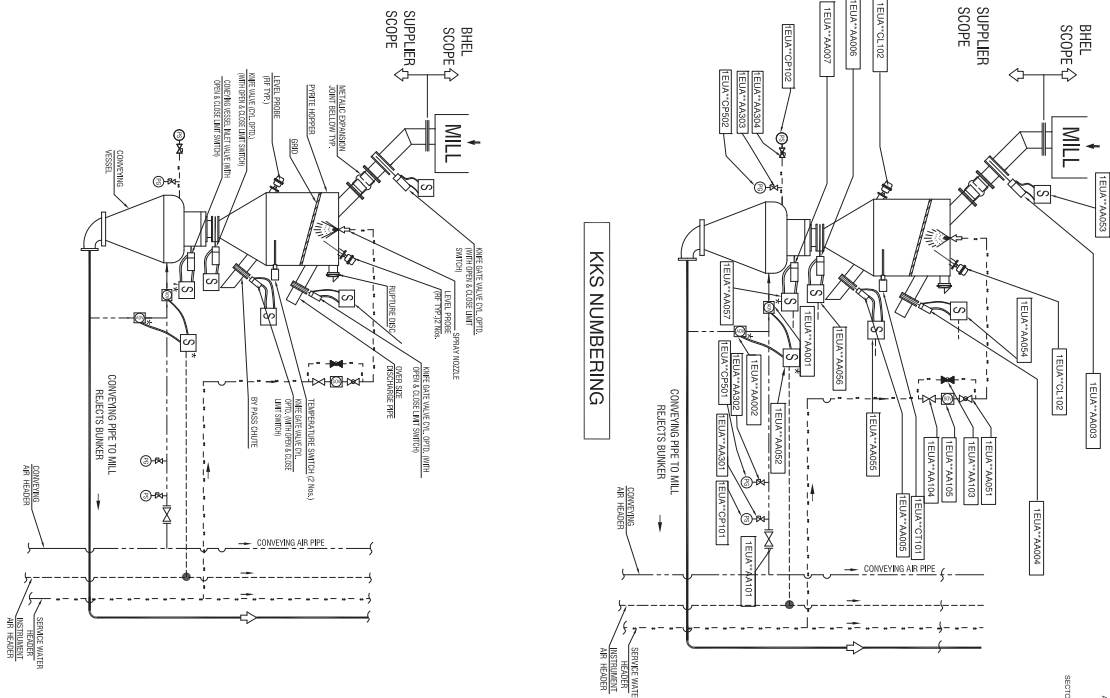


TITLE
1X800 MW NORTH CHENNAI TPP STAGE III
MILL REJECT SYSTEM (PNEUMATIC TYPE)
SPECIFIC TECHNICAL REQUIREMENTS

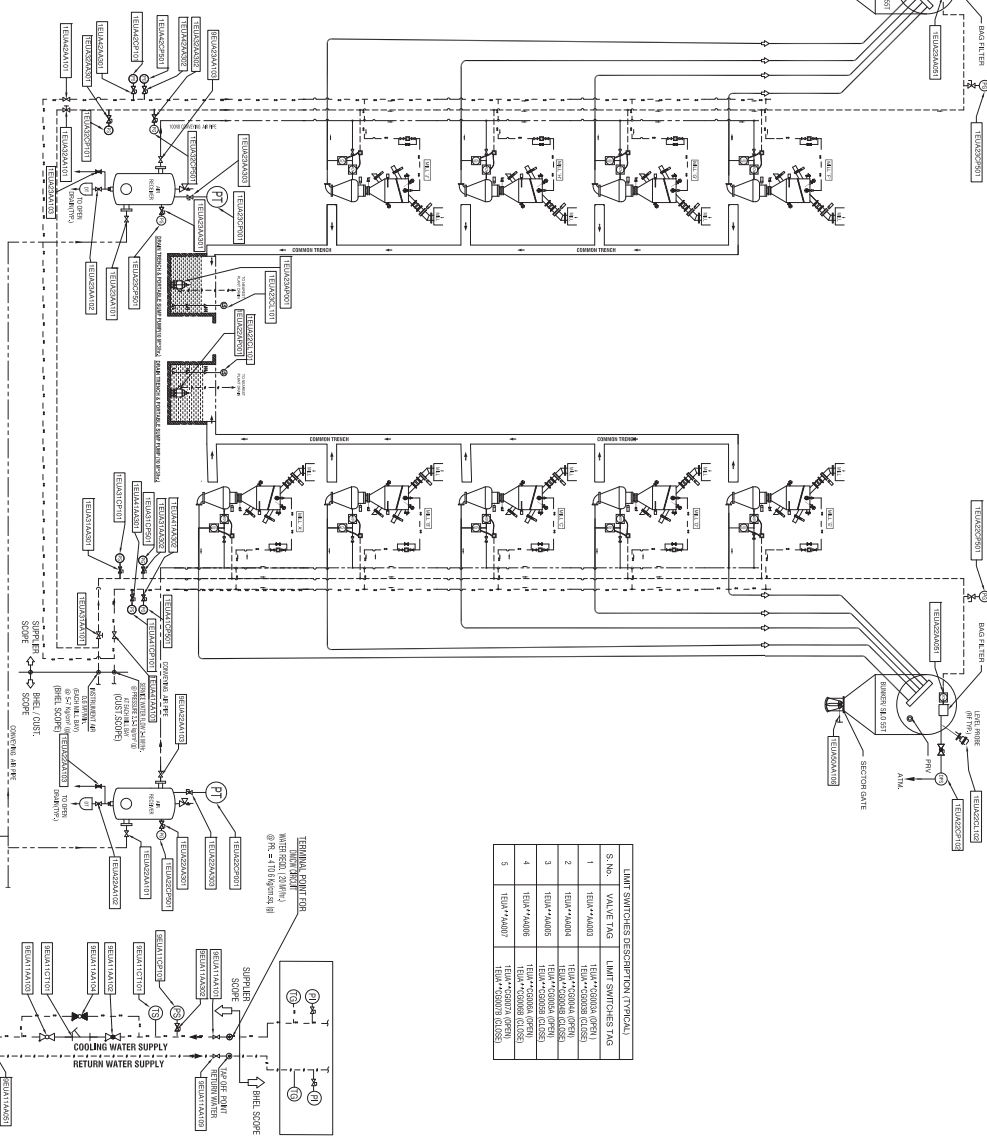
SPECIFICATION NO. PE-TS-423-160-A001
SECTION - I
REV 00
Sub Section -IA **Date**

ANNEXURE – M
INPUT DRAWINGS

KKS NUMBERING



- NOTE:**
1. * - CONVEYING AIR VALVES/ LINES MAY BE TWO OR MORE DEPENDENT UPON SUPPLIER'S SPECIFIC DESIGN.
 2. * - STANDS FOR 10/20/30... FOR MILLS ABC... RESPECTIVELY
 3. EQUIPMENT & INSTRUMENTS SHOWN IN THIS SCHEME ARE MINIMUM REQUIREMENT FOR THE SYSTEM. ANY ADDITIONAL DEVICE/ EQUIPMENT/ INSTRUMENTS REQUIRED FOR SYSTEM COMPLETION AND SATISFACTION OPERATION, SHALL BE PROVIDED.
 4. ALL SOLIDNO VALVES FOR OPERATIONS OF KNIFE/ PLATE VALVES, SHALL BE PLACED INSIDE PANEL.



LIMIT SWITCHES DESCRIPTION (TYPICAL)			
S. No.	VALVE TAG	LIMIT SWITCHES TAG	
1	TEUVA-M4003	TEUVA-M4003-01	TEUVA-M4003-01
2	TEUVA-M4004	TEUVA-M4004-01	TEUVA-M4004-01
3	TEUVA-M4005	TEUVA-M4005-01	TEUVA-M4005-01
4	TEUVA-M4006	TEUVA-M4006-01	TEUVA-M4006-01
5	TEUVA-M4007	TEUVA-M4007-01	TEUVA-M4007-01

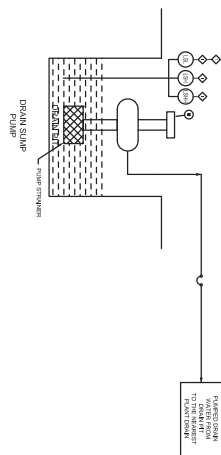
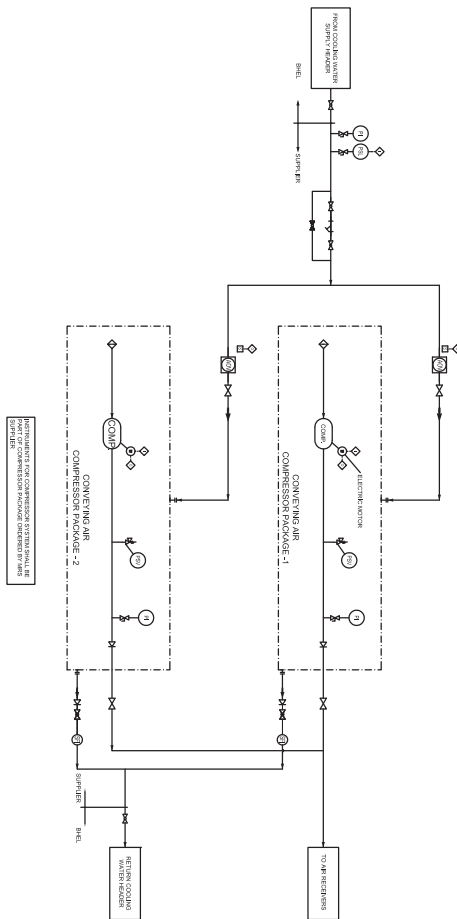
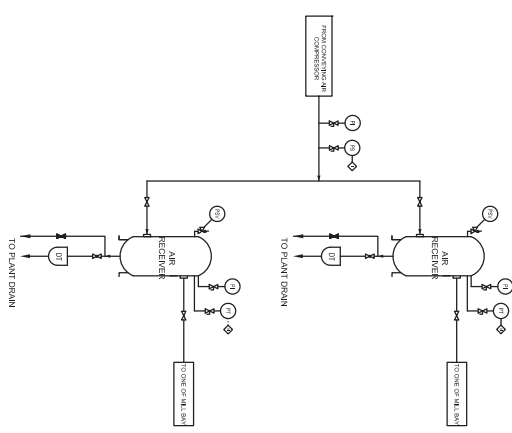
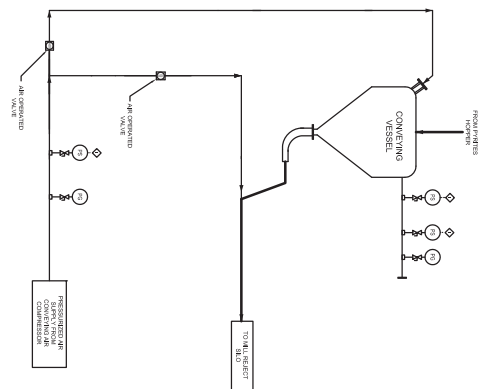
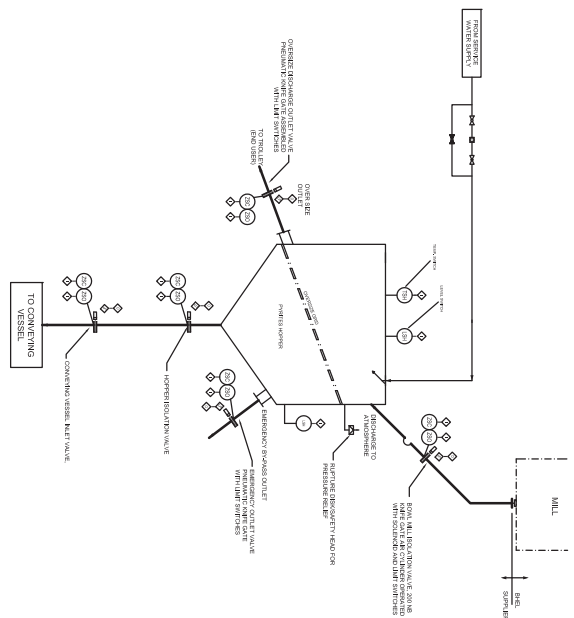
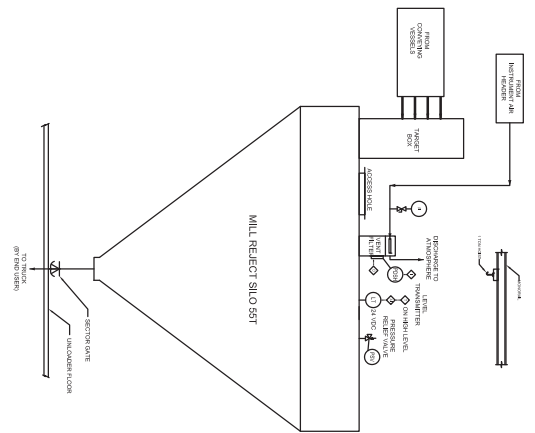
- LEGEND:**
- MILL REFLECTS
 - CONVEYING PIPE
 - CONVEYING AIR
 - INSTANTANEOUS AIR
 - SERVICE WATER
 - AIR OPERATED VALVE
 - ISOLATION COOK
 - TEMPERATURE SWITCH
 - SAFETY VALVE
 - PRESSURE GAUGE
 - PRESSURE TRANSDUCER
 - SHORT FLOW INDICATOR
 - TEMPERATURE GAUGE
 - SOLIDNO OPN. VALVE
 - KNIFE DATE VALVE
 - CHAMFER OPN. VALVE
 - PRESSURE SWITCH

Unit number identifier (9-Common, 1-unit#1, 2-unit#2)
 Function key (EUA STANDS FOR COAL REJECT HANDLING SYSTEM)
 Process/ Area Key
 Equipment/Instrument Key (AA-Boil Valve, CP-Instrument like PG and PT)
 Instrument / Equipment number key

KKS DESCRIPTION

X EUA 10 AA 001

BHARAT HEAVY ELECTRICALS LTD.			
POWER SECTOR PROJECT ENGINEERING MANAGEMENT, INDIA			
P & I DIAGRAM (MILL REFLECTS HANDLING SYSTEM)			
DRWN	DSN	CHKD	APPD
NTS	NTS	NTS	NTS
PE-DG-423-160-A01			
DATE	SCALE	DRW. No.	REV.
1	1	1	1



LEGEND:												
MIL. REFLECTS	15	LOW VALVE	10	TEMPERATURE GAUGE	1	STRAINER	100	DIFF. PRESSURE HIGH	20	PRESSURE HIGH		
CONVENTIONAL PIPE	15	TEMPERATURE SWITCH	10	SOLIDID ORDN. VALVE	1	FLATIBLE HOSE	20	TEMPERATURE HIGH	20	PRESSURE LOW		
INSTRUMENT AIR	15	SAFETY VALVE	10	PNEUMATIC PANEL	1	EXPANSION JUNT	20	LEVEL HIGH	20	LEVEL LOW		
SERVICE WATER	15	NON RETURN VALVE	10	KNIFE GATE VALVE	1	DISCONNECT	20	LIMIT SWITCH OPEN	20	LEVEL VERT. HIGH		
RETURN WATER	15	ORFFICE	10	PRESSURE GAUGE	1	LIMIT SWITCH CLOSED	20					
AIR OPERATED VALVE	15	DRAIN TAP	10	SIGHT FLOW INDICATOR	1							
INST. ISOLATION COCK	15		10		1							



BAHARATI HEAVY ELECTRICALS LTD.
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT,
Noida

P & I DIAGRAM
(MIL. REFLECTS HANDLING SYSTEM)

DRWN: _____
CHKD: _____
APP'D: _____

DATE: _____

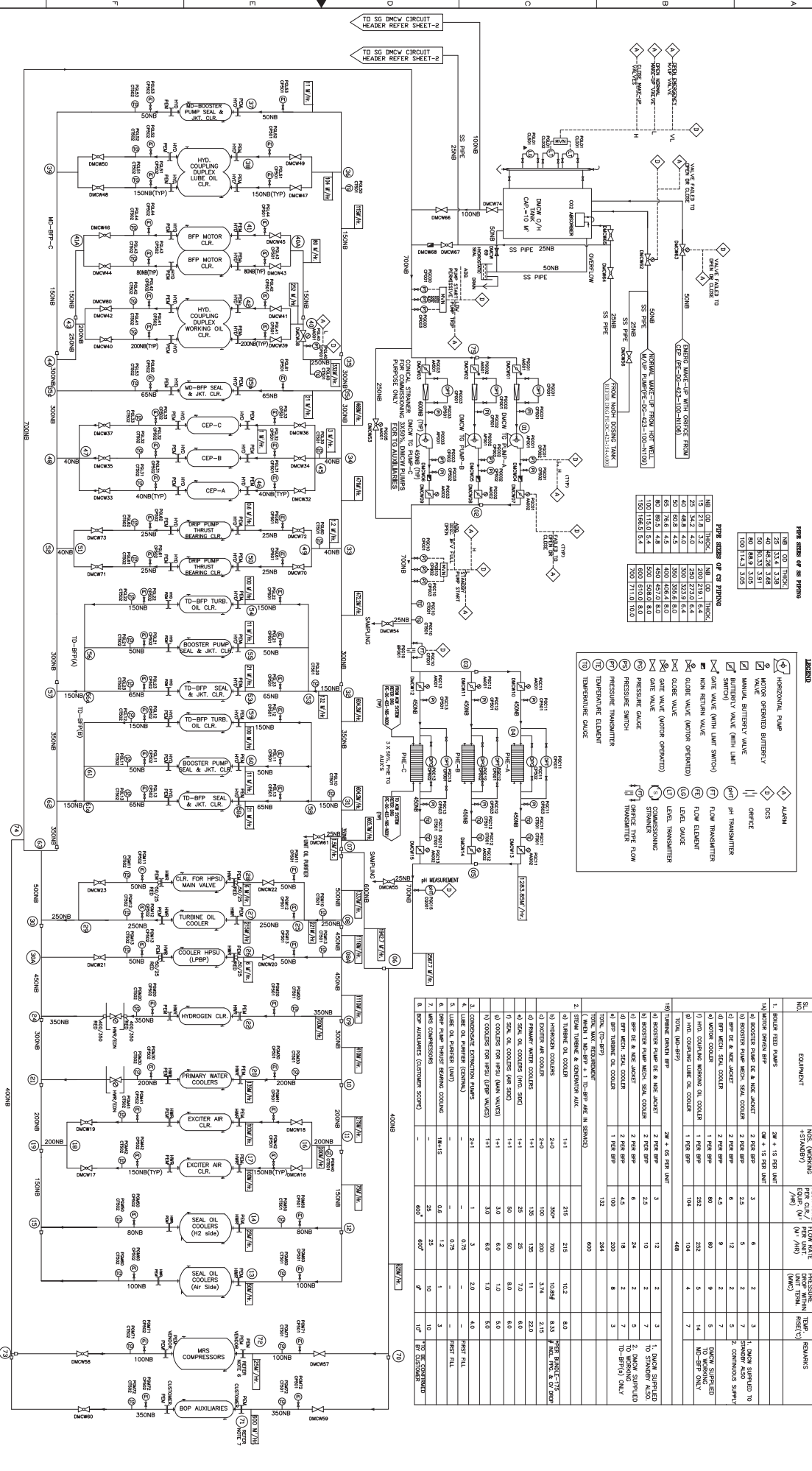
Scale: _____

NTS

Sheet No. _____ of _____

PE-DG-423-180-A001

1



PIPE SIZES OF 28" PIPE

NR 00 THICK	NR 00 THICK
25 31.4 3.98	200 219.1 6.4
40 48.26 3.69	250 273.0 6.4
50 60.3 3.91	350 353.9 6.4
80 86.3 3.95	400 406.4 8.0
100 114.3 3.05	450 457.0 8.0
	500 508.0 8.0
	600 610.0 8.0
	700 711.0 10.0

PIPE SIZES OF 42" PIPE

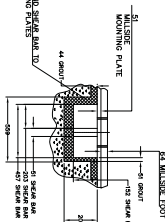
NR 00 THICK	NR 00 THICK
25 31.4 3.98	200 219.1 6.4
40 48.26 3.69	250 273.0 6.4
50 60.3 3.91	350 353.9 6.4
80 86.3 3.95	400 406.4 8.0
100 114.3 3.05	450 457.0 8.0
	500 508.0 8.0
	600 610.0 8.0
	700 711.0 10.0

4	ALARM	4	HORIZONTAL PUMP
5	OSC	5	WATER OPERATED BUTTERFLY VALVE (WATER VALVE)
6	ORICE	6	MANUAL BUTTERFLY VALVE (SWITCH)
7	TRANSMITTER	7	BATTERY VALVE (WATER LIMIT SWITCH)
8	FLOW TRANSMITTER	8	DATE VALVE (WATER LIMIT SWITCH)
9	FLOW ELEMENT	9	NON RETURN VALVE
10	LEVEL GAUGE	10	GLOBE VALVE (MANOR OPERATED)
11	LEVEL GAUGE	11	GLOBE VALVE
12	LEVEL TRANSMITTER	12	GLOBE VALVE (MANOR OPERATED)
13	COMMISSIONING STRAINER	13	DATE VALVE
14	ORFICE TYPE FLOW TRANSMITTER	14	PRESSURE GAUGE
15		15	PRESSURE SWITCH
16		16	PRESSURE TRANSMITTER
17		17	TEMPERATURE ELEMENT
18		18	TEMPERATURE GAUGE

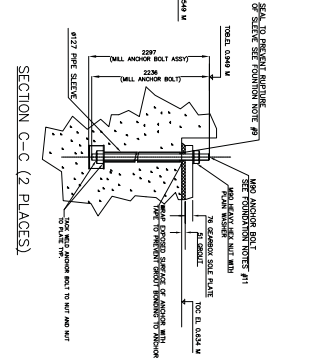
SL. NO.	EQUIPMENT	WGT. (WORKING STANDARD)	FLOW RATE PER CUB. M (L/HR)	DRIVER WATT (HP)	TEMP. RES'T.	REMARKS
1A.	BLOWER DRIVEN PUMPS	2W + 15 PER LANT				
	1) MOTOR DRIVEN BPP	2W + 15 PER LANT	3	2	3	1) DUCK SUPPLIED TO STANDBY ALSO.
	2) BOOSTER PUMP FOR 4 INCH JACKET	2 PER BPP	6	2	7	2) CONTINUOUS SUPPLY.
	3) BOOSTER PUMP FOR 6 INCH JACKET	2 PER BPP	2.5	5	2	
	4) BOOSTER PUMP FOR 8 INCH JACKET	2 PER BPP	12	2	7	
	5) BOOSTER PUMP FOR 10 INCH JACKET	2 PER BPP	6	2	7	
	6) MOTOR COOLER	1 PER BPP	80	80	5	DMW SUPPLIED TO WORKING NO BPP ONLY.
	7) FINE COAGULANT LIME/CLAY COOLER	1 PER BPP	252	252	5	14
	8) FINE COAGULANT LIME/CLAY COOLER	1 PER BPP	154	154	4	7
	TOTAL (2W-BPP)		449			
1B)	THERMAL DRIVEN BPP	2W + 55 PER LANT				
	1) BOOSTER PUMP FOR 4 INCH JACKET	2 PER BPP	3	12	2	3
	2) BOOSTER PUMP FOR 6 INCH JACKET	2 PER BPP	2.5	10	2	7
	3) BOOSTER PUMP FOR 8 INCH JACKET	2 PER BPP	6	24	2	5
	4) BPP FOR 6 INCH SEAL COOLER	2 PER BPP	4.5	18	2	7
	5) BPP FOR 8 INCH SEAL COOLER	1 PER BPP	100	200	8	3
	TOTAL (2W-BPP)		132	264		
2.	STAND BY-DRIVER (WHEN 1, 1B-BPP + 1, 1D-BPP ARE IN SERVICE)		600			
	a) THERMAL COOLER	1+1	215	215	15.2	8.0
	b) THERMAL COOLER	20+5	395	700	10.8M	10.8M
	c) DOCTER AIR COOLER	2+10	100	200	3.24	2.15
	d) PREHEAT WATER COOLERS	1+1	135	135	11	22.0
	e) SEAL OIL COOLERS (HTR. LANT)	1+1	50	50	7.0	6.0
	f) SEAL OIL COOLERS (AIR LANT)	1+1	50	50	8.0	6.0
	g) COOLERS FOR HTR. (WATER VALVES)	1+1	3.0	6.0	1.0	5.0
	h) COOLERS FOR HTR. (AIR VALVES)	1+1	3.0	6.0	1.0	5.0
3.	COMPENSATE PRODUCTION PUMPS	2+1	-	3	2.0	4.0
4.	LIME OIL PUMPER (CENTRAL)	-	-	0.75	-	-
5.	LIME OIL PUMPER (LANT)	-	-	0.75	-	-
6.	WPS COMBUSTORS	1W+1S	0.6	1.2	1	3
7.	WPS COMBUSTORS	-	-	25	10	10
8.	BPP ASSUMES (COAGULANT SCORE)	-	-	600	10	10
				600	10	10
						TO BE CONFIRMED BY CUSTOMER

INHIBITED DEMINERALISED COOLING WATER SYSTEM FOR TG AUXILIARIES & PLANT AUXILIARIES

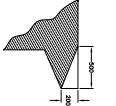
[illegible]



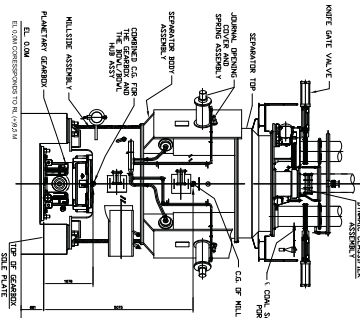
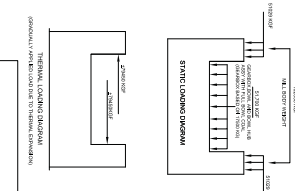
(ALL DIMENSIONS ARE IN mm.)



SECTION A-A (8 PLACES)



DIMENSIONAL PLAN VIEW
FOR MILLS E - J (TYP)



ELEVATION VIEW

MACHINE OPERATING FREQUENCIES	
MOTOR SPEED	RPM 900
GEARBOX INPUT SPEED	RPM 900
GEARBOX OUTPUT SPEED	RPM 23
GRINDING BOWL SPEED	RPM 3
NO. OF GRINDING ROLLS	3
DYN CLASSIFIER MOTOR	RPM 600-1800
REDUCER INPUT	RPM 600-1800
REDUCER OUTPUT SPEED	RPM 60-240
DYN CLASSIFIER ROTOR	RPM 32-96

DIRECTION OF ROTATION

- MILL DATA**
- | | |
|---|-----------------------|
| 1. MOTOR SPEED | : 900 RPM |
| 2. SPEED OF PULVERIZER | : 3361 RPM |
| 3. TOTAL WT. OF MILL
(EXCLUDING MOTOR) | : 140 TONNES. |
| 4. TYPE OF LOAD | : MODERATE SHOCK LOAD |

NO. OF GRINDING ROLLS	
DYN CLASSIFIER MOTOR	
REDUCER INPUT	
REDUCER OUTPUT SPEED	
DYN CLASSIFIER ROTOR	

3	600-1600
	600-1600
	80-240
	22-36

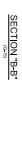
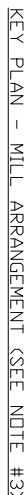
THE FOLLOWING CONDITIONS APPLY
EXCEPT OTHERWISE STATED.

1. REF. TO HYD20261 FOR
UNSPECIFIED TOLERANCES.

2. CHAPTER W/COL. SHARP EDGES 1.2 TO 1.4

4010-20 DATE OF CONTROL	4010-20 DATE OF CONTROL
-------------------------------	-------------------------------

[illegible]



9. INSTRUMENT PURGE AIR: .045 kg/hr @ 4.5–7.030 kg/cm²

14. MILL REESEL HANDLING SYSTEM IS BY BHEL TRICHY.

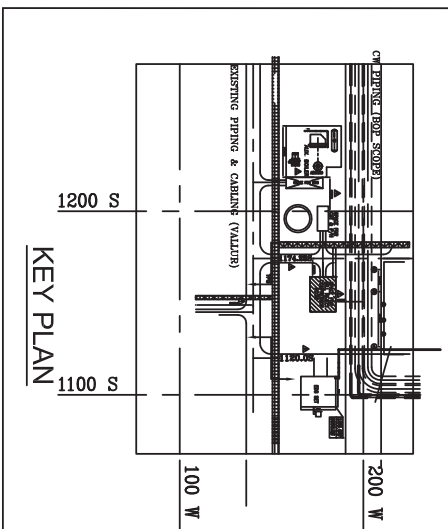
- MILL DISCHARGE VALVE REQUIREMENTS

- INT. SWITCHES:**
ELECTRICAL REQUIREMENTS: RATED 10 AMP AT 240 VAC, 5 AMP @ 125 VDC, IP 67 (8 SWITCHES PER MILL.)

BASIC COMPONENTS		ESTIMATE (M ²)
CEILING, GYM, 2ND FLOOR		16.00
CEILING, 1ST FLOOR		16.00
CEILING, 1ST FLOOR, 1ST BAY		14.25
CEILING, 1ST FLOOR, 2ND BAY		14.25
CEILING, 1ST FLOOR, 3RD BAY		21.00
CEILING, 1ST FLOOR, 4TH BAY		4.50
CEILING, 1ST FLOOR, 5TH BAY		11.00
CEILING, 1ST FLOOR, 6TH BAY		9.00
CEILING, 1ST FLOOR, 7TH BAY		1.75
CEILING, 1ST FLOOR, 8TH BAY		2.45
CEILING, 1ST FLOOR, 9TH BAY		1.80
CEILING, 1ST FLOOR, 10TH BAY		1.80
CEILING, 1ST FLOOR, 11TH BAY		1.80
CEILING, 1ST FLOOR, 12TH BAY		1.80
CEILING, 1ST FLOOR, 13TH BAY		1.80
CEILING, 1ST FLOOR, 14TH BAY		1.80
CEILING, 1ST FLOOR, 15TH BAY		1.80
CEILING, 1ST FLOOR, 16TH BAY		1.80
CEILING, 1ST FLOOR, 17TH BAY		1.80
CEILING, 1ST FLOOR, 18TH BAY		1.80
CEILING, 1ST FLOOR, 19TH BAY		1.80
CEILING, 1ST FLOOR, 20TH BAY		1.80
CEILING, 1ST FLOOR, 21ST BAY		1.80
CEILING, 1ST FLOOR, 22ND BAY		1.80
CEILING, 1ST FLOOR, 23RD BAY		1.80
CEILING, 1ST FLOOR, 24TH BAY		1.80
CEILING, 1ST FLOOR, 25TH BAY		1.80
CEILING, 1ST FLOOR, 26TH BAY		1.80
CEILING, 1ST FLOOR, 27TH BAY		1.80
CEILING, 1ST FLOOR, 28TH BAY		1.80
CEILING, 1ST FLOOR, 29TH BAY		1.80
CEILING, 1ST FLOOR, 30TH BAY		1.80
CEILING, 1ST FLOOR, 31ST BAY		1.80
CEILING, 1ST FLOOR, 32ND BAY		1.80
CEILING, 1ST FLOOR, 33RD BAY		1.80
CEILING, 1ST FLOOR, 34TH BAY		1.80
CEILING, 1ST FLOOR, 35TH BAY		1.80
CEILING, 1ST FLOOR, 36TH BAY		1.80
CEILING, 1ST FLOOR, 37TH BAY		1.80
CEILING, 1ST FLOOR, 38TH BAY		1.80
CEILING, 1ST FLOOR, 39TH BAY		1.80
CEILING, 1ST FLOOR, 40TH BAY		1.80
CEILING, 1ST FLOOR, 41ST BAY		1.80
CEILING, 1ST FLOOR, 42ND BAY		1.80
CEILING, 1ST FLOOR, 43RD BAY		1.80
CEILING, 1ST FLOOR, 44TH BAY		1.80
CEILING, 1ST FLOOR, 45TH BAY		1.80
CEILING, 1ST FLOOR, 46TH BAY		1.80
CEILING, 1ST FLOOR, 47TH BAY		1.80
CEILING, 1ST FLOOR, 48TH BAY		1.80
CEILING, 1ST FLOOR, 49TH BAY		1.80
CEILING, 1ST FLOOR, 50TH BAY		1.80
CEILING, 1ST FLOOR, 51ST BAY		1.80
CEILING, 1ST FLOOR, 52ND BAY		1.80
CEILING, 1ST FLOOR, 53RD BAY		1.80
CEILING, 1ST FLOOR, 54TH BAY		1.80
CEILING, 1ST FLOOR, 55TH BAY		1.80
CEILING, 1ST FLOOR, 56TH BAY		1.80
CEILING, 1ST FLOOR, 57TH BAY		1.80
CEILING, 1ST FLOOR, 58TH BAY		1.80
CEILING, 1ST FLOOR, 59TH BAY		1.80
CEILING, 1ST FLOOR, 60TH BAY		1.80
CEILING, 1ST FLOOR, 61ST BAY		1.80
CEILING, 1ST FLOOR, 62ND BAY		1.80
CEILING, 1ST FLOOR, 63RD BAY		1.80
CEILING, 1ST FLOOR, 64TH BAY		1.80
CEILING, 1ST FLOOR, 65TH BAY		1.80
CEILING, 1ST FLOOR, 66TH BAY		1.80
CEILING, 1ST FLOOR, 67TH BAY		1.80
CEILING, 1ST FLOOR, 68TH BAY		1.80
CEILING, 1ST FLOOR, 69TH BAY		1.80
CEILING, 1ST FLOOR, 70TH BAY		1.80
CEILING, 1ST FLOOR, 71ST BAY		1.80
CEILING, 1ST FLOOR, 72ND BAY		1.80
CEILING, 1ST FLOOR, 73RD BAY		1.80
CEILING, 1ST FLOOR, 74TH BAY		1.80
CEILING, 1ST FLOOR, 75TH BAY		1.80
CEILING, 1ST FLOOR, 76TH BAY		1.80
CEILING, 1ST FLOOR, 77TH BAY		1.80
CEILING, 1ST FLOOR, 78TH BAY		1.80
CEILING, 1ST FLOOR, 79TH BAY		1.80
CEILING, 1ST FLOOR, 80TH BAY		1.80
CEILING, 1ST FLOOR, 81ST BAY		1.80
CEILING, 1ST FLOOR, 82ND BAY		1.80
CEILING, 1ST FLOOR, 83RD BAY		1.80
CEILING, 1ST FLOOR, 84TH BAY		1.80
CEILING, 1ST FLOOR, 85TH BAY		1.80
CEILING, 1ST FLOOR, 86TH BAY		1.80
CEILING, 1ST FLOOR, 87TH BAY		1.80
CEILING, 1ST FLOOR, 88TH BAY		1.80
CEILING, 1ST FLOOR, 89TH BAY		1.80
CEILING, 1ST FLOOR, 90TH BAY		1.80
CEILING, 1ST FLOOR, 91ST BAY		1.80
CEILING, 1ST FLOOR, 92ND BAY		1.80
CEILING, 1ST FLOOR		

10	DATE	11/15/2020	DATE	11/15/2020	DATE	11/15/2020	DATE	11/15/2020	DATE	11/15/2020
	TIME	08:00	TIME	08:00	TIME	08:00	TIME	08:00	TIME	08:00
	LOCATION	000000	LOCATION	000000	LOCATION	000000	LOCATION	000000	LOCATION	000000
	DESCRIPTION		DESCRIPTION		DESCRIPTION		DESCRIPTION		DESCRIPTION	
	AMOUNT		AMOUNT		AMOUNT		AMOUNT		AMOUNT	
	TOTAL		TOTAL		TOTAL		TOTAL		TOTAL	

[illegible]

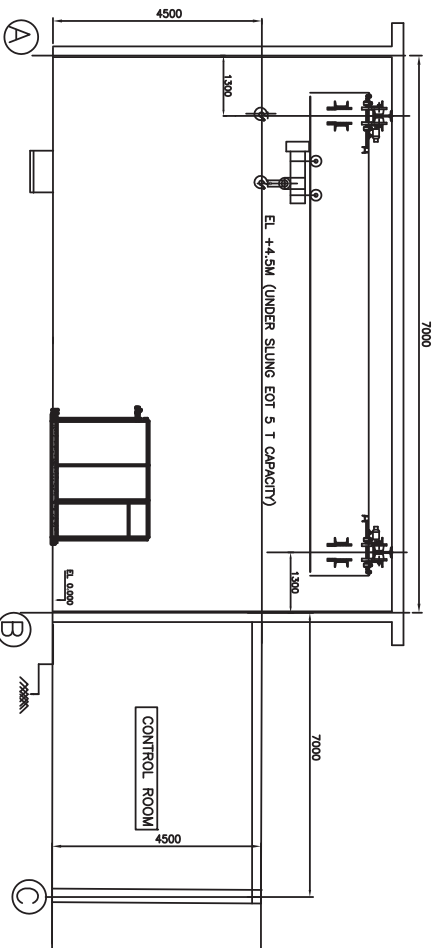


KEY PLAN

1. ALL DIMENSIONS ARE IN MM AND LEVELS ARE IN METRES.
2. ALL ELEVATION MARKED ARE W.R.T. TG HALL FINISHED FLOOR ELEVATION OF EL 0.00M WHICH CORRESPONDS TO RL(+)10.0M.

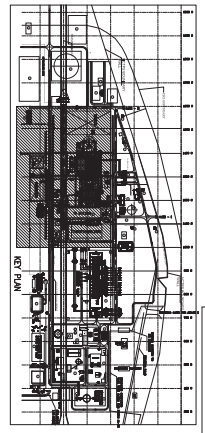
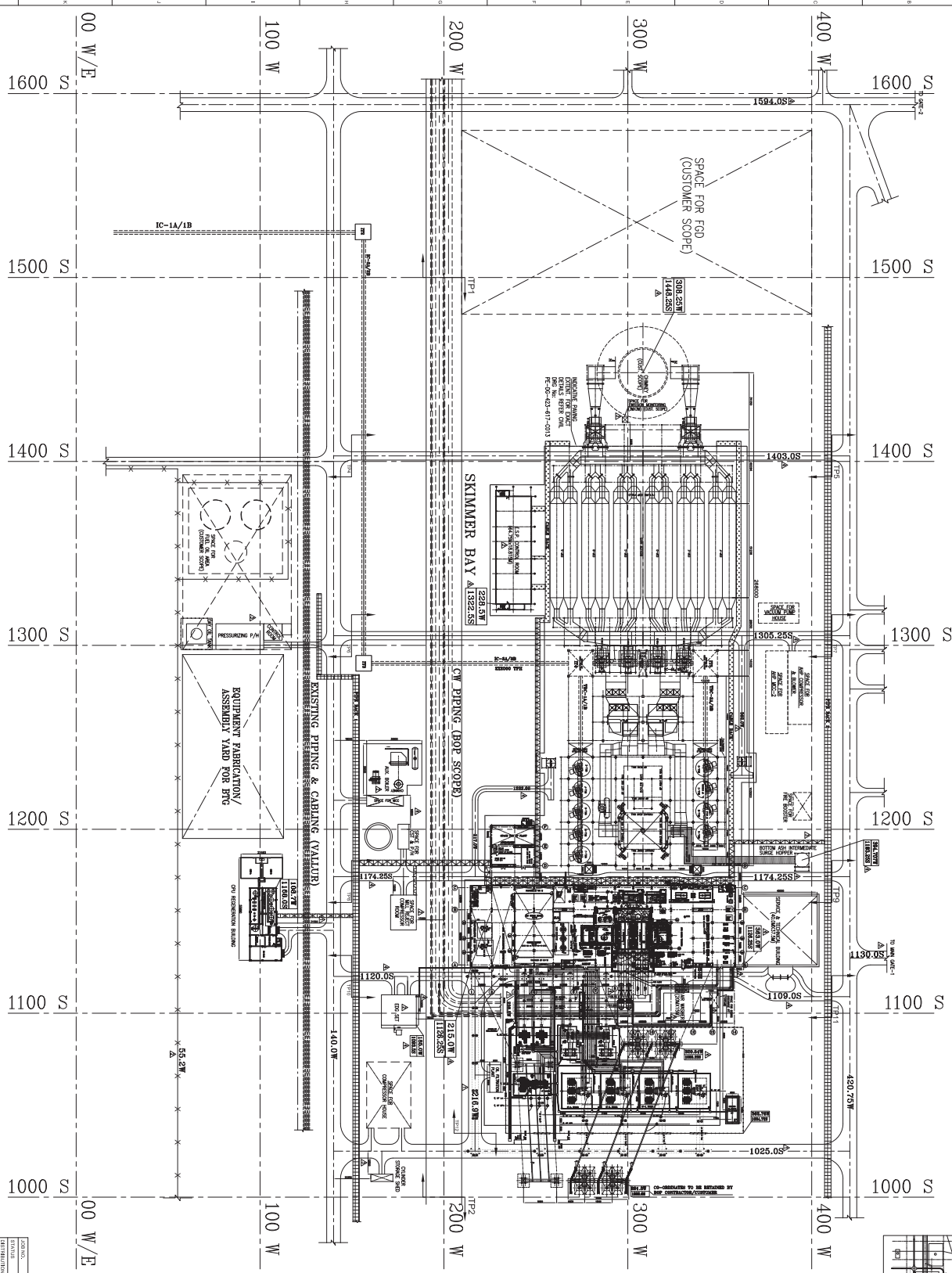
1) MAIN EQUIPMENT PLANT LAYOUT	PE-DG-423-100-M002
--------------------------------	--------------------

VIEW FROM - X



JOB No.		423	
STATUS		PROJECT	
CONTRACT			
TO			
NO.OFF			
REV	DATE	ALTD	CHD
01	08.03.2016	08.03.2016	08.03.2016
			APPD
			08.03.2016

	NAME TALLMADH GENERATION & DISTRIBUTION CORPORATION LIMITED	
	ISSUED BY: TALLMADH GENERATION LIMITED FOR PERIOD 15-10-2020	
	PROJECT DESCRIPTION PROJECT:	
	PROJECTING: Consulting Engineers (India) Private Limited, Chennai.	
	PROJECT INFORMATION PROJECT: BHARAT HEAVY ELECTRICALS LTD POWER SECTOR PROJECT INTENT: MANAGEMENT MEETING	
	DATE 15-10-2020	TIME 09:00 AM
VENUE 100, 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114, 115, 116, 117, 118, 119, 120, 121, 122, 123, 124, 125, 126, 127, 128, 129, 130, 131, 132, 133, 134, 135, 136, 137, 138, 139, 140, 141, 142, 143, 144, 145, 146, 147, 148, 149, 150, 151, 152, 153, 154, 155, 156, 157, 158, 159, 160, 161, 162, 163, 164, 165, 166, 167, 168, 169, 170, 171, 172, 173, 174, 175, 176, 177, 178, 179, 180, 181, 182, 183, 184, 185, 186, 187, 188, 189, 190, 191, 192, 193, 194, 195, 196, 197, 198, 199, 200, 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213, 214, 215, 216, 217, 218, 219, 220, 221, 222, 223, 224, 225, 226, 227, 228, 229, 230, 231, 232, 233, 234, 235, 236, 237, 238, 239, 240, 241, 242, 243, 244, 245, 246, 247, 248, 249, 250, 251, 252, 253, 254, 255, 256, 257, 258, 259, 260, 261, 262, 263, 264, 265, 266, 267, 268, 269, 270, 271, 272, 273, 274, 275, 276, 277, 278, 279, 280, 281, 282, 283, 284, 285, 286, 287, 288, 289, 290, 291, 292, 293, 294, 295, 296, 297, 298, 299, 300, 301, 302, 303, 304, 305, 306, 307, 308, 309, 310, 311, 312, 313, 314, 315, 316, 317, 318, 319, 320, 321, 322, 323, 324, 325, 326, 327, 328, 329, 330, 331, 332, 333, 334, 335, 336, 337, 338, 339, 340, 341, 342, 343, 344, 345, 346, 347, 348, 349, 350, 351, 352, 353, 354, 355, 356, 357, 358, 359, 360, 361, 362, 363, 364, 365, 366, 367, 368, 369, 370, 371, 372, 373, 374, 375, 376, 377, 378, 379, 380, 381, 382, 383, 384, 385, 386, 387, 388, 389, 390, 391, 392, 393, 394, 395, 396, 397, 398, 399, 400, 401, 402, 403, 404, 405, 406, 407, 408, 409, 410, 411, 412, 413, 414, 415, 416, 417, 418, 419, 420, 421, 422, 423, 424, 425, 426, 427, 428, 429, 430, 431, 432, 433, 434, 435, 436, 437, 438, 439, 440, 441, 442, 443, 444, 445, 446, 447, 448, 449, 450, 451, 452, 453, 454, 455, 456, 457, 458, 459, 460, 461, 462, 463, 464, 465, 466, 467, 468, 469, 470, 471, 472, 473, 474, 475, 476, 477, 478, 479, 480, 481, 482, 483, 484, 485, 486, 487, 488, 489, 490, 491, 492, 493, 494, 495, 496, 497, 498, 499, 500, 501, 502, 503, 504, 505, 506, 507, 508, 509, 510, 511, 512, 513, 514, 515, 516, 517, 518, 519, 520, 521, 522, 523, 524, 525, 526, 527, 528, 529, 530, 531, 532, 533, 534, 535, 536, 537, 538, 539, 540, 541, 542, 543, 544, 545, 546, 547, 548, 549, 550, 551, 552, 553, 554, 555, 556, 557, 558, 559, 560, 561, 562, 563, 564, 565, 566, 567, 568, 569, 570, 571, 572, 573, 574, 575, 576, 577, 578, 579, 580, 581, 582, 583, 584, 585, 586, 587, 588, 589, 590, 591, 592, 593, 594, 595, 596, 597, 598, 599, 600, 601, 602, 603, 604, 605, 606, 607, 608, 609, 610, 611, 612, 613, 614, 615, 616, 617, 618, 619, 620, 621, 622, 623, 624, 625, 626, 627, 628, 629, 630, 631, 632, 633, 634, 635, 636, 637, 638, 639, 640, 641, 642, 643, 644, 645, 646, 647, 648, 649, 650, 651, 652, 653, 654, 655, 656, 657, 658, 659, 660, 661, 662, 663, 664, 665, 666, 667, 668, 669, 670, 671, 672, 673, 674, 675, 676, 677, 678, 679, 680, 681, 682, 683, 684, 685, 686, 687, 688, 689, 690, 691, 692, 693, 694, 695, 696, 697, 698, 699, 700, 701, 702, 703, 704, 705, 706, 707, 708, 709, 710, 711, 712, 713, 714, 715, 716, 717, 718, 719, 720, 721, 722, 723, 724, 725, 726, 727, 728, 729, 730, 731, 732, 733, 734, 735, 736, 737, 738, 739, 740, 741, 742, 743, 744, 745, 746, 747, 748, 749, 750, 751, 752, 753, 754, 755, 756, 757, 758, 759, 760, 761, 762, 763, 764, 765, 766, 767, 768, 769, 770, 771, 772, 773, 774, 775, 776, 777, 778, 779, 780, 781, 782, 783, 784, 785, 786, 787, 788, 789, 790, 791, 792, 793, 794, 795, 796, 797, 798, 799, 800, 801, 802, 803, 804,		



1. ALL DIMENSIONS ARE IN MM AND LEVELS ARE IN METRES.
- Δ1. ALL ELEVATION WORKED ARE W.M.T. TO HALF FINISHED FLOOR.
- Δ2. ELEVATION OF 0.00MM WHICH CORRESPONDS TO RL (+10.00).
- Δ3. THE BOLLER AREA FTL IS AT EL.(-0.00MM) WHICH CORRESPONDS TO RL(+9.94M). TRANSPONER AREA FTL IS AT EL.(-1.00MM) WHICH CORRESPONDS TO RL(+8.94M).
- Δ4. THE FINISHED GRADE LEVEL OF POWER BLOCK AREA IS RL(+9.94M).
5. CABLE DUTY/BENCH/SIT LAYOUT IS SHOWN FOR REPRESENTATION PURPOSE ONLY. FOR DETAILS REFER ELECTRICAL DRAWING.

REFERENCE DRGS:			
SL. No.	TITLE	NUMBER	UNIT
1	FUEL PLAN	DS-44-46-U-37-1000	BOX/SEC
2	TE EQUIPMENT PLAN AT SLIDING	PC-60-42-100-1000	BOX/SEC
3	THUNDERBOLT WARD UNIFORM	PC-60-42-100-1001	BOX/SEC
4	REF PLAN OF BATTLE	0-40-20-7115	THORN

	BRIG SCOPE CABLE RACK
	BRIG SCOPE PIPE CUM CABLE RACK
	CUSTOMER SCOPE PIPE CUM CABLE RACK
	PLANT BOUNDARY

CLIENT	MARLBORO CIGARETTE & DISTRIBUTION CORPORATION LIMITED 7th Floor, Western Wing, NIPPER Mall 144, Ann Siah, Chennai 600002
CONTRACT	 Partner Consulting Engineers (Pvt) Ltd. Messon Berrymay & Pooni, No.65, St. Mary's Road, 113600 Mt. Lankajam, North Chennai 776 STAGE III - PMS
PROJECT	 BHARTI HEAVY ELECTRICALS LTD POWER SUPPLY & TRANSMISSION PROJECT, BANGALORE, KARNATAKA
EST NO.	463
CONTRACT	
ESTIMATION	

DATE	SCALE	PROJECT NO.
08/07/20	1"=20'	10000

MAIN EQUIPMENT PLANT LAYOUT
(AT EL. 0.0M)



TITLE
1X800 MW NORTH CHENNAI TPP STAGE III
MILL REJECT SYSTEM (PNEUMATIC TYPE)
SPECIFIC TECHNICAL REQUIREMENTS

SPECIFICATION NO. PE-TS-423-160-A001
SECTION: I
REV 00
Sub-Section: IB
Date

SUB-SECTION – IB

SPECIFIC TECHNICAL REQUIREMENTS (ELECTRICAL)



TITLE :
ELECTRICAL EQUIPMENT SPECIFICATION
FOR
MILL REJECT SYSTEM
1X800 MW NORTH CHENNAI TPP

SPECIFICATION NO.
VOLUME NO. : II-B
SECTION : I B
REV NO. : 00 DATE :
SHEET : 1 OF 2

1.0 EQUIPMENT & SERVICES TO BE PROVIDED BY BIDDER:

- a) Services and equipment as per “Electrical Scope between BHEL and Vendor”.
- b) Any item/work either supply of equipment or erection material which have not been specifically mentioned but are necessary to complete the work for trouble free and efficient operation of the plant shall be deemed to be included within the scope of this specification. The same shall be provided by the bidder without any extra charge.
- c) Supply of mandatory spares as specified in the specifications of mechanical equipments.
- d) Electrical load requirement for Mill reject system.
- e) All equipment shall be suitable for the power supply fault levels and other climatic conditions mentioned in the enclosed project information.
- f) Bidder to furnish list of makes for each equipment at contract stage, which shall be subject to customer/BHEL approval without any commercial and delivery implications to BHEL
- g) Various drawings, data sheets as per required format, Quality plans, calculations, test reports, test certificates, operation and maintenance manuals etc shall be furnished as specified at contract stage. All documents shall be subject to customer/BHEL approval without any commercial implication to BHEL.
- h) Motor shall meet minimum requirement of motor specification.
- i) Vendor to clearly indicate equipment locations and local routing lengths in their cable listing furnished to BHEL.
- j) Cable BOQ worked out based on routing of cable listing provided by the vendor for “ both end equipment in vendor’s scope”shall be binding to the vendor with +10 % margin to take care of slight variation in routing length & wastages.

2.0 EQUIPMENT & SERVICES TO BE PROVIDED BY PURCHASER FOR ELECTRICAL & TERMINAL POINTS:

Refer “Electrical Scope between BHEL and Vendor”.

3.0 DOCUMENTS TO BE SUBMITTED ALONG WITH BID

- 3.1 The electrical specification without any deviation from the technical/quality assurance requirements stipulated shall be deemed to be complied by the bidder in case bidder furnishes the overall compliance of package technical specification in the form of compliance certificate/No deviation certificate.
- 3.2 No technical submittal such as copies of data sheets, drawings, write-up, quality plans, type test certificates, technical literature, etc. is required during tender stage. Any such submission even if made, shall not be considered as part of offer.

4.0 List of enclosures:

- a) Electrical scope between BHEL & vendor (Annexure –I)
- b) Datasheets & quality plan for motors.
- c) Electrical Load data format (Annexure –II)
- d) BHEL cable listing format (Annexure –III)



TITLE :
ELECTRICAL EQUIPMENT SPECIFICATION
FOR
MILL REJECT SYSTEM
1X800 MW NORTH CHENNAI TPP

SPECIFICATION NO.

VOLUME NO. : II-B

SECTION : I B

REV NO. : 00 DATE :

SHEET : 2 OF 2

- e) Sub vendor list for motors (Annexure-IV)
- f) Technical specification for LT switchgear
- g) Technical specification for motors
- h) Technical specification for LV cables
- i) Technical specification for cabling
- j) Technical specification for earthing & lighting protection

ELECTRICAL SCOPE BETWEEN BHEL AND VENDOR(FOR EPC PROJECTS)

PACKAGES : MRS

SCOPE OF VENDOR: SUPPLY, ERECTION & COMMISSIONING OF VENDOR'S EQUIPMENT

PROJECT: 1X800 MW NORTH CHENNAI TPP

S.NO	DETAILS	SCOPE SUPPLY	SCOPE E&C	REMARKS
1	415V MCC	BHEL	BHEL	240 V AC (supply feeder)/415 V AC (3 PHASE 4 WIRE) supply shall be provided by BHEL based on load data provided by vendor at contract stage for all equipment supplied by vendor as part of contract. Any other voltage level (AC/DC) required will be derived by the vendor. Starter for single phase motor (if applicable) shall be in vendor's scope. BHEL shall provide only single phase supply feeder.
2	Local Push Button Station (for motors)	BHEL	BHEL	Located near the motor.
3	Power cables, control cables and screened control cables for a) both end equipment in BHEL's scope b) both end equipment in vendor's scope c) one end equipment in vendor's scope	BHEL BHEL BHEL	BHEL Vendor BHEL	1. For 3.b) & c): Sizes of cables required shall be informed by vendor at contract stage (based on inputs provided by BHEL) in the form of cable listing. Finalisation of cable sizes shall be done by BHEL. Vendor shall provide lugs & glands accordingly. 2. Termination at BHEL equipment terminals by BHEL. 3. Termination at Vendor equipment terminals by Vendor.
4	Junction box for control & instrumentation cable	Vendor	Vendor	Number of Junction Boxes shall be sufficient and positioned in the field to minimize local cabling (max 10-12 mtrs) and trunk cable.
5	Any special type of cable like compensating, co-axial, prefab, MICC, optical fibre etc.	Vendor	Vendor	Refer C&I portion of specification for scope of fibre Optical cables if used between PLC/ microprocessor & DCS.
6	Cable trays, accessories & cable trays supporting system 100/ 50 mm cable trays/ Conduits/ Galvanised steel cable troughs for local cabling	BHEL Vendor	BHEL Vendor	Local cabling from nearby main route cable tray (BHEL scope) to equipment terminal (vendor's scope) shall be through 100/ 50 mm. cable trays/ conduits/ Galvanised steel cable troughs, as per approved layout drawing during contract stage.
7	Cable glands ,lugs and bimetallic strip for equipment supplied by Vendor	Vendor	Vendor	1. Double compression Ni-Cr plated brass cable glands 2. Solder less crimping type heavy duty tinned copper lugs for power and control cables.
8	Conduit and conduit accessories for cabling between equipment supplied by vendor	Vendor	Vendor	Conduits shall be medium duty, hot dip galvanised cold rolled mild steel rigid conduit as per IS: 9537.

ELECTRICAL SCOPE BETWEEN BHEL AND VENDOR(FOR EPC PROJECTS)

PACKAGES : MRS

SCOPE OF VENDOR: SUPPLY, ERECTION & COMMISSIONING OF VENDOR'S EQUIPMENT

PROJECT: 1X800 MW NORTH CHENNAI TPP

S.NO	DETAILS	SCOPE SUPPLY	SCOPE E&C	REMARKS
9	Lighting	BHEL	BHEL	
10	Equipment grounding (including electronic earthing) & lightning protection	BHEL	BHEL	Refer note no. 4 for electronic earthing
11	Below grade grounding	BHEL	BHEL	
12	LT Motors with base plate and foundation hardware	Vendor	Vendor	Makes shall be subject to customer/ BHEL approval at contract stage.
13	Mandatory spares	Vendor	-	Vendor to quote as per specification.
14	Recommended O & M spares	Vendor	-	As specified elsewhere in specification
15	Any other equipment/ material/ service required for completeness of system based on system offered by the vendor (to ensure trouble free and efficient operation of the system).	Vendor	Vendor	
16	a) Input cable schedules (Control & Screened Control Cables) b) Cable interconnection details for above c) Cable block diagram	Vendor Vendor Vendor	- - -	Cable listing for Control and Instrumentation Cable and electronic earthing cable in enclosed excel format shall be submitted by vendor during detailed engineering stage.
17	Electrical Equipment & cable tray layout drawings	Vendor	-	For ensuring cabling requirements are met, vendor shall furnish Electrical equipment layout & cable tray layout drawings (both in print form as well as in AUTOCAD) of the complete plant (including electrical area) indicating location and identification of all equipment requiring cabling, and shall incorporate cable trays routing details marked on the drawing as per PEM interface comments. Cabling arrangement of the same (wherever overhead cable trays, trenches, cable ducts, conduits etc.) shall be decided during contract stage. Electrical equipment layout & cable tray layout drawing shall be subjected to BHEL/ customer approval without any commercial implications to BHEL.
18	Electrical Equipment GA drawing	Vendor	-	For necessary interface review.

NOTES:

ELECTRICAL SCOPE BETWEEN BHEL AND VENDOR(FOR EPC PROJECTS)

PACKAGES : MRS

SCOPE OF VENDOR: SUPPLY, ERECTION & COMMISSIONING OF VENDOR'S EQUIPMENT

PROJECT: 1X800 MW NORTH CHENNAI TPP

1. Make of all electrical equipment/ items supplied shall be reputed make & shall be subject to approval of BHEL/customer after award of contract.
2. All QPs shall be subject to approval of BHEL/customer after award of contract without any commercial implication.
3. In case the requirement of Junction Box arises on account of Power Cable size mis-match due to vendor engineering at later stage, vendor shall supply the Junction Box for suitable termination.
4. Vendor shall indicate location of Electronic Earth pit in their Civil assignment drawing.



EPC TENDER SPECIFICATION FOR BTG PACKAGE

2.2.11 LT SWITCHGEAR

2.2.11.1 CODES AND STANDARDS

All equipment and materials shall be designed, manufactured and tested in accordance with the latest editions including all applicable official amendments of relevant Indian Standards (IS) and IEC except where modified and/or supplemented by this specification.

Equipment and material conforming to any other standards, which ensure equal or better quality, may be accepted. In such case, copies of the English version of the standard adopted shall be submitted along with the bid.

The electrical installation shall meet the requirements of Indian Electricity Rules as amended up to date and relevant IS Code of Practice. In addition, other rules and regulations applicable to the work shall be followed.

All works shall be carried out as per the following codes and standards.

Sl.No	Code	Description
1	IEC-60947 IEC-60439 IS-13947	Low voltage switchgear and control gear assemblies.
2	IS-8623	Specification for Low-Voltage Switchgear and Control gear Assemblies
3	IEC-60664 IS-15382	Insulation coordination for equipment with low voltage systems
4	IEC-60044	Instrument transformers
5	IEC-60529	Degrees of protection provided by enclosures
6	IS-13118	High Voltage alternating circuit breakers
7	IS-2675	Enclosed distribution fuse boards and cut outs for voltages not exceeding 1000 V AC and 1200 V DC
8	IS-8828	Electrical Accessories – Circuit breaker for over current Protection
9	IS -12021	Specification for Control transformer for switchgear and control gear for voltages not exceeding 1000V AC
10	IS-5082	Wrought aluminium & aluminium alloy for electrical Purposes
11	IS-13703	Specification for low voltage fuses for voltages not exceeding 1000 V AC and 1500 V

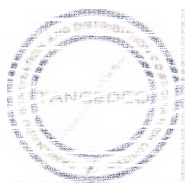


EPC TENDER SPECIFICATION FOR BTG PACKAGE

		DC
12	IS-8187	Specification for D Type fuses
13	IS- 6005	Code of practice for phosphating iron and steel
14	IS-694	694 PVC insulated cables for working voltages up to and including 1100
15	IS-722	AC Electricity Meters
16	IS-1248	Electrical Indicating instruments
17	IS-2551	Danger Notice Plates
18	IS-2629	Hot dip galvanizing
19	IS-2705	Current Transformers
20	IS-3043	Code of practice for earthing
21	IS-3072	Code of practice for installation and maintenance of Switchgear
22	IS-3156	Voltage Transformers
23	IS-3202	Code of practice for climate proofing of electrical equipment
24	IS-3231	Electrical relays for power system protection
25	IS-8686	Static Relays
26	IS-10118 (4 parts)	Code of practice for selection, installation and maintenance of switchgear and control gear
27	IS-11171	Specification for dry type transformers
28	IS-11353	Guide for uniform system of marking and identification of conductors and apparatus terminals

2.2.11.3.1 TYPE

Circuit Breakers	Shall be air break, three pole, spring charged, and horizontal
Switchgear	Fully draw out type single front



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

MCC	Fully draw out type single front/Double front.
ACDB/DCDB	Fixed type single front

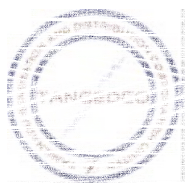
2.2.11.3.2 SYSTEM PARAMETERS

1)	Nominal system voltage	415 V AC	220 V DC
2)	Highest system Voltage	433 V	240 V DC
3)	Voltage variation	±10%	190 - 240
4)	Rated frequency	50 HZ	-
5)	Frequency variation	+3% to (-5%)	-
6)	One minute Power	2.5 kV	2.5 kV
	frequency withstand voltage Main circuit Auxiliary Circuit	2.0 KV	2.0 KV
7)	System Earthing	Solidly Grounded	Unearthed
8)	Maximum system fault level	50KA for 1sec	25KA for 1 sec

2.2.11.3.3 General Technical Requirements

Power from LV service transformers shall be supplied to 415 V switchgears. Power from 415 switchgears to the various MCCs, PDBs, ACDBs etc. shall be supplied from redundant incomers. These switchgears shall distribute power to LV auxiliary motors and also to other auxiliary loads viz. MCCs / ACDBs, etc. LV switchgears shall be of metal enclosed indoor type. Incomers / bus-couplers, outgoing tie feeders rated 630A & above and motor feeders rated 90 kW & above shall be equipped with air circuit breakers of fault interrupting capacity of 50 KA rms.

All PCC/PMCC/MCC shall be of intelligent type compatible with IEC-61850 communication protocol. Utility MCCs like service building MCC, Welding DBs, AC & Ventilation MCCs, etc., shall be non-intelligent type.



EPC TENDER SPECIFICATION FOR BTG PACKAGE

All the boards shall be sectionalized, except for turbine valve DB.

Not more than 2 out of 3 ACBs can be closed at a time unless at the time of planned short time paralleling through synchro check.

Under normal mode of operation each incoming source shall be connected to the respective bus sections with bus coupler open.

During the normal mode of operation if there is a loss of normal source to any bus-section, slow bus auto changeover shall be initiated to first trip the normal incomer connected to this section and further close the bus coupler to extend power from healthy bus section.

Restoration of normal operating condition (described in 1.14.6 above) shall be through planned manual changeover through synchro check paralleling or manual dead bus closing.

Incase parallel running between two sources prolong over a set time, an alarm shall be generated and the last ACB to close shall be opened.

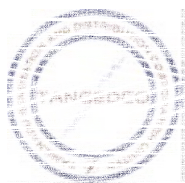
The AC control supply voltage for motors rated below 90 kW shall be 110V AC. For this purpose each motor feeder of PMCC/MCC shall be provided with suitable rated 415/110V Control Transformer. Separate control transformer for test bus supply shall be provided for each bus section.

All circuit breakers shall have 220V DC control.

2.2.11.3.4 List of minimum required LV switchgears

S.No Name of LV Switchboard

1. UNIT PMCC
2. BUNKER FLOOR MCC
3. UNIT MLDB
4. VENTILATION MCC
5. AC MCC
6. BOILER MCC
7. SOOT BLOWER MCC
8. BOILER VALVE DAMPER MCC
9. MILL SYSTEM MCC



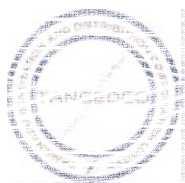
**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

10. TURBINE AUX. MCC
11. TURBINE VALVE DB
12. BOILER ACDB
13. ESP # 1A PMCC
14. ESP # 1B PMCC
15. ESP # 1C PMCC
16. ESP # 1D PMCC
17. ESP # 1E PMCC
18. ESP # 1F PMCC
19. ESP ACDB
20. ESP AC & VENTILATION MCC
21. ESP MLDB
22. DG SWGR AMF PANEL
23. UNIT NORMAL CUM EMERGENCY PMCC
24. 415 V AC ELDB
25. 415 V AC TG Building
26. FUEL OIL UNLOADING PH PMCC
27. SERVICE BUILDING MCC
28. AIR WASHER MCC
29. WELDING PDBs
30. AC AND VENTILATION MCC
31. CPU REGENERATION MCC
32. Main Lighting Distribution Boards (MLDB)
33. Emergency Main Lighting Distribution Board (EMLDB)
34. DC Lighting Distribution Board (DCLDB)
35. AC Fuse Boards

Any other PCC/PMCC/MCC/DB required as per the geographical distribution of load and for any other system which is part of mechanical system under BTG package and required for safe and reliable functioning of the plant.



EPC TENDER SPECIFICATION FOR BTG PACKAGE

2.2.11.2 TEMPERATURE RISE

The temperature rise of the horizontal and vertical busbars and main bus link including all the power drawout contracts when carrying 90% of the rated current along the full run shall in no case exceed 55 deg c with silver plated joints and 40 deg c with all other types of joints over an ambient of 50 deg c.

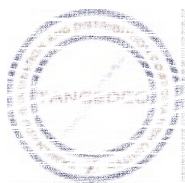
2.2.11.3 OPERATIONAL REQUIREMENTS

2.2.11.3.1 Breakers

- I. Breakers shall have anti-pumping feature and it shall be electrically drawout type. The incomer and bus coupler breakers for switchgear shall be electrically operated with over current releases or relays.
- II. Breakers shall have inherent fault making and breaking capacities. They shall have shunt trip coils. In case releases are offered, the same shall have contact for energisation of lockout relay. All breakers shall have built in interlocks for equipment and personnel safety
- III. Paralleling of two supplies shall be avoided by except for switchgear where auto-changeover is provided. Breaker contact multiplication, if required, shall be through latch relay.
- IV. Mechanical tripping shall be through red 'Trip' push button outside the panels for breakers, and through control switches for other circuits.
- V. Provision of mechanical closing of breaker only in 'Test' and 'Withdrawn' position shall be made. Alternatively, mechanical closing facility should be normally inaccessible, accessibility rendered only after deliberate removal of shrouds. It shall be possible to close the door with breaker in test position.
- VI. Clear status indication for each circuit shall be provided through lamps, switch positions or other mechanical means.
- VII. Supervision relay shall be provided for trip coil monitoring

2.2.11.3.2 Switches, Contactors and Fuses

- a. Incomers for MCCs and DBs rated up to 630A could be MCCB's & for above ratings ACB are preferred.
- b. Motor starter contactors shall be of air break, electromagnetic type suitable for DOL starting of motor, and shall be of utilisation category AC-3 for ordinary and AC-4 for reversing starters. DC contactor shall be of DC-3 utilisation category.

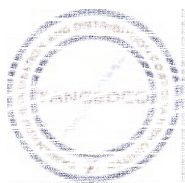


EPC TENDER SPECIFICATION FOR BTG PACKAGE

- c. Fuses shall be HRC, preferably link type, with a minimum interrupting capacity equal to the short circuit current of the LT system. Fuses shall be furnished complete with fuse bases and fittings of such design as to permit easy and safe replacement of fuse element. Visible indication shall be provided on blowing of the fuse.
- d. Motor fuse characteristics and ratings shall be chosen to ride over starting period without blowing. The fuse on incoming feeder wherever provided, shall be chosen to provide discrimination with motor/feeder fuses.
- e. Isolating switches and MCCBs shall have door interlocks and padlocking facility.
- f. Wherever two incoming switches and one bus-section switch/breaker are provided for an assembly, these shall be electrically interlocked to ensure that only two out of the three can be closed at time.
- g. Wherever two incoming switches are provided for an assembly, these shall be electrically interlocked to ensure that one of the two can be closed at time.

2.2.11.3.3 Panels

- a. All switchgears, MCCs, DBs, panels, modules, local starters and push buttons shall have prominent engraved identification plates.
- b. Local push button stations shall have metal enclosure of die cast aluminium or rolled sheet steel of 1.6mm thickness & shall be of DOP IP55. Push buttons shall be of latch type with mushroom knobs.
- c. Where breaker/starter module front serves as compartment cover, suitable blanking covers, one for each size of modules per switchboard shall be supplied for use when carriage is withdrawn.
- d. All non-current carrying metal work of boards/panels shall be effectively bonded to earth bus of galvanised steel, extending throughout the switchboard/MCC/DB. Positive earthing shall be maintained for all positions of chassis and breaker frame.
- e. Suitable trolley arrangement shall be provided for breaker/starter modules. Two trolleys per switchgear room shall be provided so that top most breaker module of all types, sizes and rating can be withdrawn on trolley and lowered for maintenance purpose.



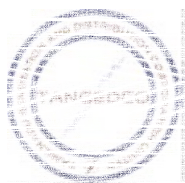
EPC TENDER SPECIFICATION FOR BTG PACKAGE

- f. The incoming connection to transformer of more than 1000KVA and inter-connecting Sections between switchboards shall preferably be of bus ducts. The bus duct enclosure shall be made of minimum 3mm thick aluminium alloy. The section of the bus duct should have adequate strength to withstand internal and external forces resulting from the various operating conditions. Aluminium sheet hood shall be provided for outdoor bus duct enclosure joints to provide additional protection against water ingress. The bus duct top shall be sloped to prevent retention of water. The bus duct shall have DOP of IP55.
- g. It should be possible to carryout maintenance on a feeder with adjacent feeders alive

2.2.11.3.4 Control, Protection & Metering Requirements

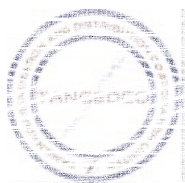
- i) Control circuits shall operate at suitable voltage of 110V AC or 220V DC. Necessary control supply transformers having primary and secondary fuses shall be provided for each MCC, 2 x 100% per section. However the breakers shall operate on 220V DC. The auxiliary bus bars for control supply shall be segregated from main bus bars. The control supplies shall be monitored.
- ii) Contractor shall fully co-ordinate overload and short circuit tripping of breaker with upstream and downstream breakers/fuses/MCCBs motor starters. Various equipment's shall meet requirement of Type-II class of coordination as per IEC.
- iii) All relays and timers shall operate on available DC supply and not have any inbuilt batteries. They shall be provided with hand-reset operation indicator (flags) or LEDs with pushbuttons for resetting.
- iv) All equipment's shall have necessary protections. However, following minimum protections shall be provided:

MPCB with Contactor controlled LV motor feeders (Motors rated 18.5kW & below) having intelligent controller
 - a. Instantaneous short circuit protection
 - b. Overload protection
- v) MCCB with Contactor controlled LV motor feeders (Motors rated above 18.5kW but below 90 kW) having intelligent controller
 - a. Instantaneous short circuit protection



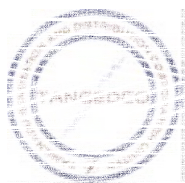
EPC TENDER SPECIFICATION FOR BTG PACKAGE

- b. Overload protection
- vi) Single phasing protection for motors rated 30 kW and above rating
- vii) In Instantaneous short circuit protection on all phases through HRC cartridge type fuses / MCCB rated for 80 kA rms (prospective breaking capacity at 415V).
- viii) Thermal overload protection
- ix) Single phasing protection for motors protected by fuses.
- x) Breaker controlled motors feeders (motors rated above 90kW)
Numerical, comprehensive motor protection relay with following minimum facility as indicated below :
 - a. Instantaneous short circuit protection
 - b. Overload protection
 - c. Under voltage protection
 - d. Locked Rotor protection
 - e. Earth fault protection
 - f. Current unbalance.
 - g. Temperature monitoring (stator, bearing etc.).
 - h. Phase reversal.
 - i. Thermal model based with RTD feedback and negative sequence current.
 - j. Voltage compensated acceleration.
- xi) Incomers (ACB):
 - a. 3 ph IDMT Overcurrent & earth fault protection (51,51N)
 - b. 3 ph Instantaneous Overcurrent protection (50)



EPC TENDER SPECIFICATION FOR BTG PACKAGE

- c. Standby earth fault protection for service transformer protection
(connected on transformer neutral CT side)
- d. Under voltage protection (27) with Timer & Fuse failure protection
- e. Neutral dEviation relay
- xii) Buscoupler (ACB):
 - a. 3ph IDMT Overcurrent & earth fault protection (51 & 51N)
 - b. Sync check relay (25)
- xiii) Bus PT:
 - a. Under voltage protection (27)
 - b. No voltage protection (27)
 - c. Fuse failure protection (97)
- xiv) ACB outgoing feeders:
 - 3 ph IDMT Overcurrent protection (51, 51N)
- xv) Incomer from DG Set.
 - a) Differential Protection (87) - Three Pole
 - b) Reverse Power Protection.
 - c) Overload Alarm on one phase
 - d) Earth Fault Detection Relay (64)
 - e) Voltage controlled Overcurrent relay
 - f) Generator under/over voltage Protection
 - g) Hand Reset/Lockout Relay with a blue lamp.
 - h) 3 Phase Energy Meter having accuracy of 1.0 class



EPC TENDER SPECIFICATION FOR BTG PACKAGE

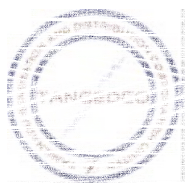
Apart from protection relays, each electrically operated breaker shall also be provided with Anti pumping (94), trip annunciation(30), lockout (86). Lockout supervision (95) and trip supervision (74) relays. Lockout relay shall be hand reset type.

2.2.11.3.5 Meters / instruments

- I. All meters/ instrument shall be flush mounted on front panel, at least 96 sq.mm. Size with 90 degree linear scales and accuracy class of 2.0. All motors above 7.5 kW shall have directly connected ammeter and Motors above 30kW shall have CT connected Ammeter with ASS. Necessary Current transducers shall be provided for the same. Bus-section shall have bus VT, voltmeter with selector switch, and other relay and timers required for protection. Adequate control and selector switches, push buttons and indicating lamps shall be provided. Thermostatically controlled space heaters with switches shall be provided to prevent condensation.
- II. All Incomer feeders shall be provided with MFM, Ammeter with selector switches & with necessary kW transducer, Current transducers etc., Bus PT feeder shall be provided with Voltmeter + VSS & necessary Transducers. All Outgoing supply feeders shall be provided with Ammeters + ASS & necessary transducers.
 - a. In case of remote controlled breaker panels, following shall be ensured. Each feeder shall have local/remote selector switch. Closing from local shall be possible only in test position whereas closing from remote shall be possible in either service or test position. Tripping from local shall be possible only when local/remote selector switch is in local position. Tripping from remote shall be either breaker in service position or selector switch being in remote position.
 - b. Control from Remote Necessary hardware shall be provided in the switchgear panel like coupling relays (24V DC, with max. burden of 2.5VA), auxiliary relays, current/voltage transducers (4-20 mA, dual output) etc. to effect interlocks, exchange information / status and exercise control from remote.

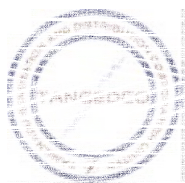
2.2.11.3.6 DESIGN AND CONSTRUCTIONAL FEATURES

- 1) All 415V switch gear motor control centres (MCCs), AC & DC distribution boards (DB s), etc. shall have following features
- 2) Shall be of metal enclosed, indoor, floor mounted and free standing type.



EPC TENDER SPECIFICATION FOR BTG PACKAGE

- 3) All frames and load bearing members shall be fabricated using mild steel structural sections or pressed and shaped cold rolled sheet steel of thickness not less than 2mm.
- 4) Frame shall be enclosed in cold rolled sheet steel of thickness not less than 1.6mm. Doors and covers shall also be of cold rolled sheet steel of thickness not less than 1.6 mm. Stiffeners shall be provided wherever necessary. Removable gland plates of thickness 3mm (hot/cold rolled sheet steel) or 4 mm (non-magnetic material) shall be provided for all panels.
- 5) All switchboards/panels shall be of dust and vermin proof. All cut-outs shall have synthetic rubber gaskets.
- 6) All switchboards, MCCs and DB s shall have following distinct vertical sections.
 - i) Completely enclosed bus bar compartment for horizontal and vertical busbars.
 - ii) Completely enclosed switchgear compartments (one for each circuit housing circuit breakers, motor starter or switch-fuse feeder).
 - iii) Compartment for cable alley or cable box for power and control cables. In case of cable box, they shall be segregated with complete shrouding for individual feeders at the rear for direct termination of cables.
 - iv) For cable connection to circuit breaker a separately enclosed cable compartment shall also be acceptable.
 - v) Compartment for relays and other control devices associated with a circuit breaker, wherever necessary.
 - vi) The switchboards/MCC/DBs of 1600A & above rating shall be of DOP IP42 & of IP52 for less than 1600A rating.
 - vii) All 415V switchgears, MCC's, AC & DC distribution boards etc. shall be painted by powder coating process. Paint shade for complete panels excluding end covers shall be RAL7032 for extreme end covers of all boards.
- 7) Busbars shall be of high conductivity aluminium alloy or copper.
- 8) Minimum air clearance in air between phases and phase-earth shall be 25 mm for busbars and cable terminations. For all other components, the Clearances



EPC TENDER SPECIFICATION FOR BTG PACKAGE

shall be at least 10mm. wherever above is not possible except for horizontal and vertical busbars, insulation shall be provided by anti-tracking sleeving or barriers. However for horizontal and vertical busbars, clearances specified above shall be maintained even when busbars are insulated/sleeved. In case of DC DBs/ fuse boards, the busbar system shall be insulated or physically segregated with barriers to prevent interpole short circuit.

- 9) Minimum air clearance in air between phases and phase-earth shall be 25 mm for busbars and cable terminations. For all other components, the Clearances shall be at least 10mm. Wherever above is not possible except for horizontal and vertical busbars, insulation shall be provided by anti-tracking sleeving or barriers. However for horizontal and vertical busbars, clearances specified above shall be maintained even when busbars are insulated/sleeved. In case of DC DBs/ fuse boards, the busbar system shall be insulated or physically segregated with barriers to prevent interpole short circuit.
- 10) Busbar insulators shall be of track-resistant high strength non-hygro- scopic, non- combustible type and suitable to withstand stresses due to over-voltages and short circuit current. Insulators and barrier of inflammable material such as Hylam shall not be accepted.
- 11) All types of relays and timer shall be subject to Purchaser's approval. They shall be flush mounted with connections from inside, and shall have transparent & dust tight cover, removable from front, drawout construction for easy replacement and testing facility. The auxiliary relays and timer may be provided in fixed cases.
- 12) Maxi terminal /cage clamp type terminal blocks shall be provided for signals to be interfaced with DDCMIS/PLC.
- 13) The switchgears/MCC shall be designed to offer adequate level of safety to operating/ maintenance personnel. Means shall be provided to prevent access to the live part to avoid accidents during service as well as maintenance period. Bidder shall bring out the safety means provided to achieve above. A detailed instruction plate suitable for wall mounting shall be provided for each switchgear/MCC room describing various safe operating procedure/safety precautions for safe operation and maintenance of switchgear/MCC.
- 14) All current and voltage transformers as required for metering & protection specified shall be completely encapsulated, cast resin insulated type. Incomers from transformers shall have CTs for transformer REF protection. All current and voltage transformers as required for metering and protection specified shall be completely encapsulated, cast resin insulated type. Incomers from



EPC TENDER SPECIFICATION FOR BTG PACKAGE

transformers shall have CTs for transformer restricted earth fault protection.
The accuracy shall be as follows:

- 15) Other CT particulars like ratio, burden knee-point voltage, excitation current and secondary resistance shall be decided by the Tenderers
- 16) CT secondary shall be rated for 1 A for metering and either 5 A or 1 A for protection.
- 17) indicating lamps shall be cluster LED type
- 18) 20% spare feeders of each type & rating used in the MCC with a minimum one (1) number on each bus section shall be provided.

2.2.11.3.7 ESSENTIAL SERVICE MODULE

During auto changeover of the supply the contactors in the affected bus would have dropped off. Services, which, shall be restarted immediately without time lapse to keep the unit running, are considered essential services. Such auxiliaries shall restart automatically without any action by the operator after an auto changeover. These modules shall have additional hardware like timer (or time delayed closing from DCS), aux. contactors and associated circuitry in the module. Such essential services shall be identified during the detailed engineering stage and suitable module/scheme shall be provided.

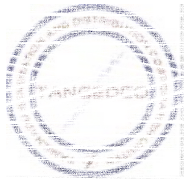
The modules of some of the critical application motors like barring gear motor, air heater motor, lube oil pump, jacking oil pump etc. irrespective of their kW rating shall be provided with a CT, ammeter and a current transducer with remote metering in DCS.

2.2.11.3.8 Type Tests

GENERAL

All equipment's to be supplied shall be of type tested quality. The Contractor shall submit for Purchaser's approval the reports of all the type tests as listed in this specification and carried out within last five years from the zero date of the project. These reports should be for the tests conducted on the equipment similar to those proposed to be supplied under this contract and the test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client.

In case the Contractor is not able to submit report of the type test(s) conducted within last five years from the zero date of the project, or in case the type test report(s) are not found to be meeting the specification requirements, the Contractor shall conduct all such tests under this contract free of cost to the Purchaser and submit the reports for approval.



EPC TENDER SPECIFICATION FOR BTG PACKAGE

All acceptance and routine tests as per the specification and relevant standards shall be carried out. Charges for these shall be deemed to be included in the equipment price.

The following type test certificates on each type & rating of L.T. Switchgear, MCC panel and distribution boards shall be submitted.

- a. Short time withstand test with circuit breaker mounted inside the switchgear panel.
- b. Temperature rise test.
- c. Type II - Short circuit co-ordination test for any three ratings of MCC module as selected by the Purchaser.
- d. Test sequence –1 & combined test sequence shall be carried out on each rating of circuit breaker mounted inside the panel.
- e. Degree of protection tests

2.2.11.3.9 ROUTINE TEST

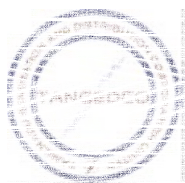
LT SWITCHGEAR

Switchgear shall be subjected to all routine tests as per relevant standards along with following tests:

Temperature rise test on power circuits

- a. Short time current tests on power circuits.
- b. Mechanical operation test
- c. Insulation resistance and 500V DC Megger before/ after 1 minute HV xvi) test
- d. Electrical control, interlock and sequential operation tests
- e. Verification of wiring as per approved schematic.

Motors



EPC TENDER SPECIFICATION FOR BTG PACKAGE

2.2.12 MOTORS

2.2.12.1 Design Criteria

- i. For the purpose of design of equipments /systems, an ambient temperature of 50 °C and relative humidity of 95% shall be considered. The equipment shall operate in a highly polluted environment.
- ii. Transient voltage dip on starting of the largest motor with DOL shall be limited to 20% of the nominal system voltage at the voltage terminals.

1. Rating

- i. The motor rating shall be arrived at considering 15% margin over the duty point input or 10% over the maximum demand of the driven equipment, whichever is higher, considering highest system frequency.
- ii. All motors shall be continuously rated (S1 duty). However, crane motors shall be rated for S4 duty, 40% cyclic duration factor.
- iii. Whenever the basis for motor ratings are not specified in the corresponding mechanical specification sub-sections, maximum continuous motor ratings shall be at least 10% above the maximum load demand of the driven equipment under entire operating range including voltage and frequency variations.

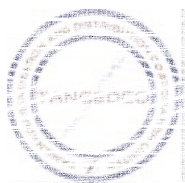
2. Starting Voltage requirement for all motors (except mill motors):

- i. 85 % of rated voltage for motors up to 1000 kW
- ii. 80 % of rated voltage for above 1000 kW and up to 4000 kW
- iii. 75 % of rated voltage for above 4000 kW

For Mill Motors:

- iv. 85 % of rated voltage for motors above 1000 kW
- v. 90 % of rated voltage for motors up to 1000 kW

3. Canopy shall be provided for outdoor motors.
4. Contractor shall provide fully compatible electrical system, equipments, accessories and services.
5. All the equipment, material and systems shall, in general, conform to the latest edition of relevant National and international Codes & Standards, especially the Indian Statutory Regulations.



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

6. Voltage and frequency variations:

- i. Frequency : (+) 3% and (-) 5%
- ii. Voltage :
 - A) AC:
 - a. $\pm 10\%$ for 11 kV/6.6 kV
 - b. $\pm 10\%$ for 415 V
 - B) DC: +10% to -15% for 220 V DC
- iii. Combined 10 % (absolute sum)

7. All LV motors above 10 kW with S1 duty.

- 8. Continuous duty LT motors rated above 0.37kW upto 200 KW Output rating (at 50 deg. C ambient temperature), shall be Efficiency class-IE3, conforming to IS 12615, or IEC:60034-30. However this is not applicable for geared motors (motors completely integrated with driven equipment) which are specifically designed to suit the driven equipment duty.**

The responsibility of coordination with electrical agencies and obtaining all necessary clearances shall be of the contractor.

9. Type

- i. AC Motors:
 - a. Squirrel cage induction motor suitable for direct-on-line starting.
 - b. Crane duty motors shall be slip ring type induction motor
- ii. DC Motors
 - a. Shunt wound

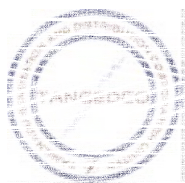
10. Temperature Rise

- i. **Air cooled** motors - 70°C by resistance method.
- ii. Water cooled - 80° C over inlet cooling water temperature mentioned elsewhere, by resistance Method.

11. Degree of Protection

Degree of protection for various enclosures shall be as follows:

- | | | |
|-------------------|---|-------|
| 1. Indoor motors | - | IP 54 |
| 2. Outdoor motors | - | IP 55 |



EPC TENDER SPECIFICATION FOR BTG PACKAGE

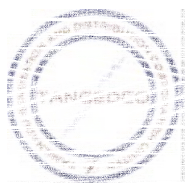
- | | | | |
|----|--|---|-------|
| 3. | CW motors (in case of screen prot. Drip proof) | - | IP 23 |
| 4. | Cable box – indoor area | - | IP 54 |
| 5. | Cable box – outdoor area | - | IP 55 |

2.2.12.2 Codes and Standards

1. All motors shall confirm to the latest editions including all applicable amendment of relevant IS, IEC and CBIP standards/Publications. In case any other standard is followed that ensures equal or better quality, may be accepted. However the English version of the Standard adopted shall be submitted.
2. Major Standards, which shall be followed, are listed below. Any other applicable Indian standards for any component part even if not covered in the list shall also be followed.
 - i. Three phase induction motors : IS:325, IEC:60034
 - ii. Single phase AC motors : IS:996, IEC:60034
 - iii. Crane duty motors : IS:3177, IEC:60034
 - iv. DC motors/generators : IS:4722
 - v. Degree of protection by enclosures for rotating electrical machines : IS: 4691 , IS: 4728, IS: 6362, IS: 2253
 - vi. Noise levels for rotating electrical machines : IS: 12065
 - vii. Mechanical Vibrations for rotating electrical machines : IS 12075

2.2.12.3 Operational Requirements

1. Starting Time
 - i. For motors with starting time less than 20 secs at minimum permissible voltage during starting, the locked rotor withstand time under hot condition at highest voltage limit shall be at least 2.5 secs more than starting time.
 - ii. For motors with starting time more than 20 secs and up to 45 secs at minimum permissible voltage during starting, the locked rotor withstand time under hot condition at highest voltage limit shall be at least 5 secs more than starting time.



EPC TENDER SPECIFICATION FOR BTG PACKAGE

- iii. For motors with starting time more than 45 secs at minimum permissible voltage during starting, the locked rotor withstand time under hot condition at highest voltage limit shall be more than starting time by at least 10% of the starting time.
- iv. Speed switches mounted on the motor shaft shall be provided in cases where above requirements are not met.
- v. Motors shall be capable of restarting under full load after a momentary loss of voltage with the possibility of 150 % nominal voltage during fast bus transfer.

2. Torque Requirements

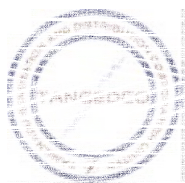
- i. Accelerating torque at any speed with the lowest permissible starting voltage shall be at least 10% motor full load torque.
- ii. Pull out torque at rated voltage shall not be less than 205% of full load torque. It shall be 275% for crane duty motors.

2.2.12.4 Design and constructional features

- 1. Suitable single phase space heaters shall be provided on motors rated 30 kW and above to maintain windings in dry condition when motor is standstill. Separate terminal box for space heaters & RTDs shall be provided.
- 2. All motors shall be suitable for direct on line starting through any type of breaker.
- 3. All motors shall be either totally enclosed fan cooled (TEFC) or totally enclosed tube ventilated (TETV) or Closed air circuit air cooled (CACA) type. However, motors rated 3000KW or above can be Closed air circuit water cooled (CACW). CW motors can be screen protected drip proof (SPDP) type. Motors located in hazardous areas shall have flame proof enclosures conforming to IS: 2148 as detailed below:
 - a. Fuel oil area : Group - IIB
 - b. Hydrogen generation plant area : Group - IIC

4. Winding and Insulation

Type	Non-hygroscopic, oil resistant, flame resistant
Starting Duty	Two hot starts in succession, with motor initially at normal running temperature.
11 kV / 6.6 kV AC motors	Class F: with winding temperature rise limited to class B. They shall withstand 1.2/50 micro sec switching surges of $4U+5$ KV (U=Line voltage in KV).



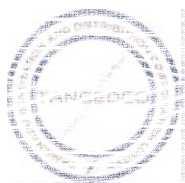
EPC TENDER SPECIFICATION FOR BTG PACKAGE

415V AC & 220V DC

The coil inter-turn insulation shall be suitable for 0.3/3 micro sec. surge of 32 KVp and 12 kVp for 11 kV and 6.6 kV system respectively followed by 1 min power frequency high voltage test of appropriate voltage on inter turn insulation

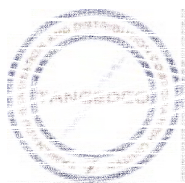
Class 'F' with temperature rise limited to class 'B'

5. Motors rated above 1000 kW shall have insulated bearings to prevent flow of shaft currents.
6. Motors with heat exchangers shall have dial type thermometer with adjustable alarm contacts to indicate inlet and outlet primary air temperature.
7. Noise level and vibration shall be limited within the limits prescribed in IS: 12065 & IS: 12075 respectively. Motors shall withstand vibrations produced by driven equipment.
8. In MV/HV motors, 12 nos. simplex or 6 nos. duplex RTDs (two per phase), each having D.C. resistance of 100 ohms at 0°C, embedded in the stator winding at locations where highest temperatures may be expected, shall be provided. The material of the RTD's shall be platinum. Each bearing shall be provided with dial type thermometer with adjustable alarm contact and resistance type temperature detector. All HV motors shall be provided with shaft grounding rings for bearing protection and earthing shaft current.
9. MV/HV motors shall also be capable of satisfactory operation at full load at a supply voltage of 80% of the rated voltage and shall be capable of either two starts in quick succession with third start after 5 minutes in cold condition or two starts at 15 minutes intervals in hot condition, both cases with voltage and frequency variation within specified limits.
10. Locked rotor current of the MV motors shall be limited to 600% (subject to IS tolerance) of the full load current of the motors and for HV motors (like BFP) shall be limited to 450% (inclusive of IS tolerance) of full load current of the motor. Locked rotor current of the LV motor shall not exceed 600% of full load current inclusive of IS tolerance.
11. MV Motors shall be provided with differential protection. These motors shall be provided with star connected stator windings. The 3 nos. current transformers, one for each phase shall be mounted in a separate compartment in the neutral side terminal box. The three phases shall be connected to form the star point after they pass through the CTs. These differential protection CTs for motors on 11/ 6.6 kV switchgear shall be supplied as loose.



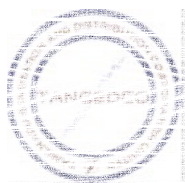
EPC TENDER SPECIFICATION FOR BTG PACKAGE

12. Motor body shall be grounded at two earthing points on opposite sides with two separate and distinct grounding pads complete with tapped holes, GI bolts and washers.
13. HV motors can be offered with either elastimould termination or dust tight phase separated double walled (metallic as well as insulated barrier) cable boxes. In case elastimould terminations are offered, then protective cover and trifurcating sleeves shall also be provided. Removable gland plates of thickness 3 mm (hot/cold rolled sheet steel) or 4 mm (non magnetic material for single core cables) shall be provided in case of cable boxes.
14. All motors shall be so designed that maximum inrush currents and locked rotor and pullout torque developed by them at extreme voltage and frequency variations do not endanger the motor and driven equipment.
15. Motors rated 18.5kW and below shall be contactor controlled having MPCB incomers with intelligent controllers. Motors rated 18.5kW and above but below 90 kW shall be contactor controlled having MCCB incomers with intelligent controllers. Motors rated 90 kW and & above up to 200KW shall be ACB controlled with numerical relays. HV & MV Motors rated above 200 KW shall have vacuum breakers. HV motors rated 1000kW and above shall be provided with insulation bearings for avoiding bearing currents. HV Motors rated 1000KW and above shall also have differential protection. Care shall be taken by BTG Bidder to ensure that parameters of the differential CT being supplied along with motors (rated above 1000kW) match with the parameters of the differential CT being supplied by BTG bidder in 11kV Switchgear.
16. The motors shall be suitable for bus transfer schemes provided on the 11 kV, 6.6 Kv and 415V systems without any injurious effect on its life.
17. For motors rated 1000 KW & above, neutral current transformers of PS class shall be provided on each phase in a separate neutral terminal box.
18. All motors shall be provided with an emergency stop push button near the motor as per the Indian Statutory regulations.
19. The motor terminal box shall be suitable for withstanding the maximum system fault current for a duration of at least 0.25 seconds.
20. Neutral in case of HV motors shall be kept accessible.
21. Motors shall be designed to easy access for drilling holes through motor feed of mounting flange for installation of dowel pins after assembly of the motor and driven equipment.



EPC TENDER SPECIFICATION FOR BTG PACKAGE

22. Well spacious working platforms shall be provided around the motor area for carrying out maintenance & testing works. Platform shall be minimum of 300 mm below the level of motor base plate.
23. Flow switches shall be provided for monitoring oil flow of forced lubrication bearings, if used. Alarm switch contact rating shall be minimum 0.5 A at 220 V DC and 10 A at 230 V AC.
24. For bearing temperature measurement, duplex RTDs shall be provided for each bearing and shall be wired up to the terminal box.
25. Lube oil pressure transmitters shall be provided to DCS for remote monitoring. Lube oil pressure very low trip to HV equipment shall be 2 out of 3 logic.
26. Capillary type temperature gauge cum switch shall be provided for DE / NDE of HV Motors.
27. Motors with CACA/CACW heat exchangers shall have dial type thermometer with adjustable alarm contacts to indicate the following:
- a) Hot and cold air temperatures of the closed air circuit for CACA motors.
 - b) Hot and cold, air and water temperatures for CACW motors.
28. The Alarm switch contact rating shall be minimum 0.5 A at 220 V DC and 10 A at 230 V AC.
29. DIRECTION OF ROTATION
- As needed by driven equipment. The 3 phase motor shall, however, be suitable for operation in both directions of rotation. A plate showing direction of rotation as determined by the phase sequence on the terminals marking shall be screwed at non-driving end of the body of the motor. If, in the case of HV & MV motors, fan is suitable for only one direction of rotation, the fan shall be so designed that with the slight modification work, it can be made suitable for other direction of rotation also. No extra material shall be required for doing above modification work.
30. BEARINGS
- Greased ball, roller and/or sleeve bearing shall be rated for minimum standard life of 40000 hours taking bearing and driven equipment loads into account. Loss of grease shall be scarce and it shall not creep along shaft into motor housing. Bearing shall be effectively sealed against dust ingress and shall be pressure grease gun lubricated.
- If the bearings are oil lubricated, a drain plug shall be provided for draining residual oil and oil level gauge shall be provided to show precisely oil level required under standstill and running conditions.



EPC TENDER SPECIFICATION FOR BTG PACKAGE

Unless otherwise approved, bearing lubricating system shall be such that no external forced oil or water is necessary to maintain required oil supply to keep bearing temperature within design limits.

For MV & HV motors rated 1000KW and above, the bearings shall be insulated wherever necessary to prevent damage to motor bearings from shaft current.

When pressure oiling is required for horizontal motors, bearings shall be sleeve type arranged for pressure oiling supplied from lubrication system of driven machine, with ring oiling for starting and emergency duty. Ring oiling system shall be adequate for starting and continuous operation of motor for at least half an hour, without pressure oiling system in operation. Oil sight flow gauges shall be provided to indicate oil flow through each bearing.

Lubricants shall be selected for prolonged storage and normal use of motors in tropical climate and shall contain corrosion and oxidation inhibitors. Greases shall have suitable bleeding characteristics to minimize setting. The selected lubricants shall be indigenously available.

Sleeve bearings for use with motors having flexible coupling with limited end play, shall have adequate axial end play to prevent transmission of thrust from driven equipment to motor bearings.

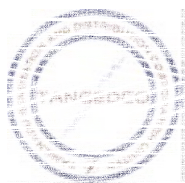
Bearings shall be of reputed make subject to the approval of the Purchaser/Consulting Engineer.

Large motors shall preferably have spherically seated babitted, ring forced, feed lubricated, water-cooled bearings. If anti-friction bearings are provided, these shall be roller bearings rated for a minimum standard life of 30000 hours taking all bearing and driven equipment loads into account.

31. TERMINAL BOXES

General

- i) Motors shall be provided with separate terminal boxes for main, space heaters, embedded temperature detectors, bearing temperature indicators and moisture detectors terminals, Neutral CT terminals. When it is not possible to provide LT motors with separate terminal box for space heater terminals, space heater terminals shall be adequately segregated from the main terminals in the single box. Terminal boxes shall be weatherproof and water-tight conforming to minimum IP-55 degree of protection with removable front cover for making connections. IP-55 degree of protection shall be achieved without application of compound. Space between and



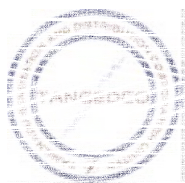
EPC TENDER SPECIFICATION FOR BTG PACKAGE

around terminals shall be adequate for easily connecting aluminium conductor cables. Terminal box arrangement shall be to the approval of the Purchaser /Consulting Engineer. All terminal boxes shall be suitable for proper termination cable to be finalized during detailed engineering.

- ii) The terminal boxes shall be complete with cable glands and termination accessories as required. Suitable non-magnetic material construction shall be adopted for terminal boxes where single core cables are to be terminated. All HV & MV motors shall be provided with phase segregated terminal box.
- iii) Terminal bushings and clamps shall be non-absorbent, non- inflammable, insulated material for connecting with cable.

Main Terminal Box

- i) LV Motors Main terminal box shall be capable of being turned through 360 degrees in steps of 90 degrees.
- ii) MV & HV Motors shall be provided with two (2) terminal boxes for stator terminals. One (1) terminal box shall be for phase terminals while other one for forming star connection. For motors rated below 1000 KW should be interchangeable to facilitate cable routing.
- iii) Neutral terminal box for HV motors rated 1000 KW and above shall be suitable for mounting of three (3) Nos. wound/bar primary/ring type cast resin insulated current transformers for differential protection. These CTs shall be mounted in the motor neutral terminal box. Stator phase terminal box shall be phase segregated terminal box suitable for both top or bottom entry of cables (i.e. they should be capable of being turned through 180 Degrees). The terminal box shall be designed for termination of XLPE cables using heat shrinkable terminating Kit. Terminal leading shall be stud type or leading wire type.
- iv) Terminal Boxes shall be provided with cable end boxes having cable lugs and cable glands for cables.
- v) The terminal boxes shall be capable of withstanding at the terminals the system fault level (as indicated below) without rupture for a duration of atleast 0.25 seconds.
 - a) Min. fault level for 11kV Motors - 50kA
 - b) Min. fault level for 6.6 kV Motors - 40kA
 - c) Min. fault level for 415V Motors -50kA



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

- d) Min. fault level for 220V DC Motors -25kA
- vi) Phase to Phase/ Phase to Earth Air Clearance:-
- a) Minimum inter-phase and phase-earth air clearances for LT motors with lugs installed shall be as follows:-

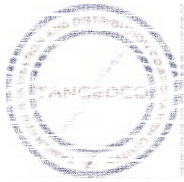
Motor MCR in KW	Clearance
UP to 110 KW	10mm
Above 110 KW and upto 150 KW	12.5mm
Above 150 KW	19mm

- vii) Terminal Accessories.....Each terminal end shall be furnished with bimetallic washers, spring washers, nuts and crimp type aluminium (preferably tinned) lugs suitable for cables of sizes.

32. TYPE AND SIZE OF CABLES

Space Heaters

- i) For LV Motors: Two point five (2.5) mm², two (2) core copper conductor PVC insulated, armoured and FRLS PVC sheathed heavy duty 650/1100 V grade cable to IS: 1554 (Part-I).
- ii) For MV & HV Motors: Six (6) mm² two core aluminium conductor XLPE insulated armoured and FRLS PVC sheathed heavy duty 650/1100V grade cable to IS: 1554 (Part-I).
- iii) For Embedded Temperature Detectors two sets of six (6) Twisted triad 0.5 mm² ATC copper conductor armoured, shielded cable, 650/1100 V Grade IS: 1554 (Part-I). For bearing temperature, RTDS, two (2) sets of four (4) twisted triad 0.5 mm², ATC copper conductor armoured shielded 650/1100 V Grade, IS: 1554 (Part-I).
- iv) Bearing Temperature Indicators - For each indicator, 0.5 mm² six (6) tarnished triad ATC copper conductor, PVC insulated, shielded armoured and FRLS PVC



EPC TENDER SPECIFICATION FOR BTG PACKAGE

sheathed heavy duty 650/1100 V grade cable as per IS: 1554 Part-I. Two (2) cables one (1) for each bearing temperature indicator.

- v) For Moisture Detectors.....As for space heaters

For Main Terminals:-

- i) LT Motors

a) Three (3) core cablesStranded aluminium conductor, XLPE insulated, colour coded, laid up, FRLS PVC type ST2 sheathed, GI wire / strip armoured, FRLS PVC type-ST2 jacketed overall, 650 / 1100V grade, heavy-duty cables as per IS: 1554 (Part-I).

b) Single core cablesStranded aluminium conductor, XLPE insulated, hard drawn aluminium wire/ strip armoured FRLS PVC type ST2 jacketed overall, 1100V grade, heavy duty cable as per IS: 1554 (Part-I).

- ii) HV & MV Motors

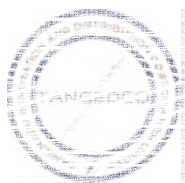
Three (3) core cables stranded aluminium conductor, XLPE insulated, screened colour coded, laid up, FRLS PVC type ST2 sheathed, GI wire/strip armoured FRLS PVC type ST2 jacketed overall, 6.6 KV / 11 KV un earthed grade, heavy duty cables as per requirement for unearthed system as per IS: 7098 (Part-II).

33. GROUNDING

General..... Two (2) grounding terminals one (1) on either side at the bottom suitable for connecting mild steel/GI flat/GI wire grounding conductor, size of grounding conductor shall be decided during detailed engineering.

LV Motors.....At each earthing point, two (2) drilled and tapped holes with hexagonal head bolts, plain washers, spring washers and tinned lugs (for motors upto 5.5 KW) for size of conductor specified shall be provided.

HV & MV Motors.....Non-corrodible metallic grounding pad shall be welded or brazed at each earthing point. The size of grounding pad shall be 75x65x25 mm. Grounding pad shall have 40 mm apart two (2) drilled and tapped holes with hexagonal head bolts, plain washers and spring washers for size of conductor



EPC TENDER SPECIFICATION FOR BTG PACKAGE

specified. In addition, one suitable earthing terminal shall be provided inside the stator phase terminal box for earthing metallic shield of XLPE cables.

34. EMBEDDED TEMPERATURE DETECTORS

HV & MV motor shall be provided with four (4) Nos. simplex or two (2) Nos. duplex platinum resistance temperature detectors (RTDs) in each phase embedded in stator winding at locations where high temperatures are expected. In addition one (1) duplex type RTD shall be provided in each bearing. The RTDs shall be 3 wire duplex platinum resistance type having a value of 100 ohms at 0 Deg.C

35. BEARINGS TEMPERATURE INDICATORS

HV & MV motors shall be provided with dial type two (2) bearing temperature indicators and shall have two (2) sets of contacts, each set having 2 NO + 2 NC contacts rated for 5A at 240V AC and 0.5A at 220V DC. One set shall be set to operate at lower value to give alarm and other set at a higher value to trip the motor.

36. SPACE HEATERS

Valve / Damper actuator motors; and Motors 30 KW and above shall be provided with one (1) or two (2) space heaters suitable for 240V, 50 Hertz single phase AC supply and of adequate capacity to maintain motor internal temperature above dew point to prevent moisture condensation or deterioration of insulation during shut down. Heaters shall be mounted inside the motor in accessible locations so that their removal and replacement is simple.

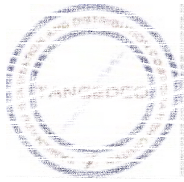
The terminals of space heaters shall be brought out to a separate totally enclosed dust proof and weatherproof terminal box.

The space heater shall be wired to maintain the motor internal temperature above dew point when the motor is in idle condition.

37. HOT AIR TEMPERATURE DETECTOR

If the motor is of CACA or CACW enclosure, dial type temperature indicator shall be provided (one each for hot and cold air temperature monitoring for CACA and CACW and one each for inlet and outlet water temperature monitoring for CACW). If alarm and trip are required for cooling air temperature, temperature switch shall be provided.

38. WATER FLOW INDICATOR



EPC TENDER SPECIFICATION FOR BTG PACKAGE

If the motor is of CACW enclosure a provision shall be made for visual indication of water flow and flow switch shall also be provided with alarm contacts. Thermometers shall be provided in water inlet and outlet circuits.

39. MOISTURE DETECTORS

Motors with type of cooling 1C 81W or 1C 91 W shall be provided with moisture detectors for raising alarm in the event of water tube failure.

40. BED PLATE

Whenever motor is supplied with driven equipment the Supplier shall ensure that bed plate suits both motor and driven equipment and is adequately braced to keep vibration and misalignment within allowable limits to the approval of driven equipment and motor manufacturers.

41. Painting

Motor including fan shall be painted with corrosion proof paints of colour shade RAL 5012.

42. Local Push Button Stations

The LPBS shall be installed near the motors to be controlled. Individual channel supports shall be used for each LPBS. These shall be installed as per approved erection detail drawing. LPBS for hazardous areas shall be CMRS certified and CCE approved.

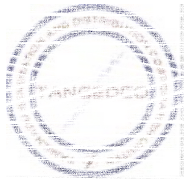
All LPBS shall have necessary canopies. Wiring of LPBS shall be checked before giving control supply.

Local push button station having only stop push button shall be provided for all the drive motors (HV, MV & LV motors).

The degree of protection of LPBs shall be IP65 with canopy.

All PBs shall be push to actuate type and the stop PB shall be lockable in off position as per the scheme requirement.

Emergency local stop push button should not be lockable. Stop Push buttons shall be mushroom type with latched or stay put feature with protective lid/cover. Start push button shall be self-reset type.



EPC TENDER SPECIFICATION FOR BTG PACKAGE

All push buttons shall be provided with 2 nos. NO and 2 nos. NC contacts for various interlocking purposes. One contact of stop PB shall be directly wired to the switchgear module for direct tripping and another contact to control system.

Terminals to be suitable for 2 cores of 2.5 sq.mm conductors with 20% spare terminals. All LPBs shall be of Di-cast aluminium/ FRP.

LPB shall be of following types:

1. Type-A: With Stop Push Button in FRP enclosure
2. Type-B: With Start & Stop Push Buttons in FRP enclosure
3. Type-C: With Forward, Reverse & Stop Push Buttons in FRP enclosure
4. Type-D: With Stop Push Button in flame-proof enclosure
5. Type-E: With Start & Stop Push Buttons in flame-proof enclosure
6. Type-F: With Forward, Reverse & Stop Push Buttons in flame-proof enclosure

43. OTHER ACCESSORIES

Motor shall be supplied with all accessories and parts other than those, specified above which are necessary and/or useful for efficient operation.

44. NOISE LEVEL

Noise level for all the motors shall be limited to 85dB(A) except for BFP motor for which the maximum limit shall be 90dB(A). at 1m from operating motor measured in accordance with IS: 10265.

2.2.12.5 Documents and Drawings

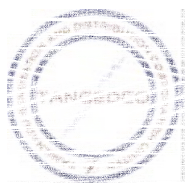
1. INFORMATION WITH PROPOSAL

AC Motor Data Sheet
Dimension Drawing/Foundation load details of motor and driven equipment.
Manufacturer's catalogue showing constructional details.

2. INFORMATION ON AWARD OF CONTRACT

Motor Data Sheet

Certified binding dimension drawing of motor complete with all accessories and fittings specifically showing terminal boxes, terminal spacing and sizes, earthing connections and sizes thereof, mounting details, lifting lugs, final foundation loads and dimensions with tolerances of centering spigot (where needed), shaft extension and key.



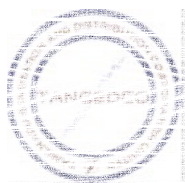
EPC TENDER SPECIFICATION FOR BTG PACKAGE

Following characteristics curves:-

- i) Torque-speed curves for motor at eighty (80), hundred (100) and hundred ten (110) percent rated voltage as well as torque-speed curve for driven equipment except for mill motor. For mill motor torque speed curve for motor at ninety (90) hundred (100) and hundred ten (110) percent rated voltage as well as torque-speed curve for driven equipment
- ii) Current-speed curves at eight (80), hundred (100) and hundred ten (110) percent rated voltage except for mill motor. For mill motor current speed curve for motor at ninety (90) hundred (100) and hundred ten (110) percent rated voltage
- iii) Current-time curves at eighty (80), hundred (100) and hundred ten (110) percent rated voltage except for mill motor. For mill motor current time curve for motor at ninety (90) hundred (100) and hundred ten (110) percent rated voltage.
- iv) Thermal withstand curves for hot and cold at eighty (80), hundred (100) and hundred ten (110) percent rated voltage except for mill motor. For mill motor thermal withstand curve for motor at ninety (90) hundred (100) and hundred ten (110) percent rated voltage.
- v) Efficiency, power factor, current and speed versus power output curves.
- vi) Speed-time curves at eight (80), hundred (100) and hundred ten (110) percent rated voltage except for mill motor. For mill motor speed time curve for motor at ninety (90) hundred (100) and hundred ten (110) percent rated voltage.
- vii) Negative phase sequence current withstand characteristics.

2.2.12.6 List of tests to be conducted for HV, MV and LV Motors

- 1. Type tests
 - i. No load saturation and loss curves up to approximately 115% of rated voltage.
 - ii. Momentary overload test.
 - iii. Temperature rise test at rated conditions. During heat run test, bearing temp., winding temp., core temp., coolant flow and its temperature shall also be measured. In case the temperature rise test is carried at load other than rated load, specific approval for the test method and procedure is required to be obtained. Wherever ETD's are provided, the temperature shall be measured by ETD's also for the record purpose.



EPC TENDER SPECIFICATION FOR BTG PACKAGE

- iv. Surge withstand test on the sample coil after placing it in stator core at (4U + 5 KV) and with at least five impulse of 1.2/50 micro sec. wave, for HV motors only, where U is the line to line voltage in kV.
- v. Surge-withstand test with 0.3/3 micro sec. wave on each type of 6.6/11 kV motor coils with at least five such impulses, followed by one minute power frequency high voltage test on turn to turn insulation, after cutting the coil and bringing out the turns suitably. The power frequency test voltage shall be decided during detailed engineering.
- vi. Dimensions (for motors covered by IS 1231:1974 and IS 2223:1983 only).
- vii. Measurement of resistance of windings of stator and wound rotor.
- viii. Reduced voltage running up test at no load (for squirrel cage motors up to 37kw only).
- ix. Full load test to determine efficiency, power factor and slip.
- x. Insulation resistance test.
- xi. Test for vibration severity of motor.
- xii. Test for noise levels of motor.
- xiii. Test for degree of protection by enclosure.
- xiv. Temperature rise test at limiting values of voltage and frequency variations.
- xv. Over speed test.

2. Routine Tests

The following shall constitute the routine tests.

- i. Insulation resistance test
- ii. Measurement of resistance of windings of stator and wound rotor.
- iii. No load test
- iv. Locked rotor readings of voltage, current and power input at a suitable reduced voltage
- v. Reduced voltage running up test (for squirrel cage motor)

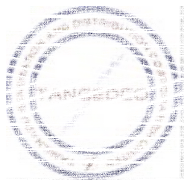


EPC TENDER SPECIFICATION FOR BTG PACKAGE

- vi. Open circuit voltage ratio of stator and rotor windings (for slip ring motors); rotor;
- vii. High voltage test

2.2.12.7 Inspection and Testing at site

1. Insulation resistance of 415V motors shall be measured between the winding of the machine and its frame by means of a 500/1000V megger. A minimum value of 1 mega ohm for 415V motors shall be considered a safe value. In case of lower I.R. Value, the insulation value shall be brought up by any of the following methods as desired by the Site Engineer.
 - i. Blowing hot air in case of big motors.
 - ii. Putting the motor in electric oven in case of smaller motors.
 - iii. Placing heaters or lamps around and inside in case of small motors after making suitable guarding and covering arrangements so as to conserve the heat.
2. Site Test
 - i. Measurement of vibration.
 - ii. Measurement of insulation resistance and polarization index.
 - iii. Measurement of full load current.
 - iv. Test running of the motors, checking the temperature rise and identifying the hot spot etc.
3. 6.6 kV motors shall be tested for insulation by 500/1000V megger and its value should not be less than the safe minimum insulation of $\geq 20 \text{ M}\Omega$ resistance at 60 deg. C. In case the insulation is low, the following method of drying has to be adopted.
 - i. By locking the motor so that it cannot rotate and then applying such a low voltage to the stator terminals that full load current flows in the stator, keeping the stator winding temperature below 90 deg. C. In this a close watch shall be kept for any possible overheating and I.R. Values vs. temperature shall be plotted and heating continued till I.R. Value becomes steady.
 - ii. By blasting hot air from external source, Maximum temperature of winding while drying should be 70 deg. C to 80 deg. C. (Thermometer) or 90 deg. C. to 95 deg. C. by resistance method. Heating should be done slowly till steady



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

temperature of winding is reached after 4 to 5 hours and for large machines after 10 hours. A record has to be kept for drying process, with half an hour readings and, after steady temperature is reached, at an interval of 2 hours. In case it is essential, the drying process can be supplemented by blower.

	TITLE LV MOTORS <u>DATA SHEET-A</u>		SPECIFICATION NO.	
			VOLUME	II B
			SECTION	D
			REV NO. 00	DATE 16.05.2017
			SHEET 1	OF 1
1.0	Design ambient temperature	:	50 °C	
2.0	Maximum acceptable kW rating of LV motor	:	Upto 200KW	
3.0	Installation (Indoors/ Outdoors)	:	As required	
4.0	Degree Of Protection	:	IP55	
5.0	Cooling	:	TEFC / TETV / CACA	
6.0	Details of supply system			
	a) Rated voltage (with variation)	:	415V $\pm$ 10%	
	b) Rated frequency (with variation)	:	50 Hz (Variation: +3% and –5%)	
	c) Combined voltage & freq. variation	:	10% (sum of absolute values)	
	d) System fault level at rated voltage	:	50 kA for 1 sec	
	e) Short time rating for terminal box	:	50 kA for 0.25 sec	
	f) LV System grounding	:	Solidly	
7.0	Class of insulation	:	Class 'F', with temp rise limited to class B.	
8.0	Minimum voltage for starting (As percentage of rated voltage)	:	85% of rated voltage	
9.0	Power cables data	:	Shall be given during Detailed engg.	
10.0	Earth Conductor Size & Material	:	Shall be given during Detailed engg.	
11.0	Space heater supply (30KW & ABOVE)	:	240 V, 1 Φ , 50 Hz	
12.0	Rating up to which Single phase motor	:	Acceptable below 0.20 Kw	
13.0	TYPE OF STARTER PROVIDED IN MCC	:	DOL	
14.0	Locked rotor current			
	a) Limit as percentage of FLC	:	As per IS 12615	
	b) Permissible tolerance, if any	:		
15.0	Additional tests	:	As per QP	
16.0	Flame-proof motor			
	a) Enclosure suitable (As per IS:2148)	:	As per requirement	
	b) Classification of Hazardous area (As per IS: 5572 part-I)	:	As per requirement	
	c) Degree of protection	:	IP65	
17.0	Makes	:	AS PER ANNEXURE-I	
18.0	Terminal box	:	Suitable to rotate at 90 degrees	
19.0	Paint shade	:	RAL 5012	



TITLE

LV MOTORS**DATA SHEET-A**

SPECIFICATION NO.

VOLUME II B

SECTION D

REV NO. 00 DATE 16.05.2017

SHEET 2 OF 1

20.0 Efficiency class : IE3

NOTE :

1. Also detailed Customer spec. for Motors is to be referred as enclosed with technical spec.

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

		CUSTOMER :		PROJECT		SPECIFICATION :							
		BIDDER/ :		TITLE		NUMBER :							
		VENDOR		QUALITY PLAN		SPECIFICATION :							
SHEET 2 OF 9		SYSTEM		ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)		VOLUME III							
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY	SECTION	REMARKS		
1	2	3	4	5	6	7	8	9	P	W	V		
1.5	SHAFT (FORGED OR ROLLED)	1. SURFACE COND. 2. CHEM. & PHYSICAL PROPERTIES 3. DIMENSIONS 4. INTERNAL FLAWS	MA	VISUAL	100%	-	FREE FROM VISUAL DEFECTS	-DO-	3	-	-	VENDOR'S APPROVAL IDENTIFICATION SHALL BE MAINTAINED	
1.6	SPACE HEATERS, CONNECTORS, TERMINAL BLOCKS, CABLE LUGS, CARBON BRUSH TEMP. DETECTORS, RTD, BTD'S	1. MAKE & RATING	MA	VISUAL	-DO-	1/HEAT NO. OR HEAT TREATMENT BATCH NO	MFG. DRG. SPEC.	SUPPLIER'S TC	3	-	2		
		2. PHYSICAL COND.	MA	-DO-	-DO-	100%	-DO-	MANUFR'S DRG.	LOG BOOK	3	-	2	
		3. DIMENSIONS (WHEREVER APPLICABLE)	MA	MEASUREMENT	SAMPLE	MEASUREMENT	ASTM-A388	MANUFR'S SPEC. BHEL SPEC.	-DO-	3	2	1	FOR DIA OF 55 MM & ABOVE
		4. PERFORMANCE/ CALIBRATION	MA	TEST	100%	-DO-	MANUFR'S DRG. SPEC.	MANUFR'S DRG. / SPEC.	-DO-	3	-	2	
			MA										
BHEL		PARTICULARS		BIDDER/VENDOR									
		NAME											
		SIGNATURE											
		DATE											
										BIDDER'S/VENDORS COMPANY SEAL			

		QUALITY PLAN		CUSTOMER :		PROJECT		SPECIFICATION :			
				TITLE		NUMBER :					
SHEET 4 OF 9		COMPONENT/OPERATION		CHARACTERISTIC CHECK		BIDDER/ :		SPECIFICATION :			
						VENDOR :		TITLE			
1		2		3		SYSTEM		QUALITY PLAN		VOLUME III	
						CAT.		ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)		REMARKS	
1.10		BEARINGS		3.DIMENSIONS 1.MAKE & TYPE 2.DIMENSIONS		EXTENT OF CHECK		ACCEPTANCE		SECTION	
						TYPE/METHOD OF CHECK		NORM		AGENCY	
1.11		SLIP RING (WHEREVER APPLICABLE)		3.DIMENSIONS 1.SURFACE COND. 2.DIMENSIONS 3.TEMP.WITH- STAND CAPACITY 4.HV/IR		100%		-DO-		10	
						100%		-DO-		3 - 2	
1.12		OIL SEALS & GASKETS		1.MATERIAL OF GASKET 2.SURFACE COND. 3.DIMENSIONS		100%		-DO-		3 - 2	
						100%		-DO-		3 - 2	
BHEL		BHEL		BHEL		BIDDER/VENDOR		BIDDER/VENDOR		BIDDER/VENDORS COMPANY SEAL	
						NAME		NAME		BIDDER/VENDORS COMPANY SEAL	
BHEL		BHEL		BHEL		SIGNATURE		SIGNATURE		BIDDER/VENDORS COMPANY SEAL	
						DATE		DATE		BIDDER/VENDORS COMPANY SEAL	

		QUALITY PLAN		CUSTOMER :		PROJECT		SPECIFICATION :				
				BIDDER/ VENDOR		TITLE		NUMBER :				
						QUALITY PLAN		SPECIFICATION :				
		SHEET 5 OF 9		SYSTEM		NUMBER PED-506-00-Q-007, REV-03		TITLE				
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	SECTION			REMARKS
									P	W	V	
1	2	3	4	5	6	7	8	9	10			11
2.0	IN PROCESS											
2.1	STATOR FRAME WELDING (IN CASE OF FABRICATED STATOR)	1.WORKMANSHIP & CLEANNES	MA	VISUAL	100%	-DO-	GOOD FINISH	LOG BOOK	3/2	2	-	
2.2	MACHINING	2.DIMENSIONS	MA	MEASUREMENT	-DO-	MANUF'S DRG	MANUF'S DRG	-DO-	2	-	-	
		1.FINISH	MA	VISUAL	100%	-DO-	GOOD FINISH	LOG BOOK	2	-	-	
		2.DIMENSIONS	MA	MEASUREMENT	-DO-	MANUF'S DRG	MANUF'S DRG	-DO-	2	-	-	
		3.SHAFT SURFACE FLOWS	MA	PT	-DO-	RELEVANT SPEC./ ASTM-E165	MANUF'R'S SPEC./ BHEL SPEC./	-DO-	2	-	1	
2.3	PAINTING	1.SURFACE PREPARATION	MA	VISUAL	100%	MANFR'S SPEC./BHEL SPEC./RELEVANT STAND	BHEL SPEC. SAME AS COL.7	LOG BOOK	2	-	-	
		2.PAINT THICKNESS (BOTH PRIMER & FINISH COAT)	MA	MEASUREMENT BY ELCOMETER	SAMPLE	-DO-	-DO-	-DO-	2	-	-	
		3.SHADE	MA	VISUAL	-DO-	-DO-	-DO-	Log Book	2	-	-	
		4.ADHESION	MA	CROSS CUTTING & TAPE TEST	-DO-	-DO-	-DO-	Log Book	2	-	-	
BHEL												
			PARTICULARS			BIDDER/VENDOR						
			NAME									
			SIGNATURE									
			DATE									
BIDDER'S/VENDORS COMPANY SEAL												

新和丰源 bhel				CUSTOMER :		PROJECT TITLE		SPECIFICATION : NUMBER :			
QUALITY PLAN				BIDDER/ VENDOR :		SPECIFICATION : TITLE					
SHEET 6 OF 9				SYSTEM		NUMBER PED-506-00-Q-007, REV-03					
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	SECTION AGENCY	VOLUME III REMARKS	
1	2	3	4	5	6	7	8	9	P W V	10 11	
2.4	SHEET STACKING	1.COMPLETENESS	MA	MEASUREMENT	SAMPLE	MANUFR'S SPEC.	MANUFR'S SPEC.	Log Book	2	-	-
		2.COMPRESSION & TIGHTENING	MA	MEASUREMENT	100%	-DO-	-DO-	Log Book	2	-	-
		3.CORE LOSS & HOTSPOT	MA	ELECT.TEST	-DO-	-DO-	-DO-	Log Book	2	1*	1
2.5	WINDING	1.COMPLETENESS	CR	VISUAL	100%	MANUFR'S SPEC./BHEL SPEC.	MANUFR'S SPEC./BHEL SPEC.	Log Book	2	-	-
		2.CLEANLINESS	CR	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	-
		3.IR-HV-IR	CR	ELECT.TEST	-DO-	-DO-	-DO-	Log Book	2	-	1
		4.RESISTANCE	CR	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	1
		5.INTERTURN INSULATION	CR	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	-
		6.SURGE WITH STAND AND TAN.DELTA TEST	CR	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	1
2.6	IMPREGNATION	1.VISCOSCITY	MA	PHY. TEST	AT STARTING	-DO-	-DO-	Log Book	2	-	-
		2.TEMP. PRESSURE VACCUM	MA	PROCESS CHECK	CONTINUOUS	-DO-	-DO-	Log Book	2	-	-
		3.NO. OF DIPS	MA	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	1
THREE DIPS TO BE GIVEN											
BHEL				PARTICULARS		BIDDER/VENDOR					
				NAME							
				SIGNATURE							
				DATE							
BIDDER'S/VENDORS COMPANY SEAL											

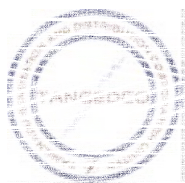
		QUALITY PLAN		CUSTOMER :		PROJECT TITLE		SPECIFICATION : NUMBER :						
SHEET 8 OF 9		BIDDER/ VENDOR :		QUALITY PLAN NUMBER PED-506-00-Q-007, REV-03		SPECIFICATION : TITLE		SECTION VOLUME III						
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	SYSTEM	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS	
										P	W	V		
1	2	3	4	5	6	7	8	9	10	11				
3.0	TESTS	1.TYPE TESTS INCLUDING SPECIAL TESTS AS PER BHEL SPEC. 2.ROUTINE TESTS INCLUDING SPECIAL TEST AS PER BHEL SPEC. 3.VIBRATION & NOISE LEVEL 4.OVERALL DIMENSIONS AND ORIENTATION 5.DEGREE OF PROTECTION 6. MEASUREMENT OF RESISTANCE OF RTD & BTD 7. MEASUREMENT OF RESISTANCE, IR OF SPACE HEATER 8. NAMEPLATE DETAILS 9.EXPLOSION FLAME PROOF NESS (IF SPECIFIED) 10. PAINT SHADE, THICKNESS & FINISH	MA		ELECT.TEST	1/TYPE/SIZE	IS-325/ BHEL SPEC./ DATA SHEET	IS-325/ BHEL SPEC./ DATA SHEET	TEST REPORT	2	1*	1	* NOTE - 1	
			MA		-DO-	100%	-DO-	-DO-	-DO-	-DO-	2	1\$	1	\$ NOTE - 2
			MA		-DO-	100%	IS-12075 & IS-12065	IS-12075 & IS-12065	-DO-	-DO-	2	1\$	1	\$ NOTE - 2
			MA		MEASUREMENT & VISUAL	100%	APPROVED DRG/DATA SHEET	APPROVED DRG/DATA SHEET & RELEVANT IS	INSPC. REPORT	2	1	-		
			MA		ELECT. & MECH. TEST	1/TYPE/ SIZE	RELEVANT IS	BHEL SPEC. AND DATA SHEET	TC	2	-	1		TC FROM AN INDEPENDENT LABORATORY, REFER NOTE-3
			MA		-DO-	100%	-DO-	-DO-	-DO-	-DO-	2	1\$	1	\$ NOTE - 2
			MA		-DO-	100%	-DO-	-DO-	-DO-	-DO-	2	1\$	1	\$ NOTE - 2
			MA		VISUAL	100%	IS-325 & DATA SHEET	IS-325 & DATA SHEET	INSPC. REPORT	2	1\$	1	\$ NOTE - 2	
			MA		EXPLOSION FLAME PROOF TEST	1/TYPE	IS-3682 IS-8239 IS-8240	IS-3682 IS-8239 IS-8240	TC	2	-	1		TC FROM AN INDEPENDENT LABORATORY, REFER NOTE-3
			MA		VISUAL & MEASUREMENT BY ELKOMETER	SAMPLE	BHEL SPEC. & DATA SHEET	BHEL SPEC. & DATA SHEET	TC	2	1\$	1		SAMPLING PLAN TO BE DECIDED BY INSPECTION AGENCY \$ NOTE - 2
BHEL			PARTICULARS		BIDDER/VENDOR									
			NAME											
			SIGNATURE											
			DATE											
							BIDDER/SVENDORS COMPANY SEAL							

		QUALITY PLAN		CUSTOMER :		PROJECT TITLE		SPECIFICATION : NUMBER :	
				BIDDER/ VENDOR :		QUALITY PLAN		SPECIFICATION :	
				SYSTEM		NUMBER PED-506-00-Q-007, REV-03		TITLE	
SHEET 9 OF 9				CAT.		ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)		SECTION	
COMPONENT/OPERATION		CHARACTERISTIC CHECK		TYPE/ METHOD OF CHECK		REFERENCE ACCEPTANCE NORM		AGENCY	
						DOCUMENT		P W V	
SL. NO.		2		3		4		5	
		6		7		8		9	
1								10	
								11	
NOTES: 1 DEPENDING UPON THE SIZE AND CRITICALLY, WITNESSING BY BHEL SHALL BE DECIDED. 2 ROUTINE TESTS ON 100% MOTORS SHALL BE DONE BY THE VENDOR. HOWEVER, BHEL SHALL WITNESS ROUTINE TESTS ON RANDOM SAMPLES. THE SAMPLING PLAN SHALL BE MUTUALLY AGREED UPON. 3 IN CASE TEST CERTIFICATES FOR THESE TESTS ON SIMILAR TYPE, SIZE AND DESIGN OF MOTOR FROM INDEPENDENT LABORATORY ARE AVAILABLE, THESE TEST MAY NOT BE REPEATED. 4 WHEREVER CUSTOMER IS INVOLVED IN INSPECTION, AGENCY (1) SHALL MEAN BHEL AND CUSTOMERS BOTH TOGETHER. <u>Legends for Inspection agency</u> 1. BHEL/CUSTOMER 2. VENDOR (MOTOR MANUFACTURER) 3. SUB-VENDOR (RAW MATERIAL/COMPONENTS SUPPLIER) P. PERFORM W. WITNESS V. VERIFY									
BHEL									
PARTICULARS									
NAME									
SIGNATURE									
DATE									
BIDDER/VENDOR									
BIDDER'S/VENDORS COMPANY SEAL									

		QUALITY PLAN		CUSTOMER :		PROJECT		SPECIFICATION :				
				BIDDER/ VENDOR		QUALITY PLAN		NUMBER :				
				SYSTEM		ITEM AC ELECT. MOTORS BELOW 55KW (LV)		SPECIFICATION				
		SHEET 1 OF 2		CAT.		REFERENCE DOCUMENT		ACCEPTANCE NORM		SECTION		
COMPONENT/OPERATION		CHARACTERISTICS CHECK		TYPE/ METHOD OF CHECK		EXTENT OF CHECK		FORMAT OF RECORD		AGENCY		
										REMARKS		
										P W V		
1	2	3	4	5	6	7	8	9	10			11
1.0	ASSEMBLY	1.WORKMANSHIP 2.DIMENSIONS 3.CORRECTNESS COMPLETENESS TERMINATIONS/ MARKING/COLOUR CODE 1.SHADE	MA	VISUAL	100%	MANUF'S SPEC	MANUF'S SPEC	-DO-	2	-	-	
			MA	-DO-	-DO-	MFG. DRG./ MFG. SPEC.	MFG. DRG./ MFG. SPEC.	-DO-	2	-	-	
			MA	VISUAL	100%	MFG.SPEC./ RELEVANT IS	MFG.SPEC./ RELEVANT IS	-DO-	2	-	-	
2.0	PAINTING		MA	VISUAL	SAMPLE	MANUF'R'S SPEC/BHEL SPEC./RELEVANT STANDARD	BHEL SPEC. SAME AS COL.7	LOG BOOK	2	-	-	
3.0	TESTS	1.ROUTINE TEST INCLUDING SPECIAL TEST AS PER BHEL SPEC. 2.OVERALL DIMENSIONS & ORIENTATION	MA	-DO-	100%	IS-325/ BHEL SPEC./ DATA SHEET	SAME AS COL.7	TEST REPORT	2	1		NOTE -1 & NOTE-3
			MA	MEASUREMENT & VISUAL	100%	APPROVED DRG/DATA SHEET	APPROVED DRG/DATA SHEET & RELEVANT IS	INSPN. REPORT	2	1	-	NOTE -1 & NOTE-3
BHEL		PARTICULARS		BIDDER/VENDOR								
		NAME										
		SIGNATURE										

		QUALITY PLAN		CUSTOMER :		PROJECT TITLE		SPECIFICATION : NUMBER :				
		BIDDER/ :		VENDOR :		QUALITY PLAN		SPECIFICATION : TITLE :				
		SHEET 2 OF 2		SYSTEM CAT.		ITEM AC.ELECT. MOTORS BELOW 55KW (LV)		SECTION VOLUME III				
SL. NO.	COMPONENT/OPERATION	CHARACTERISTICS CHECK	TYPE/METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY	P	W	V	REMARKS
1	2	3	4	5	6	7	8	9	10			11
		3.NAMEPLATE DETAILS	MA	VISUAL	100%	IS-325 & DATA SHEET	IS-325 & DATA SHEET	INSPN. REPORT	2	1	-	
NOTES: 1 ROUTINE TESTS ON 100% MOTORS SHALL BE DONE BY THE VENDOR. HOWEVER, BHEL SHALL WITNESS ROUTINE TESTS ON RANDOM SAMPLES. THE SAMPLING PLAN SHALL BE MUTUALLY AGREED UPON 2 WHERE EVER CUSTOMER IS INVOLVED IN INSPECTION, (1) SHALL MEAN BHEL AND CUSTOMERS BOTH TOGETHER. 3 FOR EXHAUST/VENTILATION FAN MOTORS OF RATING UPTO 1.5KW . ONLY ROUTINE TEST CERTIFICATES SHALL BE FURNISHED FOR SCRUTINY.												
<u>Legends for Inspection agency</u> 1. BHEL/CUSTOMER 2. VENDOR (MOTOR MANUFACTURER) 3. SUB-VENDOR (RAW MATERIAL/COMPONENTS SUPPLIER) P. PERFORM W. WITNESS V. VERIFY												
BHEL		PARTICULARS		BIDDER/VENDOR								
		NAME										
		SIGNATURE										
		DATE										
BIDDER'S/VENDORS COMPANY SEAL												

LV Cables



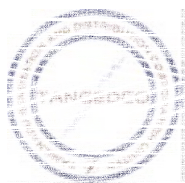
EPC TENDER SPECIFICATION FOR BTG PACKAGE

2.2.16 LV CABLES

2.2.16.1 Codes and Standards

All standards, specifications and codes of practice referred to herein shall be the latest editions including all applicable official amendments and revisions as on date of opening of bid. In case of conflict between this specification and those (IS: codes, standards, etc.) referred to herein, the former shall prevail. All the cables shall conform to the requirements of the following standards and codes:

IS : 3961	: Recommended current ratings for cables.
IS : 3975	: Low carbon galvanised steel wires, formed wires and tapes for armouring of cables.
IS : 4905	: Methods for random sampling.
IS : 5831	: PVC insulation and sheath of electrical cables.
IS:7098 (Part -I)	: Cross linked polyethylene insulated PVC sheathed cables for working voltages up to and including 1100V.
IS : 8130	: Conductors for insulated electrical cables and flexible cords.
IS : 10418	: Specification for drums for electric cables.
IS : 10810	: Methods of tests for cables.
ASTM-D -2843	: Standard test method for density of smoke from the burning or decomposition of plastics.
ASTM-D-2863	: Standard method for measuring the minimum oxygen concentration to support candle like combustion of plastics.
IEC-60754 (Part-I)	: Test on gases evolved during combustion of electric cables.
IEEE-383	: Standard for type test of Class IE Electric Cables.
IEC -60332	: Tests on Electric cables under fire conditions.
IS:6380	: Specification of elastomeric insulation and sheath of electric cables
IS:5608	: Specification for low frequency wires and cables with PVC insulation and PVC Sheath.

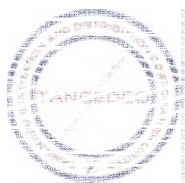


EPC TENDER SPECIFICATION FOR BTG PACKAGE

IEC:502	: Extruded solid dielectric insulated power cables for rated voltages from 1.00 kV upto 30 kV
IEC:287	: Calculations of the continuous current rating of cables (100% load factor)
IEC:228	: Conductors for insulated cables
IEC: 60	: High voltage test techniques
IEC: 230	: Impulse tests on cables and their accessories
IEC-331	: Fire resisting characteristics of electric cables
NEMA-WC-5	: Thermoplastic insulated wires and cables for transmission and distribution of electrical energy.
IEC: 540	: Test methods for insulations and sheaths of electric cables and cords (elastomeric and thermoplastic compounds)
SS-4241475 classF3	: Cables - Testing of fire characteristics
NES-715-1	: Temperature index

2.2.16.2 Technical Requirements

1. The cables shall be suitable for laying on racks, in ducts, trenches, conduits and under ground buried installation with chances of flooding by water.
2. Cables shall be flame retardant, low smoke (FRLS) type designed to withstand all mechanical, electrical and thermal stresses develop under steady state and transient operating conditions as specified elsewhere in this specification.
3. Aluminium conductor used in power cables shall have tensile strength of more than 100 N/ sq.mm. Conductors shall be multi stranded.
4. XLPE insulation shall be suitable for a continuous conductor temperature of 90 deg. C and short circuit conductor temperature of 250°C.
5. The cable cores shall be laid up with fillers between the cores wherever necessary. It shall not stick to insulation and inner sheath. All the cables, other than single core



EPC TENDER SPECIFICATION FOR BTG PACKAGE

unarmoured cables, shall have distinct extruded PVC inner sheath of black colour as per IS: 5831.

6. For single core armoured cables, armouring shall be of aluminium wires/ formed wires. For multicore armoured cables armouring shall be of galvanised steel as follows :

Calculated nominal dia Size and Type of armour of cable under armour

- i. Up to 13 mm 1.4mm dia GS wire
 - ii. Above 13 & upto 25mm 0.8 mm thick GS formed wire / 1.6 mm dia GS wire
 - iii. Above 25 & upto 40 mm 0.8mm thick GS formed wire / 2.0mm dia GS wire
 - iv. Above 40 & upto 55mm 1.4 mm thick GS formed wire /2.5mm dia GS wire
 - v. Above 55 & upto 70 mm 1.4mm thick GS formed wire / 3.15mm dia GS wire
 - vi. Above 70mm 1.4 mm thick GS formed wire / 4.0 mm dia GS wire
7. The aluminium used for armouring shall be of H4 grade as per IS:8130 with maximum resistivity of 0.028264 ohm mm² per meter at 20 deg C. Aluminium armouring shall be same as indicated above for galvanized steel.
8. The gap between armour wires / formed wires shall not exceed one armour wire / formed wire space and there shall be no cross over / over-riding of armour wire / formed wire. The minimum area of coverage of armouring shall be 90%. The breaking load of armour joint shall not be less than 95% of that of armour wire / formed wire. Zinc rich paint shall be applied on armour joint surface of G.S.wire/ formed wire.
9. Cable Identification
1. Outer sheath shall be of PVC (of suitable grade) & black in colour. In addition to meeting all the requirements of Indian standards referred to, outer sheath of all the cables shall have the following FRLS properties.
- a. Oxygen index of min. 21 (As per NES-715-1).
 - b. Acid gas emission of max. 20% (As per IEC-60754-I).
 - c. Smoke density rating shall not be more than 60% during Smoke Density Test as per ASTM D-2843.



EPC TENDER SPECIFICATION FOR BTG PACKAGE

2. Cores of the cables shall be identified by colouring of insulation. Following colour scheme shall be adopted:

- a. 1 core - Red, Black, Yellow or Blue
- b. 2 core - Red & Black
- c. 3 core - Red, Yellow & Blue
- d. 4 core - Red, Yellow, Blue and Black

3. For reduced neutral conductors the core shall be black.

4. In addition to manufacturer's identification on cables as per IS, following marking shall also be provided over outer sheath.

- a. Cable size and voltage grade - To be embossed.
- b. Word 'FRLS' at every 5 metre - To be embossed.
- c. Sequential marking of length of the cable in metres at every one metre-To be embossed / printed.

The embossing shall be progressive, automatic, in line and marking shall be legible and indelible.

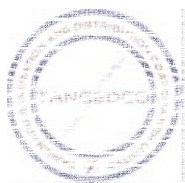
5. Cores of the cables of upto 5 cores shall be identified by colouring of insulation. Following colour scheme shall be adopted.

- a. 1core - Red, Black, Yellow, Blue
- b. 2 core - Red & Black
- c. 3 core - Red, Yellow & Blue

10. All cables shall meet the fire resistance requirement of IEEE - 383 with cable installations made in accordance with clause "Flammability test" and as per Category-B of IEC 60332 Part -3.

11. Allowable tolerances on the overall diameter of the cables shall be ± 2 mm maximum over the declared value in the technical data sheets.

12. In plant repairs to the cables shall not be accepted. Pimples, fish eye, blow holes etc, are not acceptable.



EPC TENDER SPECIFICATION FOR BTG PACKAGE

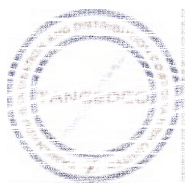
2.2.16.3 Cable selection & sizing

1. Cables shall be sized based on the following considerations:
 - i) Rated current of equipment.
 - ii) Maximum voltage drop limits under steady state and during starting for motor being fed from 415V switchgear restricted to 5% and 10% respectively.
 - iii) Maximum voltage drop limits under steady state for feeder (i.e. Outgoing feeders being fed from 415V switchgear) restricted to 3%.
 - iv) For cables to motors and feeders protected by MCCBs the cross section will be chosen according to the tripping time of MCCBs.

2. Derating Factors

Derating factors for various conditions of installations including the following shall be considered while selecting the cable sizes:

- a. Variation in ambient temperature for cables laid in air.
 - b. Grouping of cables.
 - c. Variation In ground temperature and soil resistivity for buried cables.
3. Cable lengths shall be considered in such ways that straight through cable joints are avoided.
 4. Cables shall be armoured type if laid in switchyard area, coal handling area or directly buried. All LV power cables except trailing cables shall be XLPE insulated FRLS.
 5. All control cables shall be 2.5 Sq mm copper cable.
 6. Multicore control cables will generally have spare conductor (s) in accordance with the following chart and cores of a single cable will not be split for different auxiliary/ equipment:



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

Conductors	Required Cables
1 or 2	: 1-3/C
3 or 4	: 1-5/C
5 or 6	: 1-7/C
7 or 8	: 1-10/C
9 or 10	: 1-12/C
11 or 12	: 1-16/C
13 or 14	: 1-18/C
Above 14 core	: Two or more of above cables

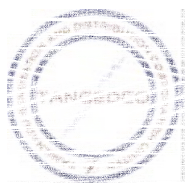
2.2.16.4 Constructional Features

i) 1.1 kV grade Power Cables

1. 1.1 kV grade XLPE power cables shall have compacted aluminium conductor for cables including 10 sq. mm and above and copper conductor for cables below 10 sq.mm, XLPE insulated, PVC inner-sheathed (as applicable), armoured, FRLS PVC outer-sheathed conforming to IS: 7098. (Part-I).
2. 1.1 kV grade Trailing cables shall have tinned copper (class 5) conductor, insulated with heat resistant elastomeric compound based on Ethylene Propylene Rubber (EPR) suitable for withstanding 90°C continuous conductor temperature and 250 deg C during short circuit, inner-sheathed with heat resistant elastomeric compound, nylon cord reinforced, outer-sheathed with heat resistant, oil resistant and flame retardant heavy duty elastomeric compound conforming to IS 9968.

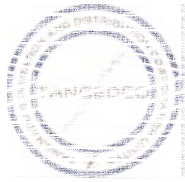
ii) 1.1 kV Grade Copper Conductor Fire Survival Power Cables

1. 1100 volt grade, 90 Deg.C rating, power cables with stranded Copper conductor, heat resistance elastomeric insulation generally conforming to Type IE-2 of IS: 6380-1984, extruded Halogen free or very low Halogen elastomeric inner sheath, generally conforming to Type SE-3 of IS-6380-1984, round wire/strip armour and extruded outer sheath of elastomeric material generally conforming to Type SE-3 of IS: 6380-1984.
2. The cables shall be generally manufactured in conformity to IS-9968 Part-1/1988.
3. The cables shall be rated for 3 hours fire rating.
4. Conductor shall be of stranded construction, consisting of high conductivity annealed plain copper wires conforming to Class-II of IS 8130. A suitable heat barrier tape, preferably glass mica tape shall be provided over the Conductor.



EPC TENDER SPECIFICATION FOR BTG PACKAGE

5. The insulation shall consist of heat resisting elastomeric material EPR (Ethylene Propylene rubber) and shall conform to Type IE-2 of IS:6380/1984 amended up to Date.
6. The suitable fire retardant material fillers shall be used for filling in the interstices. Two layers of plain glass fiber binder tape shall be applied over the laid up cores.
7. Fire Survival Power & Control cables shall be provided for the following services:
 - a. DC emergency lube oil pump.
 - b. Turbine lube oil pump/barring gear.
 - c. Jacking oil pump.
 - d. Scanner air fan.
 - e. Incoming & outgoing cables for DC lighting distribution board.
 - f. Fire /smoke detection system.
 - g. DC seal oil pump.
 - h. DC emergency lighting cables for Main Plant Building.
 - i. Incomer cables for DG board, emergency board, DC lighting board
 - j. Batteries to charger and DC distribution board.
 - k. Emergency turbine trip by push button in control room.
 - l. Boiler turbine: Generator inter-trip which includes the interconnecting cables between
 1. Boiler master fuel trip and turbine trip relays
 2. Generator trip relays and turbine trip relays
 3. Generator trip relays and 765kV kV circuit breaker
 4. Generator trip relays and generator field breaker.
 5. Generator trip relays and UAT breaker.



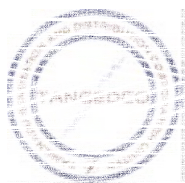
EPC TENDER SPECIFICATION FOR BTG PACKAGE

iii) 1.1 KV Grade Control Cable

1. Control cable shall be multi core, minimum 2.5 sq.mm cross section, stranded copper conductor, PVC insulated, inner PVC sheathed / galvanized steel wire armored and outer sheath made of FRLS PVC compound. In situation where accuracy of measurement or voltage drop in control circuit, warrant, higher cross sections as required shall be used. 4 sq.mm copper conductors shall be used for CT circuits, all other specification remaining same. In 4 sq.mm conductor impose unacceptable high burden on CTs, higher cross section of conductor shall be used.
2. Voltage Transformer leads shall be checked for voltage drop, which shall be limited to within 1 % for all cases other than tariff metering, for which the voltage drop shall be limited to 0.2 %. In case the voltage drop with 4 sq.mm Cu conductors exceeds this value, higher conductor sizes shall be used.

iv) 1.1kV Copper Conductor Fire Survival Control Cables

1. Conductor shall be of stranded construction, consisting of high conductivity annealed tinned copper conductors conforming to IS 8130/1984 amended up to date.
2. A suitable heat barrier tape, preferably glass mica tape shall be provided over the conductor.
3. The conductor insulation shall consist of heat resisting elastomeric material EPR (Ethylene Propylene rubber) and shall conform to Type IE-2 of IS:6380/1984 amended up to date.
4. An inner sheath of extruded special low smoke and very low halogen content (acid gas generation shall be less than 2% by weight) elastomeric (HOFR) compound of black colour or any other natural colour with prior approval from Owner conforming to Type SE-3 of IS-6380/1984, amended up to date, shall be provided over the laid up cores.
5. The armouring over inner sheath shall consist of single layer of wire/round galvanized steel wire as per IS 3975 amended up to date.
6. The outer sheath shall be of special low smoke and very low Halogen content (Acid gas generation shall be less than 2% by weight) elastomeric HOFR compound comprising of synthetic rubber and shall generally conform to the type SE-3 of IS: 6380 latest revision.



EPC TENDER SPECIFICATION FOR BTG PACKAGE

7. The colour of outer sheath shall be black or any other natural colour agreed mutually between Owner and Contractor.
8. The minimum sizes of L.T. cable to be chosen are as below:
 - a. Al – 16 Sq.mm (3 core)
 - b. Cu – 2.5 Sq.mm (3 core)
9. In power cables maximum conductor size to be used will be 300 sq. mm & 630 sq.mm for multi core and single core cables. In case of multi core cables not more than 3 runs to be used or otherwise single core cable to be used.

v) Cable Drums

Cables shall be supplied in non returnable wooden or steel drums of heavy construction. The surface of the drum and the outer most cable layer shall be covered with water proof cover. Both the ends of the cables shall be properly sealed with heat shrinkable PVC/ rubber caps secured by 'U' nails so as to eliminate ingress of water during transportation, storage and erection. Wood preservative anti-termite treatment shall be applied to the entire drum. Wooden drums shall comply with IS: 10418.

2.2.16.5 DRAWINGS, DATA AND MANUALS TO BE FURNISHED FOR APPROVAL

- i) Cable datasheets
- ii) Cable sizing
- iii) QAPs & Test Reports.
- iv) Relevant catalogues

2.2.16.6 Tests

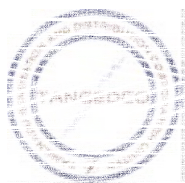
i) Type Tests

a. For Conductor

- i. Annealing test - For copper conductor only.
- ii. Tensile test - For aluminium conductor only.
- iii. Wrapping test - For aluminium conductor only.
- iv. Resistance test.

b. For Armour Wires/ Formed Wires

- i. Measurement of Dimensions.



EPC TENDER SPECIFICATION FOR BTG PACKAGE

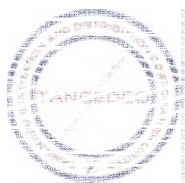
- ii. Tensile Test - For aluminium wires only
- iii. Elongation test - For aluminium wires only
- iv. Torsion test - For round wires only.
- v. Winding test - For Formed wires only.
- vi. Resistance test.
- vii. Zinc Coating test - For G.S. Formed wires /wires only.
- viii. Wrapping test - For Al. Formed wires /wires

c. For XLPE insulation & PVC Sheath

- i. Test for thickness.
- ii. Tensile strength & elongation tests before ageing and after ageing.
- iii. Ageing in air oven.
- iv. Loss of mass test - For PVC sheath only.
- v. Hot deformation test - For PVC sheath only.
- vi. Heat shock test - For PVC sheath only.
- vii. Shrinkage test .
- viii. Thermal stability test - For PVC sheath only.
- ix. Hot set test - For XLPE insulation only.
- x. Water absorption test - For XLPE insulation only.
- xi. Oxygen index test – For outer sheath only.
- xii. Smoke density test - For outer sheath only.
- xiii. Acid gas generation test - For outer sheath only.

d. For completed cables

- i. Insulation resistance test (Volume resistivity method)



EPC TENDER SPECIFICATION FOR BTG PACKAGE

- ii. High voltage test
- iii. Flammability test as per clause "Flammability test" of IEEE - 383 .
- iv. Flammability test as per IEC - 332 Part-3 (Category -B).
- v. Test for rodent & termite repulsion property.

ii) Flammaability Test

1. This test shall generally be carried out as per IEEE 383. The cable installation to be tested shall consist of as many cables as are necessary to give atleast 10 kg of organic material per metre run.
2. The following cable installation shall be tested :
Installation with single / multi core cables in touching formation.
3. Size of cables, number of cables, number of layers and laying arrangements for each installation shall be subject to Owner's approval.
4. The size of the cables selected (measured by total cross sectional area of the conductor) shall have maximum organic material per sq. mm of total cross sectional area of all the conductors.

iii) Acceptance Tests

Acceptance tests shall be carried out on each type and size of the cables on the cable drums selected at random as per following sampling plan:

Sl.no	No. of drums in the lot	No. of drums to be taken as sample
	Upto 100	10% (Subject to minimum of 1 drum)
	101 to 300	13
	301 to 500	20
	Above 500	32

The following shall constitute acceptance tests:

1. Item No. 1 to 14, 16, 19, 20, 22, 23, 24, 25 of list of type tests specified in cluase 2.2.15.5.1.



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



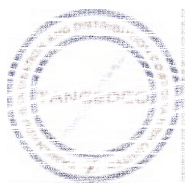
EPC TENDER SPECIFICATION FOR BTG PACKAGE

2. Fire resistance test as per SS 4241475 (F3 category).
3. One length per size / lot for surface finish and length measurement.
4. Lay length / sequence of cores, armour coverage, Gap between two consecutive armour wires / formed wires, Band marking.

iv) Routine Tests

Routine tests shall be carried out as per relevant standard for each drum of cables of all types and sizes.

Cabling System



EPC TENDER SPECIFICATION FOR BTG PACKAGE

2.2.17 CABLING SYSTEM

2.2.17.1 SCOPE OF WORK

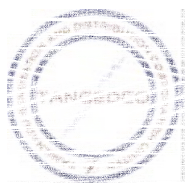
The scope of work covers supply, erection, testing and commissioning of complete electrical system including cabling, fire stop mortar seal, fire retardant cable coating system etc. the scope shall broadly cover, but not be limited to:

- i) TG Building & Transformer Yard
- ii) Boiler Area, ESP
- iii) All auxiliary buildings (including electrical rooms of respective buildings) and structures as per details in the general electrical specification/ plot plan & related drawings.
- iv) Service Building
- v) CPU Regeneration
- vi) DG House
- vii) Pipe cum cable rack (within the battery limits).
- viii) Air Washer Units
- ix) All electrical equipment as described in different sections.
- x) As built drawing for all above systems on completion of project.

The scope of work shall also include all civil and structural works necessary for successful installation, commissioning & commercial operation of all electrical equipment to be erected under this specification.

2.2.17.2 SCOPE OF SUPPLY

- 1 The scope of work shall include complete supply, installation, testing, commissioning and putting into successful commercial operation of the cabling system for the entire plant covering all indoor & outdoor areas of BTG area.
- 2 The equipments and materials within the scope of supply shall include but not limited to
 - i. Power & control cabling works (including that of special cables):
Supply and installation of cable and cable trays/raceways, supports, conduits, duce bank, cable accessories such as jointing/termination kits, cable glands, lugs, ferrules, etc. as required for all the systems & equipments.
 - ii. Supply and installation (including laying & termination) of control cables, special cables, instrumentation cables for all equipments and systems.



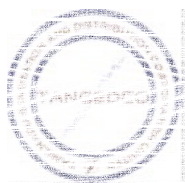
EPC TENDER SPECIFICATION FOR BTG PACKAGE

- iii. Supply and installation (including laying & termination) of all power cables (HV and LV) of all power cables (HV and LV) for all equipments and systems.
- iv. Cable routing has to be planned such that it shall not cross the steam lines, oil lines.
- v. Fire Sealing Arrangement: All cable entries into the panel (HV & MV & LV SWGR panels) should be provided with fire sealing arrangements.
- vi. Cable/cable tray openings in walls and floors or through pipe sleeves from one area to another or from one elevation to another within the unit shall be seated by a fire proof sealing system (FPSS). The FPSS shall effectively prevent the spread of fire from the flaming to non-flaming side of a fire
- vii. Galvanized steel rigid/ flexible conduits and accessories, ferrules, lugs, glands, terminal blocks, galvanized sheet steel junction boxes, cable fixing clamps, nuts & bolts etc as required.
- viii. All necessary erection materials, consumables and sundry items including arc welding rods to complete the installation for satisfactory and trouble free operation.
- ix. Any item of works or erection materials which have not been specifically mentioned but are necessary to complete the work involved shall be deemed to be included in the scope of this specification and shall be furnished by the Bidder without any extra charge to the purchaser.

2.2.17.3 CODES AND STANDARDS

All standards, specifications and codes of practice referred to herein shall be the latest editions including all applicable official amendments and revisions as on date of opening of bid. In case of conflict between this specification and those (IS codes, standards, etc.) referred to herein, the former shall prevail. All work shall be carried out as per the following standards/ codes as applicable.

IS:513	Cold rolled low carbon steel sheets and strips.
--------	---



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



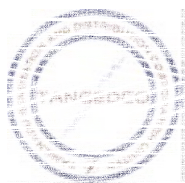
EPC TENDER SPECIFICATION FOR BTG PACKAGE

IS:1079	Hot Rolled carbon steel sheet & strips
IS:1239	Mild steel tubes, tubular and other wrought steel fittings
IS:1255	Code of practice for installation and maintenance of power cables upto and including 33 KV rating
IS:1367 Part-13	Technical supply conditions for threaded Steel fasteners. (Hot dip galvanized coatings on threaded fasteners).
IS:2147	Degree of protection provided by enclosures for low voltage switchgear and control gear
IS:9537	Conduits for electrical installation.
IS:9595	Metal – arc welding of carbon and carbon manganese steels - recommendations.
IS:13573	Joints and terminations for polymeric cables for working voltages from 3.3kv up to and including 33kv performance requirements and type tests.
BS:476	Fire tests on building materials and structures
DIN 46267 (Part-II)	Non tension proof compression joints for Aluminium conductors.
DIN 46329	Cable lugs for compression connections, ring type ,for Aluminium conductors
VDE 0278	Tests on cable terminations and straight through joints
BS:6121	Specification for mechanical Cable glands for elastomers and plastic insulated cables.
	Indian Electricity Act.
	Indian Electricity Rules.

Equipment complying with other internationally accepted standards such as IEC, BS, DIN, USA, VDE etc. will also be considered if they ensure performance and constructional features equivalent or superior to standards listed above. In such a case, the Contractor shall clearly indicate the standard(s) adopted, furnish a copy in English of the latest revision of the standards along with copies of all official amendments and revisions in force as on date of opening of bid and shall clearly bring out the salient features for comparison.

2.2.17.4 DESIGN AND CONSTRUCTIONAL FEATURES

1 Inter Plant Cabling



EPC TENDER SPECIFICATION FOR BTG PACKAGE

Interplant cabling for main routes shall be laid along overhead trestles/duct banks. However, from tap-offs, same can be through shallow trenches with sand filling. All the switchgear room shall be provided with cable spreader room at ground floor. The cable trenches are allowed between switchyard control room and transformer yard only. In case of Duct banks, pull-pits shall be filled with sand and provided with a PCC covering.

2 Transformer yard

In transformer yard cables shall be laid in RCC concrete trenches with RCC covers. The main cable routes coming out from Main plant building and crossing the Transformer yard shall be laid in overhead trestles/duct banks. Minimum clear height of trestle shall be 3 m and for Rail/road crossing, it shall be as per rail/road crossing norms. False floors are not to be provided for cabling purpose.

3 Cable entry

Cable entry from outdoor underground/cable routes to the buildings, if any, shall be above the finished floor level of the building.

All Buildings shall have suitable cable spreader rooms /cable vaults.

4 Trenches

PCC flooring of built up trenches shall be sloped for effective drainage with sump pits and sump pumps.

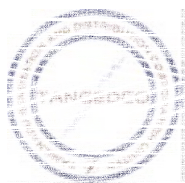
No sub-zero level cable vault/trenches shall be provided below control building/switchgear rooms in main plant areas.

All field switches for equipments corresponding to a stream located within a radius of 4-5 m shall be wired out to a field junction box and from field junction box to control panel/Input – Output cabinet by screened instrumentation cables.

Cable trenches shall be provided in Transformer Yard and Switchgear/MCC rooms. In other areas local cable trenches with length not exceeding 5 metres are allowed just near the equipment.

Cables for one set of auxiliaries such as ID,FD & PA fans & half of the coal mills shall be routed in one route & for through other set of auxiliaries through other route.

Bidder shall provide two independent routes for cables between Switchyard Control Room & Main Plant Control Room. Bidder shall provide the cable trays along with its supporting structure arrangement on the trestle.



EPC TENDER SPECIFICATION FOR BTG PACKAGE

5 Cable Vault:

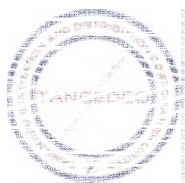
- i) Cable vault of not less than 3.5 metres clear height shall be provided.
- ii) Clear access passage of at least 750 mm wide & 2.0 Mts clear height shall be provided at entrances & along cable ways. Wherever the passage is through cable routes clear height shall not be less than 1.5 Mts.
- iii) Cable vaults shall be provided with adequate drainage facility for drainage of fire water.
- iv) Each cable vault should have two fire proof doors.
- v) Exit signs shall be provided near doors for personnel escape in case of emergency.

- 6 Major routes in Turbine area (STG Package area) shall be on overhead cable trays either supported from available structures, building structure. Only in specific areas as shall be approved by purchaser/consultant where number of cables are too small compared to the route length and in transformer yard, cable shall be routed in cable trenches.

2.2.17.5 EQUIPMENT DESCRIPTION

Cable trays, Fittings & Accessories

- 1 Cable trays shall be ladder type as specified complete with matching fittings (like brackets, elbows, bends, reducers, tees, crosses, etc.), accessories (like side coupler plates, etc.) and hardware (like bolts, nuts, washers, G.I. strap, hook etc.) as required. Cable tray shall be ladder type for power & control cables and perforated for instrumentation cables.
- 2 These shall be either prefabricated hot dip galvanized sheet steel trays or site fabricated angle iron trays free from flaws such as laminations, rolling marks, pitting etc. These (including hardware) shall be hot dip galvanized as per relevant IS.
- 3 Cable trays shall have standard width of 150 mm, 300 mm & 600 mm and standard lengths of 2.5 metre. Minimum thickness of mild steel sheets used for fabrication of cable trays and fittings shall be 2 mm. The thickness of side coupler plates shall be minimum 3 mm.
- 4 Cable troughs shall be required for branching out few cables from main cable route. These shall be U-shaped, fabricated of mild steel sheets of minimum thickness 2 mm and shall be hot dip galvanized as per relevant IS. Troughs shall be standard width of 50 mm & 75 mm with depth of 25 mm.
- 5 Prefabricated hot dip galvanized sheet steel cable trays shall be used for maximum support span of 2000 mm unless design is approved for larger span. Cable trays shall be suitable for a cable weight of 100 kg/meter running length of tray. Minimum thickness of sheet steel/galvanizing shall be 2mm/86 microns respectively. The



EPC TENDER SPECIFICATION FOR BTG PACKAGE

amount of zinc deposit shall not be less than 610 gm per square meter.

- 6 Cable trays fabricated from standard rolled sections shall be 50x50x6/75x75x6 sections for runners for supporting spans limited to 2000 mm/more than 2000 mm respectively. Cross support shall be 32x6 mm / 50x6 flat for widths up to 500mm/more than 500mm respectively.
- 7 Separate coloured paint strips 2 inch width each numbers equally spaced at 5 metres interval shall be applied for identification of different type of trays depending upon types of usage/applications/area as below:

High/ medium voltage cables:

11kV/6.6kV : red strips

1.1kv power cables : yellow strips

1.1kv control cables : blue strips

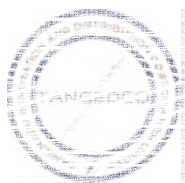
Instrumentation cables : green strips

8 Support System for Cable Trays

Cable tray support system shall be pre-fabricated similar or equivalent to "Unistrut make".

Support system for cable trays shall essentially comprise of the two components i.e. main support channel and cantilever arms. The main support channel shall be of two types:

- (i) C1:- having provision of supporting cable trays on one side and
- (ii) C2:- having provision of supporting cable trays on both sides. The support system shall be the type described hereunder
 - a. Cable supporting steel work for cable racks/cables shall comprise of various channel sections, cantilever arms, various brackets, clamps, floor plates, all hardware such as lock washers, hexagon nuts, hexagon head bolt, support hooks, stud nuts, hexagon head screw, channel nut, channel nut with springs, fixing studs, etc.
 - b. The system shall be designed such that it allows easy assembly at site by using bolting. All cable supporting steel work, hardware's fittings and accessories shall be prefabricated factory galvanised.
 - c. The main support and cantilever arms shall be fixed at site using necessary brackets, clamps, fittings, bolts, nuts and other hardware etc. to form various arrangements required to support the cable trays. Welding of



EPC TENDER SPECIFICATION FOR BTG PACKAGE

- the components shall not be allowed. However, welding of the bracket (to which the main support channel is bolted) to the overhead beams, structural steel, insert plates or reinforcement bars will be permitted. Any cutting or welding of the galvanized surface shall be brushed and red lead primer, oil primer & aluminium paint shall be applied.
- d. All steel components, accessories, fittings and hardware shall be hot dip galvanized after completing welding, cutting, drilling and other machining operation.
 - e. The main support channel and cantilever arms shall be fabricated out of minimum 2.5 thick rolled steel sheets conforming to IS.
 - f. Cantilever arms of 300 mm, 600 mm and 750 mm in length are required. The arm portion shall be suitable for assembling the complete arm assembly on to component constructed of standard channel section. The back plate shall allow sufficient clearance for fixing bolt to be tightened with tray in position.
 - g. Cable trays in areas subjected to excessive coal dust or mechanical damage shall have hot dip galvanized sheet steel metal trays cover installed on front tray in vertical run and inverted 'V' type on upper tray in horizontal run with consideration for ventilation.

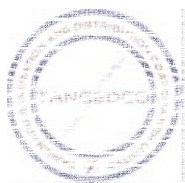
The size of structural steel members or thickness of sheet steel of main support channel and cantilever arms and other accessories as indicated above are indicative only. Nevertheless, the support system shall be designed by the contractor to fully meet the requirements of type tests as specified. In case the system fails in the tests, the components design modification shall be done by the Contractor without any additional cost. The contractor shall submit the detailed drawings of the system offered by him along with the bid.

9 FRP CABLE TRAYS

FRP Cable trays shall be used for areas like intake raw water pump house, Desalination plant, CHP, Battery room, NDCT and chemical house.

Cable trays shall be of ladder / perforated type complete with all necessary coupler plates, elbows, tees, bends, reducers, stiffeners and other accessories. Cable trays of ladder and perforated types and the associated accessories such as coupler plates, tees, elbows, etc. shall be of FRP.

The FRP cable tray shall be ultra violet resistant. FRP cable trays shall be manufactured in accordance with NEMA FG-1-1984-1993 and Standards IS-6746 and ASTM E 84. Manufacturing process shall be pultrusion using automated pultrusion machines. Resin to be used shall be ultraviolet resistant polyester resin.



EPC TENDER SPECIFICATION FOR BTG PACKAGE

All cable trays and accessories shall be corrosion / chemical resistant, weather resistant, easy to drill and cut. Lightweight, high strength and flame retardant in accordance with ASTM E-84-Class 1 Rating and as per IS-6746-Very Low Flammability. An additive material shall be mixed with the FRP to make them resistant to ultraviolet light. The oxygen index shall be minimum 30 as per ASTM-D-2863.

The minimum glass content in the FR material shall be 55%.

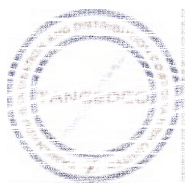
The Ladder type trays shall have side rails and horizontal rungs. Both of these shall be of same material i.e. the FRP with additive material. The rungs shall be placed 300 mm apart from each other. The side runner of the Ladder type FRP cable trays shall be pultruded FRP channel of 100 x 35 mm height. The minimum thickness of the tray will remain 4mm. The rungs to side member are connected to the Larger portion of the side rail by using pin made of fiberglass reinforced thermoplastic, and should have both mechanical and adhesive lock.

Minimum thickness of perforated type FRP cable tray shall be 4mm. Minimum thickness of coupler plates shall be 4mm.

HV, MV and LV power single core cable shall be laid in trefoil formation with 2D gap where 'D' is the diameter of cable.

HV & MV cables and LV power cables (95 sq. mm & above) multicore cables shall be laid in touching formation in single layer. 1100V multicore cables below 95 sq. mm shall be laid in two layers. Control and instrumentation cables shall be laid in 3 layers.

- i) Individual tray systems shall be established for the following services: -
 - a) 6.6 kV and higher voltage power cables.
 - b) 415 Volt power cables.
 - c) Special noise-sensitive circuits or instrumentation cables.
 - d) Control cables. (Control cables shall be laid along with LV power cables and instrumentation cables if required for short length near the equipment with GI separators).
 - e) Further subdivision of tray systems shall be provided if required to meet special segregation/separation requirements.
- ii) In areas having coal dust, cable trays shall be run in vertical formation while horizontal trays shall be provided in other areas. Cable depth not to exceed two cables for vertical trays.
- iii) The minimum design vertical spacing for trays shall be 300 mm measured from the bottom of the upper tray to the top of the lower tray. At least a 250 mm clearance shall be maintained between the top of a tray and beams, piping, or



EPC TENDER SPECIFICATION FOR BTG PACKAGE

other obstacles to facilitate installation of cables in the tray. A working space of not less than 600 mm shall be maintained on at least one side of each tray. Tray covers shall be provided on the top most tray of each tier of cable trays.

10 Pipes, Fittings & Accessories

Pipes offered shall be complete with fittings and accessories (like tees, elbows, bends, check nuts, bushings, reducers, enlargers, coupling caps, nipples etc.) The size of the pipe shall be selected on the basis of maximum 40% fill criteria

GI Pipes shall be of medium duty as per IS: 1239

Duct banks shall be High Density PE pipes encased in PCC (10% spare of each size, subject to minimum one) with suitable water-proof manholes.

11 Junction Boxes

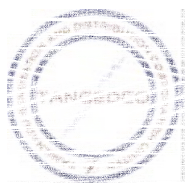
Junction Boxes shall comprise of a case with hinged door constructed from cold rolled sheet steel of minimum thickness 2mm. Top of the boxes shall be arranged to slope towards rear of the box. Gland plate shall be 3 mm thick sheet steel with neoprene/synthetic rubber gaskets. All junction boxes shall be of adequate strength and rigidity, hot dip galvanised as per relevant IS, and suitable for mounting on wall, columns, structures etc. The boxes shall include brackets, bolts, nuts, screws M8 earthing stud etc. required for installation.

Glass Fibre Reinforced Junction Boxes No. of Ways: 12/24/36/48 with 20% spares terminals.

Junction boxes shall be Glass Fibre Reinforced with saturated polyester conforming to standards like DIN 16911 type 803/16913 type 834, 5 self extinguishing in accordance with ASTM D635/UL 94 VO. Junction boxes for use in outdoor or damp locations shall be sturdy construction. Temperature resistance shall be between – 10 to 100°C. Impact resistance shall be greater than 7 Nm, (EN 50014). Protective insulation shall be in line with VDE 0100, dielectric strength shall be greater than 10 KV/mm, halogen free toxicity, the enclosure and door cover shall be painted and electro statically power coated (preferably in RAL7032). Earth connection (studs size shall be M 6) shall be provided on the cover as well as door.

Protection Class

Protection Category shall be IP 66 to EN 60529. There shall be guaranteed perfect seal to meet Protection class IP 66 providing arrangement like highly elastic foamed in special type seal like polyurethane/chloroprene. The sealing rubber shall not have aging effect and shall retain its sealing characteristics for more than 20 years. Contractor shall indicate this in data sheet. The rubber seal should be pasted at its



EPC TENDER SPECIFICATION FOR BTG PACKAGE

place with pasting technology for like more than 20 years (double sealing arrangement is preferred).

Mounting clamps and accessories

Junction boxes shall be suitable for mounting on walls, columns and structure. Brackets, bolts, nuts, screws, glands and lugs required for erection shall be of brass. The accessories like mounting plates etc. of steel shall be powder coated. The support rails for terminal box shall be zinc coated.

General

1. JBs shall have small canopy at the top.
2. There shall be rainwater collection arrangement from top and side of the outer ages to ensure that any leakage into the junction box shall be avoided and it shall fall outside.
3. Cable entry shall be from bottom side only.
4. Ensure gland plate sealing perfect. It shall be of the same quality and arrangement as that of door to cover arrangement.

Steel Junction Boxes

No. of Ways 12/24/36/48 with 20% spares terminals.

Junction boxes shall be designed in accordance with NEC, article 370, paragraph 18, 19 & 20 or equivalent standards.

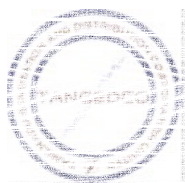
Enclosure

Junction boxes for use in outdoor or damp locations shall be sturdy steel construction. The enclosure and door cover shall be surface finished clean, degreased, phosphated, deep coated primed (preferably in RAL 7044) and electrostatically powder coated (preferably in RAL 7032). Earth connection (studs size shall be M6) shall be provided on the cover as well as door. The sheath steel thickness shall be more than 2 mm.

Doors

The doors shall be hinged and lockable. The doors shall have industrial heavy duty hinges. The doors shall be easily but firmly lockable with quick release fastener and with integrated viewing window of 3mm resistant plexi glass or equivalent. The doors shall be industrial heavy duty hinges. The doors shall be easily but firmly lockable with quick release fastener.

Junction boxes shall be provided with two nos. earthing terminals (externally available) suitable for connection of 8 SWG G.I. wire. Knockouts shall be provided at bottom and both sides. These shall be provided by fixing plates in order to make



EPC TENDER SPECIFICATION FOR BTG PACKAGE

them detachable type with suitable neoprene gaskets. Bottom and side plates for cable/conduit connection shall be provided. All unused holes shall be sealed with suitable grommets.

Junction boxes shall be provided with external designation label. The label inscriptions shall be informed to the Contractor by the Owner. Junction boxes shall be provided with danger sign in case of 415V circuit.

Junction boxes shall be of two types, viz. One suitable for control cabling and the other suitable for power cabling.

Junction boxes for control cabling shall have 24 way/ 48 way terminal blocks suitable for up to 2.5 sq.mm. Cu. Cable. However, for instrumentation junction boxes there shall be 24/48 ways suitable for terminating cable of 0.5 sq.mm. Cu. Cable.

Junction boxes for power circuit cabling shall be suitable for 1 no. 3 core 16 sq.mm.AL. Incoming cable and 1 no. 3 core 2.5 sq.mm Cu. Outgoing cable.

12 Terminal blocks

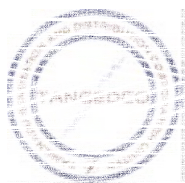
Terminal blocks shall be 650 volts grade, rated for 10 Amps and in one piece, rigid, Bakelite moulded, with disconnecting /shorting link. It shall be complete with insulating barriers, Klip-on-type terminals and identification strips, terminal studs, washers, nuts, lock nuts, marking strips etc.

Marking on terminal strip shall correspond to the terminal numbering on wiring diagrams. It shall be Elmex type CSLT-1 with insulating material of Melamine conforming to ESI Standard 12.1 or equivalent. Cage clamp type terminal block suitable for terminating 2 wires of 2.5 sq mm. on both sides arranged to facilitate easy termination shall be provided. 20% spare terminals shall be provided

13 Terminations & Straight through Joints

Termination and jointing kits for 11/6.6 kV grade XLPE insulated cables shall be of proven design and make which have already been extensively used and type tested. Termination kits and jointing kits shall be pre-moulded type, taped type or heat shrinkable type. 11/6.6 kV grade joints and terminations shall be type tested as per IS: 13573. Critical components used in cable accessories shall be of tested and proven quality as per relevant product specification/ESI specification. Kit contents shall be supplied from the same source as were used for type testing. The kit shall be complete with the aluminium solder less crimping type cable lugs & ferrule as per DIN standard.

Straight through joint and termination shall be capable of withstanding the fault level for 33kV, 11 kV and 6.6 kV systems.



EPC TENDER SPECIFICATION FOR BTG PACKAGE

1.1 KV grade straight through joints shall be of proven design.

14 Cable glands

Cable glands shall conform to BS: 6121 and be of robust construction capable of clamping cable and cable armour (for armoured cables) firmly without injury to insulation. Cable glands shall be made of heavy duty brass machine finished and nickel chrome plated. Thickness of plating shall not be less than 10 micron. All washers and hardware shall also be made of brass with nickel chrome plating. Rubber components shall be of neoprene and of tested quality. Necessary cable dimensions shall be furnished to the successful contractor.

Cable glands shall be single compression for indoor use, double compression type for outdoor use. Glands for classified hazardous areas shall be double compression type flameproof and weather proof duly certified by CMRS and approved by CCE.

15 Cable lugs/ferrules

The cables lugs shall be conforming to IS: 8309.

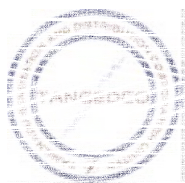
Machine ferruling shall be adopted.

Cable lugs for power cables shall be Aluminium solder less crimping type suitable for aluminium compacted conductor cables.

The cable lugs for control/instrumentation/ telephone cables shall be provided with insulating sleeve and shall suit the type of terminals provided on the equipments.

Cable lugs shall be suitable for termination of different cross-sections of control/instrumentation/telephone cables and shall be of following types.

- i) Copper tubular terminal end for solder less crimping to copper conductors.
- ii) Cable lugs for control cable termination shall be insulated type. These lugs shall be flat type/ring type/U type to suit the terminals provided in the pan
- iii) Pin type lugs shall not used.
- iv) Aluminium tubular terminal ends for solder less crimping of to Aluminium conductor. Solder less crimping of terminals shall be done by using corrosion inhibiting compound. The cable lugs shall suit the type of terminals provided on the equipment. Lugs for control/instrumentation cables shall be PVC insulated/sleeved type.



EPC TENDER SPECIFICATION FOR BTG PACKAGE

16 Cable Clamps & Straps

The cable clamps required to clamp multicore cables on vertical runs shall be made up of Aluminium strip of 25x3 mm size. For clamping the multicore cables on horizontal trays, self-locking, de-interlocking type nylon clamps/straps shall be used. The clamps/straps shall have sufficient strength and shall not get affected by direct exposure to sun rays and outdoor environment.

Trefoil clamps for single core cables shall be pressure die cast aluminum or fibre glass or nylon and shall include necessary fixing accessories like G.I. nuts, bolts, washers, etc. Trefoil clamps shall have adequate mechanical strength to withstand the forces generated by the system short circuit current of 105 KA peak.

17 Galvanizing

Galvanizing of steel components and accessories shall conform to IS: 2629 & IS: 2633. Additionally galvanizing shall be uniform, clean smooth, continuous and free from acid spots

The amount of zinc deposit over threaded portion of bolts, nuts, screws and washers shall be as per IS: 1367. The removal of extra zinc on threaded portion of components shall be carefully done to ensure that the threads shall have the required zinc coating on them as specified.

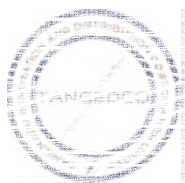
18 Welding

The welding shall be carried out in accordance with IS: 9595. All welding procedures and welders qualification shall also be followed strictly in line with IS: 9595

2.2.17.6 INSTALLATION

1 Cable tray and Support System Installation

Cables shall run in cable trays mounted horizontally or vertically on cable tray support system which in turn shall be supported from floor, ceiling, overhead structures, trestles, pipe racks, trenches or other building structures. All cable trays shall be in vertical configuration in boiler, CHP & ESP areas. Horizontally running cable trays shall be clamped by bolting to cantilever arms and vertically running cable trays shall be bolted to main support channel by suitable bracket/clamps on both top and bottom side rails at an interval of 1500 mm. For vertical cable risers/shafts cable trays shall be supported at an interval of 1000mm. Fixing of cable trays to cantilever arms or main support channel by welding shall not be accepted. Cable tray installation shall generally be carried out as per relevant Standard. The cantilever arms shall be positioned on the main support channel with a minimum vertical spacing of 300 mm unless otherwise indicated in the relevant



EPC TENDER SPECIFICATION FOR BTG PACKAGE

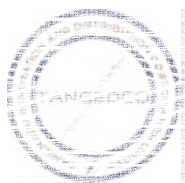
approved tray layout drawings.

All cable way sections shall have identification, designations as per approved cable way layout as and painted/stenciled at each end of cable way and where there is a branch connection to another cable way. Minimum height of letter shall be not less than 75 mm. For long lengths of trays, the identification shall be painted at every 10 meter. Risers shall additionally be painted/ stenciled with identification numbers at every floor.

In certain cases it may be necessary to site fabricate portions of trays, supports and other non standard bends where the normal prefabricated trays, supports and accessories may not be suitable. In such cases the Contractor shall fabricate at site suitable sections of trays, supports and accessories to make the installation complete for the specific purpose after obtaining owner's prior approval, which shall be neat in appearance and shall match with the prefabricated sections in the dimensions. They shall be applied with one coat of red lead primer, one coat of oil primer followed by two finishing coats of aluminium paint.

2 Conduits/Pipes/Ducts Installation

- (a) The Contractor shall be fully responsible for properly embedding conduit pipe sleeves wherever necessary for cabling work. All openings in the floor/roof/wall / cable tunnel/cable trenches made for conduit installation shall be sealed and made water proof by the Contractor.
- (b) GI pull wire of adequate size shall be laid in all conduits before installation. Metallic conduit runs at termination shall have two lock nuts wherever required for junction boxes etc.
- (c) Conduit runs/sleeves shall be provided with PVC bushings having round edge at each end. All conduits/pipes shall have their ends closed by caps until cables are pulled. After cables are pulled, the ends of conduits/pipes shall be sealed with Glass wool/Cement Mortar/Putty to prevent entrance of moisture and foreign material.
- (d) Cable routing between lined cable trench and equipment/motors shall be taken through GI pipe sleeves of adequate size. Pipe sleeves shall be laid at an angle of maximum 150 to the trench wall. In case of larger dia cables i.e. 50mm and above, adequately sized pipe with larger bend radius shall be provided for ease of drawing of cable or for replacement. In places where it is not possible, a smaller trench may be provided if approved by Site Engineer.
- (e) Exposed conduit/pipe shall be adequately supported by racks, clamps, straps or by other approved means. Conduits /pipe support shall be installed square and true to line and grade with an average spacing between the supports as given below, unless specified otherwise



EPC TENDER SPECIFICATION FOR BTG PACKAGE

Conduit /pipe size (dia).	Spacing
Up to 40 mm	1 M
50 mm	2.0 M
65-85 mm	2.5 M
100 mm	3.0 M

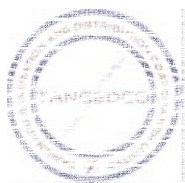
- (f) In areas like WTP, chemical handling, battery room etc. exterior surface of the conduits shall be further coated with chromate or polymer for better resistance to corrosion.
- (g) All G.I. pipes shall be laid as per approved layout drawings and site requirements.
- 1 Before fabrication of various profiles of pipe by hydraulically operated bending machine (which is to be arranged by the contractor), all the burrs from the pipes shall be removed. The bends formed shall be smooth. GI Pipes with bends shall be buried
 - 2 in oil/concrete in such way that that the bends shall be totally concealed. For GI pipes shall be undertaken well before paving is completed and necessary co- ordination with paving agency shall be the responsibility of Electrical Contractor. The open ends of pipes shall be suitably plugged with G.I. plugs after they are laid in final position. G.I. plugs shall be supplied by the contractor at no extra cost.

3 Junction Boxes Installation

Junction boxes shall be mounted at a height of 1200mm above floor level or as specified in the approved drawings or as decided by Owner and shall be adequately supported/mounted on masonry wall by means of anchor fasteners/ expandable bolts or shall be mounted on an angle, plate or other structural supports fixed to floor, wall, ceiling or equipment foundations.

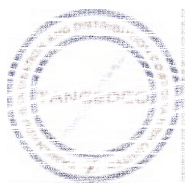
4 Cable Laying and Installation

- 1) Cable network shall include power, control, lighting, communication and fire alarm system cables, which shall be laid in trenches, cables trays/conduits as detailed in the approved drawings and cable schedules. Erection of cable trays and aligning and leveling as required shall be the responsibility of the contractor.
- 2) Cable installation shall be carried out as per IS: 1255 and other applicable standards.



EPC TENDER SPECIFICATION FOR BTG PACKAGE

- 3) Cable drums shall be unloaded, handled and stored in an approved manner on hard and well drained surface so that they may not sink. In no case shall be drum be stored flat i.e. with flange horizontal. Rolling of drums shall be avoided as far as possible. For short distances, the drums may be rolled provided they are rolled slowly and in proper direction as marked on the drum. In absence of any indication, the drums may be rolled in the same direction as it was rolled during taking up the cables. For unreeling the cable, the drum shall be mounted on suitable jacks or on cable wheels and shall be rolled slowly so that cable comes out over the drum and not from below. All possible care shall be taken during unreeling and laying to avoid damage due to twist, kink or sharp bends. Cable ends shall be provided with sealed plastic caps to prevent damage and ingress of moisture.
- 4) Laying of cables directly buried in ground is not acceptable.
- 5) For coal handling plant the cables shall not be routed along conveyor galleries. The cables shall be routed on independent cable trestles. All tray levels shall be checked after erection and marked in as built drawings. Cable routing given on the layout drawings shall be checked in the field to avoid interference with structures, heat sources, drains, piping, air-conditioning duct etc. and minor adjustments shall be done to suit the field conditions wherever deemed necessary. All tray runs shall be installed parallel to the trench/building walls and floors except otherwise noted in the approved drawings. The contractor shall have to secure rack/tray supports by welding to those inserts or other available building steel surfaces. Outdoor trays shall be installed by welding on the steel/concrete structure with inserts by the contractor. As far as practicable, cable trays shall be supported from one side only in order to facilitate installation and maintenance of cables from the other side.
- 6) While laying cable, ground rollers shall be used at every 2 metre interval to avoid cable touching ground. The cables shall be pushed over the rollers by a gang of people positioned in between the rollers. Cables shall not be pulled from the end without having intermediate pushing arrangements. Pulling tension shall not exceed the values recommended by cable manufacturer. Selection of cable drums for each run shall be so planned so as to avoid using straight through joints. Care should be taken while laying the cables so as to avoid damage to cables.
- 7) All temporary ends of cables must be protected against dirt and moisture to prevent damage to the insulation. For this purpose, ends of all cables shall be tapped with an approved PVC or rubber insulating tape. Use of friction type or other fabric type tape is not permitted.



EPC TENDER SPECIFICATION FOR BTG PACKAGE

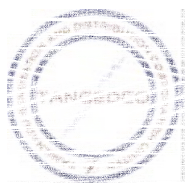
- 8) Cables installed above grade shall be run in trays, exposed on walls, ceilings or structures and shall be run parallel or at right angles to beams, walls columns. Cables shall be so routed that they will not be subjected to heat from adjacent hot piping or vessels.

5 Laying of cables in cable trays

- 1) Cables shall be laid on cable trays strictly in line with cable schedule furnished. Where specific cable layouts are not shown on approved drawings, contractor shall route these as directed by the Owner.
- 2) Power and control cables shall be laid on separate tiers. The laying of different voltage grade cables shall be on different tiers according to the voltage grade of the cables. In horizontal tray stacks, H.V. cables shall be laid on topmost tier and cables of subsequent lower voltage grades on lower tiers of trays. Single core cable in trefoil formation shall be laid with a distance of four times the diameter of cable between trefoil center lines and clamped at every two metre. All multicore cables shall be laid in touching formation. LT power cables above 95 sq.mm size shall be laid in single layer touching formation in trays while cables upto & including 95 sq.mm shall be laid in maximum of 2 layers. Control and Instrumentation cables can be laid upto a maximum of three layers in each tray.
- 3) All communication cables (telephone, P.A. System) RTD Cables shall run on instrument trays/ducts/trenches. Wherever these are not available, cables shall be taken in a separate trench/trays with a minimum clearance of 600mm away from electrical trench/trays as per the direction of Site Engineer and Communication cables shall cross power cables at right angles
- 4) Power and control cables shall be secured fixed to trays/support with self locking type nylon cable straps with de-interlocking facilities. For horizontal trays arrangements, multicore power cables and control cables shall be secured at every five meter interval. For vertical tray arrangement, individual multicore power cables and control cables shall be secured at every one meter by nylon cable strap. After completion of cable laying work in the particular vertical tray, all the control cables shall be binded to trays/supports by aluminium strips at every five meter interval and at every bend.

Bending radii for cables shall be as per manufacturer's recommendations and IS1255.

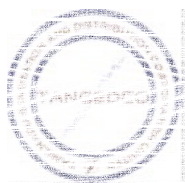
- 5) Individual cables or small groups which run along structures/walls etc will



EPC TENDER SPECIFICATION FOR BTG PACKAGE

be clamped by means of 16 SWG GI saddles on 25x6mm saddle bars. The cost of saddle and saddle bars shall be deemed to have been included in the installation of cables. Alternatively small group of cables can be taken through 100mm slotted channel/ISMC 100. They shall be rightly supported on structural steel and masonry, individual or in groups as required, if drilling of steel must be drilled where the minimum weakening of the structure will result.

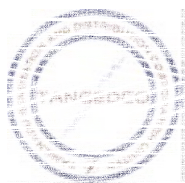
- 6) Cables shall be supported so as to prevent unsightly sagging. In general distance between supports shall be approximately 300mm for cables upto 25mm diameter and maximum 500mm for cables larger than 25mm dia and cables laid in vertical run of cable trays shall be clamped at an interval of 900mm.
- 7) Where cables cross roads/rail tracks, the cables shall be laid in Hume pipe/PVC pipe.
- 8) At road crossing and other places where cables enter pipe sleeves adequate bed of sand shall be given so that the cables do not slack and get damaged by pipe ends.
- 9) Power and Control Cables, as far as possible, shall be laid in complete, uncut lengths from one termination to the other. Straight through joints in power cable shall be allowed only in nearest of rare situation only after approval of owner.
- 10) Joints for less than 250 Meters run of cable shall not be permitted.
- 11) In each cable run some extra length shall be kept at suitable point to enable one LV/two HV straight through joints to be made, should the cable develop fault at a later stage. Control cable termination inside equipment enclosure shall have sufficient lengths so that shifting of termination in terminal blocks can be done without requiring any splicing.
- 12) Wherever few cables are branching out from main trunk route troughs shall be used.
- 13) Cables shall be neatly arranged in the trenches/trays in such a manner so that criss-crossing is avoided and final take off to the motor/switchgear is facilitated. Arrangement of cables within the trenches/trays shall be the responsibility of the contractor.
- 14) The contractor shall ascertain the exact requirement of cable for a particular feeder by measuring at site and avoiding interference with structure, foundation, pipelines or any other works. Before the start of



EPC TENDER SPECIFICATION FOR BTG PACKAGE

cable laying, cable drum schedule shall be prepared by electrical contractor and get that approved by site engineer to minimize/avoid straight through joints. The actual number of straight through joints required shall be worked out by the contractor. During the erection period the contractor shall furnish a monthly report on cable position in an approved proforma so as to keep the owner apprised of the position.

- 15) The installation work shall be carried out in a neat workman like manner & areas of work shall be cleaned of all scraps, water, etc. after the completion of work in each area every day. Contractor shall replace RCC/Steel trench covers after the Installation work in that particular area is completed or when further work is not likely to be taken up for some time.
- 16) Minimum number of spare cores required to be left for interconnection in control cables shall be as cl.3.07.00, chapter 16.
Electrical cable trays exposed to hazardous process fluid shall be covered with detachable G.I. covers. The covers shall be suitable to resist wind forces.
- 17) For cables laid above ground in cable racks, asbestos sheeting of 3mm thickness shall be provided below the bottom cable tray to protect the cables from fire.
- 18) Supporting steel shall be painted before laying of cables. The painting shall be done with one coat of red lead paint and two coats of approved bituminous aluminium paint unless otherwise specified.
 - a) Separation
 - b) Sufficient spacing not less than 300 mm shall be provided between different tiers of trays and the same shall be maintained to permit adequate access for installation and maintenance of cables.
 - c) At least 300mm clearance shall be provided between HV power & LV power cables, LV power & LV control/instrumentation cables,
 - d) Segregation
 - e) Segregation means physical isolation to prevent fire jumping.
 - f) Cables from two different services viz. supply from Station Board and Unit Board shall be segregated.
 - g) Interplant cables of station auxiliaries and unit critical drives shall be



EPC TENDER SPECIFICATION FOR BTG PACKAGE

segregated in such a way that not more than half of the drives are lost in case of single incident of fire. Power and control cables for AC drives and corresponding emergency AC or DC drives shall be laid in segregated routes. Cable routes for one set of auxiliaries of same unit shall be segregated from the other set.

- h) For Coal Handling Plant all the cables of one stream shall be segregated from the cables of the other stream and shall run on either side of the trestle.

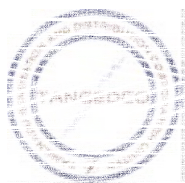
6 Cable fire sealing

- i) Cable/cable tray openings in walls and floors or through pipe sleeves from one area to another or from one elevation to another within the unit shall be sealed by a fire proof sealing system (FPSS). The FPSS shall effectively prevent the spread of fire from the flaming to non-flaming side of a fire.
- ii) Wherever the cables/cable trays pass through walls/floors, fire proof cable penetration seals rated for one hour shall be provided. This shall be by suitable block system using individual blocks with suitable framework or by silicon RTV foaming system. In case foaming system is offered, damming board, if used, shall not be considered for fire rating criteria. Any of the system offered shall be of proven type as per BS: 476 (Part-20) or equivalent standard.
- iii) In order to prevent fire propagation through cable penetrations, after laying, dressing & clamping of cables, all the openings shall be properly sealed by using Fire Stop Mortar Seal and Fire Retardant Cable coating compound. Also the cable runs both before and after the fire scale shall be suitably sprayed with anti-fire propagation liquid.

7 Cable laying in trenches between switchyard and Transformer yard

- 1 RCC cable trenches with removable covers will be provided by the contractor. Cables shall be laid in 3 or 4 tiers in these trenches. Concrete cable trenches shall be filled with sand where specified to avoid accumulation of hazardous gases. RCC covers of trenches in process area shall be effectively sealed to avoid ingress of chemicals etc. Removal of concrete covers for purposes of cable laying and reinstating them in their proper positions after the cables are laid shall be done by the contractor at no extra cost.

For cable trays are laid in trench in more than two tiers a space of minimum 600 mm shall be available for maintenance. In case two or



EPC TENDER SPECIFICATION FOR BTG PACKAGE

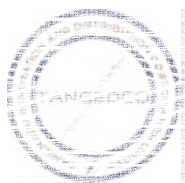
more tiers of cable trays are running parallel along both sides of trench walls there shall be space of minimum 600 mm between them.

Cables shall be handled carefully during installation to prevent mechanical injury to the cables. Ends of cable leaving trenches shall be coiled and provided with a protective pipe or cover till such times the final termination to the equipment is completed.

- 2 Prior to laying of cables inside trenches, the contractor shall properly clean inside of those trenches.
- 3 When cables are laid in multiple tiers, spacing between individual tiers shall be as approved by Site Engineer. Space between individual tiers shall be filled and compacted with soil and sand.
- 4 As each row of cables is laid in place and before covering with sand every cable shall be given on insulation test in the presence of Site Engineer. Any cable, which proves defective, shall be replaced before the next groups of cables are laid.
- 5 All wall openings/pipe sleeves shall be effectively sealed after installation of cables to avoid seepage of water inside building/lined trench.
- 6 Where cables rise from trenches to motor, control station, lighting panels etc., they shall be taken in G.I. Pipes for mechanical protection up to a minimum of 150mm above grade.
- 7 Cable ends shall be carefully pulled through the conduit, to prevent damage to these cables. Where required, approved cable lubricant shall be used for this purpose. Where cable enters conduit the cable should be bent in large radius. Radius shall not be less than the recommended bending radius of the cables specified by the manufacturer.
Following guide of the pipe fill shall be used for sizing the pipe size:

1. 1 Cable in pipe - 53% full
2. 2 cables in pipe - 51% full
3. 3 or more cables - 43% full
4. Multiple cables - 40% full.

After the cables are installed and all testing is complete, conduit ends above grade shall be plugged with a suitable weatherproof plastic compound/'PUTTI' for sealing purpose. Alternatively, G.I. Lids or PVC bushes shall be employed for sealing purposes. The cost for the same shall be deemed to have been included in the installation of G.I. pipe and



EPC TENDER SPECIFICATION FOR BTG PACKAGE

no separate payment shall be allowed.

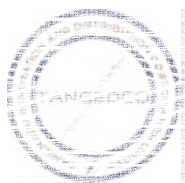
- 8 Where cables pass through foundation walls or other underground structures, the necessary ducts or openings will be provided in advance for the same. However, should it become necessary to cut holes in existing foundations or structures, the electrical contractor shall determine their location and obtain approval of the Site Engineer before cutting is done.

2.2.17.7 CABLE IDENTIFICATION

1. Cable tags shall be provided on all cables at each end (just before entering the equipment enclosure), on both sides of a wall or floor crossing, on each duct/conduit entry & exit, and at every 20 meters in cable tray/trench runs. Cable tags shall also be provided inside the switchgear, motor control centers, control and relay panels etc. where a number of cables enter together through a gland plate. Cable tag shall be of rectangular shape for power cables and control cables. Cable tag shall be of 2 mm thick aluminum with number punched on it and securely attached to the cable by not less than two turns of 20 SWG GI wire conforming to IS:280. Alternatively, the Contractor may also provide cable tags made of nylon, cable marking ties of 'TY-CAB' or equivalent type with cable number heat stamped on the cable tags.
2. If laying of underground cable is specifically agreed by Owner as a special case then the underground cables shall be provided with identity tags of Stain less steel securely fastened every 30 M of its underground length with at least one tag at each end before the cable enters the ground. In unpaved areas cable trenches shall be identified by means of markers. These posts shall be placed at location of changes in the direction of cables and at intervals of not more than 30 M for straight run and at cable joint locations with additional inscription 'Cable Joint'. For buried cables the marker shall project 150mm above ground.
3. Drum number of each cable from which it is taken shall be recorded against the cable number in the cable schedule.

2.2.17.8 CABLE TERMINATIONS & CONNECTIONS

1. The termination and connection of cables shall be done strictly in accordance with cable termination kit manufacturer's instructions, drawings and/or as directed by Site Engineer. Cable jointer shall be qualified to carryout satisfactory cable jointing/termination. Contractor shall furnish for review documentary evidence/experience reports of the jointers to be deployed at site.

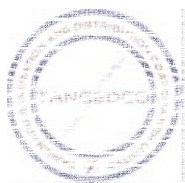


**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

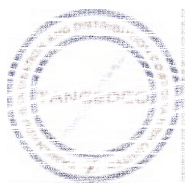
2. Work shall include all clamps, fittings etc. and clamping, fitting, fixing, plumbing, soldering, drilling, cutting, taping, preparation of cable end, crimping of lug, insulated sleeving over control cable lugs, heat shrinking (where applicable), connecting to cable terminal, shorting and grounding as required to complete the job to the satisfaction of the Engineer in charge of TANGEDCO.
3. Responsibility of proper termination shall lie on the contractor. Guarantee for termination shall also have to be given by the contractor.
4. The equipment will be generally provided with undrilled gland plates for cables/conduit entry. The Contractor shall be responsible for punching of gland plates, painting and touching up. Holes shall not be made by gas cutting. The holes shall be true in shape. All cable entry points shall be sealed and made vermin and dust proof. Unused openings shall be effectively sealed by 2mm thick aluminium sheets.
5. Contractor shall drill holes for fixing glands wherever necessary at no extra cost. Gland plate shall be of non-magnetic material/aluminium sheet in case of single core cables. If the cable end box or terminal chamber provided on the equipment is found unsuitable and requires major modifications the same shall be carried out by the contractor at the discretion of the Engineer- in-Charge.
6. Control cable cores entering control panel/switchgear/MCC/ miscellaneous panels shall be neatly bunched, clamped and tied with self locking type nylon cable ties with de interlocking facility to keep them in position.
7. The panels where a larger number of cables are to be terminated and cable identification may be difficult, each core ferrule shall include the complete cable number. The ferrules shall be indelible interlocking type and shall fit tightly on cores. Spare cores shall have similarly ferrules with a suffix letter 'S' alongwith cable numbers and coiled up after end sealing.
8. All cable terminations shall be appropriately tightened to ensure secure and reliable connections.
9. It is the responsibility of the Contractor to terminate the cables at motor terminals in correct phase sequence to ensure the proper direction of rotation.
10. All cables upto 1.1KV grade shall be terminated at the equipments by means of compression type cable glands. They shall have a screwed



EPC TENDER SPECIFICATION FOR BTG PACKAGE

nipple with conduit electrical threads and check nut.

11. All cable entries shall be through bottom only and top entry terminations are made only after getting approval of Site Engineer.
12. Power cables, wherever colour coding is not available, shall be identified with red, yellow and blue PVC tapes. Where copper to aluminium connections is made, necessary bimetallic washers shall be used. For trip circuit identification additional red ferrules shall be used only in the particular cores of control cables at the termination points in the Switchgear/Control panels and Control Switches.
13. In case of control cables all cores shall be identified at both ends by their terminal numbers by means of PVC ferrules. Wire numbers shall be as per schematic/ wiring/ inter-connection diagram. Contractors shall have the samples of PVC markers approved before starting the work. All unused spare cores of control cables shall be neatly bunched and ferruled with cable tag at both ends. Control cables shall be neatly bunched and served with PVC perforated tape to keep it in position at the terminal block.
14. Where threaded cable gland is screwed into threaded opening of different size, suitable brass threaded reducing bushing shall be used provided.
15. The cable shall be taken through glands inside the panels or any other electrical equipment such as motors. The individual cores shall then be dressed and taken along the cable ways (if provided) or shall be fixed to the panels with polyethylene straps. Only control cables of single strand and lighting cables may be directly terminated on to the terminals. In case of termination of cables at the bottom of a panel over a cable trench having no access from the bottom, close fit hole should be drilled in the bottom plate for all the cables in one line, and then bottom plate should be split in two parts along the centre line of holes. After installation of bottom plate and cables it should be sealed with cold setting compound. Cables shall be clamped over the open armouring to connect it to earth bus.
16. Cable leads shall be terminated at the equipment terminals by means of crimped type solder less connectors. Crimping shall be done by hand crimping/hydraulically-operated tool and conducting jelly shall be applied on the conductor. Insulation of the leads should be removed immediately before the crimping. Conductor surface shall be cleaned and shall not be left open the terminals.



EPC TENDER SPECIFICATION FOR BTG PACKAGE

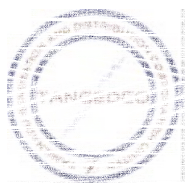
17. All cable entry points shall be properly sealed and made dust and vermin proof.
Unusual opening, if any, shall be effectively closed. Sealing work shall be carried out with approved sealing compound having fire withstand capability for at least three hours.

18. Cable accessories for H.V. Systems

1. The H.V. cables terminations/joints shall be done by skilled, certified and experienced jointers duly approved by the Site Engineer.
2. The termination and straight through joint kits for use on high voltage system shall be suitable for the type of cables offered by the contractor or the type of cables issued by owner for installation. The materials required for termination and straight through joints shall be supplied in kit form. The kit shall include all insulating and sealing materials apart from conductor fittings and consumable items. An installation instruction shall be included in each kit.
3. The termination kits shall be suitable for termination of the cables to an indoor switchgear or to a weatherproof cable box of an outdoor mounted transformer/motor. The termination kits shall preferably be as of the following types.
 - a. 'PUSH ON' type for LV cables.
 - B Heat-shrinkable sleeve type for LV & HV cables.However, termination kits for HV cables shall be of Heat Shrinkable type of makes with specific approval of owner.
For outdoor installations, weather shields/sealing ends and any other accessories required shall also form part of the kit.
4. The straight through jointing kits shall be suitable for underground buried installation with uncontrolled backfill and possibility of flooding by water. The jointing kit shall be one of the following types.
 - a. 'TAPEX' of M-seal make or equivalent for LV cables
 - b. Heat-shrinkable sleeve type for LV & HV cables.However, termination kits for HV cables shall be of Heat Shrinkable type of makes with specific approval of owner. For outdoor installations, weather shields/sealing ends and any other accessories required shall also form part of the kit.

2.2.17.9 QUALITY ASSURANCE PROGRAMME

Contractor shall furnish detailed Quality Assurance Programme and Quality Plans for all materials and accessories to be supplied and installed under the



EPC TENDER SPECIFICATION FOR BTG PACKAGE

scope of the specification as per General Technical Conditions of technical specification. The Quality Plans shall include all tests/ checks as per relevant National/International Standards and the requirements of this specification including tests listed in this section.

2.2.17.10 LIST OF TESTS TO BE CONDUCTED

1 Type tests on Cable Trays support system

a) Test 1A

On main support channel type-C2 for cantilever arms fixed on one side only.

A 3.5 metre length of main support channel shall be fixed vertically at each end to a rigid structure as per appropriate fixing arrangement. Eight (8) nos. 750 mm cantilever arms shall be fixed to the main channel and each arm shall be loaded over the outboard 600 mm with a uniform working load of 100 kg. Subsequently a point load of 100 kg shall be applied on arm 2. A uniform proof load on all the arms equal to twice the working load shall be then be applied. Deflections shall be measured at the following load intervals and other necessary points:

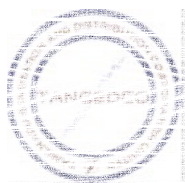
- a) Working load
- b) Working load + point load
- c) Off load
- d) Proof load + point load
- e) Off load

The deflection measured at working loads shall not exceed 16 mm. The permanent deflection after removing the combination of working load and point load shall not exceed 10 mm at the arm tips and 6 mm on the channel. No collapse of the structure shall occur with a combination of proof load and point load applied.

- b) Test 1B:** Test 1A shall be repeated with Eight Cantilever arms uniformly loaded and with the same point load on arm 2

On Main support channel type -C2 for cantilever arms fixed on both sides

- a) Test 2A:** A 3.5 m length of main support channel C2 for cantilever arms fixing on both sides shall be fixed at each end to rigid structure as per appropriate fixing arrangement. Six (6), 750 mm cantilever arms shall be attached to each sides and each arm uniformly loaded to a working load of 100 kg over the out board 600 mm. A point load of 100 kg shall than be applied to arm 2, followed by a uniform proof load



EPC TENDER SPECIFICATION FOR BTG PACKAGE

of twice the working load on all the arms; deflection shall be measured at the following load intervals and other necessary points.

- i) Working load
- ii) Working load + Point load
- iii) Off load
- iv) Proof load + Point load
- v) Off load

The deflection measured at working loads shall not exceed 16mm. The permanent deflection after removing the combination of working load and point load shall not exceed 10 mm at the arm tips and 6 mm on the channel. No collapse of the structure shall occur with a combination of proof load and point load applied

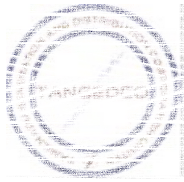
- b) Test 2B:** The test 2 A shall be repeated with the assembly but with an asymmetrical load on the C2 column and point load applied to arm 8. The 100 kg and 200 kg uniformly distributed loads shall be applied to the upper three arms on one side and the lower three arms on the opposite side.

- c) Test 3:** Tests on Channel Fixed on Beam/Floor
A length of main support channel section shall be fixed to steel structure/floor and have loads applied as detailed below and other important points not mentioned herein.

- c) Test 3A** A length of steel structure shall be rigidly supported it should be fitted on a metre length of channel section using beam clamps welded/bolted. A point load of 1200 kg shall be applied to the centre point via two brackets. No distortion or pulling of the components shall take place.

- d) Test 3B** With the components assembled as in Test 3A, two perpendicular point loads of 600 kg shall be simultaneously applied at positions 150 mm either side of the centre line, no distortion or pulling of the components shall take place.

- e) Test 3C** With the components assembled as in Test 3A, a perpendicular point load shall be applied at a point 150 mm on one side of the centre line. The load shall be gradually increased to the maximum value that can be applied without causing distortion or pulling of the components. This value shall be recorded.



EPC TENDER SPECIFICATION FOR BTG PACKAGE

- d) Test 4 Channel nut slip characteristics (what ever applicable)

Tests 4A1, 4A2, 4A3:

A length of channel C1 section 200 mm long shall have fitted bracket with the two bolts fixing. With loads applied at the appropriate position nut slip shall be determined with bolt torque of 30 NM, 50 NM and 65 NM. No fewer than three measurements shall be made for each torque setting. A minimum loading of 720 kg shall be obtained before nut slip with bolt torque of 65 NM.

Tests 4B1, 4B2, 4B3:

The length of channel C1 section 200 mm long shall have fitted bracket with the one bolt fixing. With loads applied at the appropriate position, nut slip shall be determined with bolt torques of 30 NM, 50 NM and 65 NM. No fewer than three measurements shall be made for each torque setting. A minimum loading of 350 kg shall be obtained before nut slip with a bolt torque of 6 NM.

Test 5 Weld Integrity Test

After deflection test as per test 1A, 1B, 2, 3 & 4 weld integrity shall be checked by magnetic particle inspection to detect sub-surface cracks developed, if any. Cable termination kit and straight through joints should have been tested as per IS: 13573 for 6.6kV and 11kV class. Fire proof Cable Penetration system should have been tested for the following tests:

- a) Accelerated Ageing test
- b) Water absorption test
- c) Fire rating test
- d) Hose Stream test
- e) Vibration test followed by fire rating test

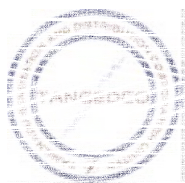
2 Routine/ Acceptance Tests

Following routine/acceptance tests shall be carried out on all the equipments, devices & materials supplied:

a) Galvanizing Tests

The quality of galvanizing shall be inspected visually and shall be smooth, continuous, and free from flux stains.

- i) Uniformity of coating – The coating of any article shall withstand four 1 minute dips in standard copper sulphate solution without the formation of an adherent red spot of metallic copper upon the basic metal.



EPC TENDER SPECIFICATION FOR BTG PACKAGE

- ii) The quality of cadmium/zinc plating on items with screw threads shall be inspected visually and shall be free from visible defects such as unplated areas, blisters and modules.
- lii) In addition, the plating thickness shall be determined microscopically/chemically or electronically.

3 Welding

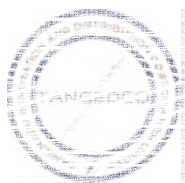
The quality of welding shall be visually inspected, particular attention being paid to the following points.

- 1) The welded joints shall be continuous along its length on both sides and of uniform width and thickness. It should be free from blow holes.
- 2) The weld metal shall be properly fused with the parent metal without undercutting.
- 3) The outside surface of the weld shall be clean. All slag shall have been removed. All welding shall be regularly checked for cracking using magnetic particle inspection or their equivalent technique.
 - 1. Physical and dimensional checks for all items.
 - 2. All conduits/pipes, etc. shall be routine/acceptance tested as per relevant standards.
 - 3. All acceptance and routine tests on cable glands as for BS: 6121. Additionally Proof torque test shall be carried out as acceptance on each body group of cable glands.
 - 4. Deflection test cable trays.
 - 5. All acceptance and routine tests on Junction boxes.
 - 6. Following tests shall also be carried out on each type of equipments, devices and materials/items supplied:
 - 1) Physical and Dimensional checks
 - 2) Check/measurement of thickness for Nickel chrome plating for cable glands and tinning for cable lugs.
 - 3) Check chemical composition of brass parts for cable glands.
 - 4) Hardness check on gaskets.
 - 5) Test for uniformity of galvanization.

4 Cable trays / supports and accessories

- 1) Check for proper galvanizing/painting and identification number of the cable trays/supports and accessories.
- 2) Check for continuity of cable trays over the entire route.
- 3) Check that all sharp corners, burrs, and waste materials have been removed from the trays supports.
- 4) Check for earth continuity

Earthing and Lightning Protection System



EPC TENDER SPECIFICATION FOR BTG PACKAGE

2.2.18 EARTHING AND LIGHTNING PROTECTION SYSTEM

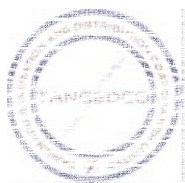
2.2.18.1 Earthing System

2.2.18.2 Scope

- ii. The Contractor shall provide all required material and carry out main earth grid, treated earth pits, raisers and inter connections, equipment earthing, interconnection to the existing, BOP area earth mats etc. for the following areas and all areas/buildings/structures including but not limited to:
 - a) Main Plant Building (TG Building)
 - b) Boiler Area, ESP area, Circulating water system, DG room & other electrical systems.
 - c) Service building
 - d) Air washer room
 - e) Transformer yard
 - f) All other miscellaneous building not mentioned herein but in BTG supplier scope.
- iii. Earthing system shall consist of earth grids and electrodes buried in soil in the plant area, embedded in concrete inside the buildings to which all the electrical equipment, metallic structures are connected to have earth continuity for safety reasons. The earthing system shall conform to IS 3043 and Indian Electricity Act/rules.
- iv. The Contractor shall furnish the detailed design, layout and calculations for Owner's approval. Contractor shall obtain all necessary statutory approvals for the system.

2.2.18.3 Codes and Standards

- i. All standards, specifications and codes of practice referred to herein shall be the latest editions including all applicable official amendments and revisions as on date of opening of bid. In case of conflict between this specification and those (IS codes, standards, etc.) referred to herein, the former shall prevail. All work shall be carried out as per the following standards / codes as applicable.
- ii. Equipment complying with other internationally accepted standards such as IEC, BS, DIN, USA, VDE etc. will also be considered if they ensure performance and constructional features equivalent or superior to standards listed below. In such a case, the Contractor shall clearly indicate the standard(s) adopted, furnish a copy in English of the latest revision of the standards along with copies of all official amendments and revisions in force as on date of opening of bid and shall clearly bring out the salient features for comparison.

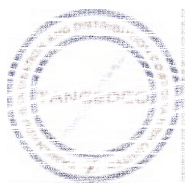


EPC TENDER SPECIFICATION FOR BTG PACKAGE

- | | | |
|-----|---------------------------|---|
| 1. | IS:513 | - Cold rolled low carbon steel sheets and strips |
| 2. | IS:802 | - Code of practice for the use of Structural Steel in Overhead Transmission Line Towers |
| 3. | IS:1079 | - Hot Rolled carbon steel sheet & strips |
| 4. | IS:1239 | - Mild steel tubes, tubular and other wrought steel fittings |
| 5. | IS:1367 Part-13 | - Technical supply conditions for threaded Steel fasteners. (Hot dip galvanized coatings on threaded fasteners) |
| 6. | IS:2309 | - Code of Practice for the protection of building and allied structures against lightning |
| 7. | IS:2629 | - Recommended practice for hot dip galvanising of iron & steel |
| 8. | IS:2633 | - Method for testing uniformity of coating on zinc coated articles |
| 9. | IS:3043 | - Code of practice for Earthing |
| 10. | IS:6745 | - Methods for determination of mass of zinc coating on zinc coated iron & steel articles |
| 11. | IS:9595 | - Metal – arc welding of carbon and carbon manganese steels – recommendations |
| 12. | IEEE:80 | - IEEE guide for safety in AC substation grounding |
| 13. | IEEE:142 | - Grounding of Industrial & commercial power systems |
| 14. | Indian Electricity Act. | |
| 15. | Indian Electricity Rules. | |

2.2.18.4 Design Criteria

1. Fault Current & Duration



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

Earthing system network/earth mat shall be interconnected mesh of mild steel rods buried in ground in the plant. For earth mat design, the size of earthing conductor shall be calculated considering maximum fault current 50 kA for duration of 1 second and corrosion factor. The maximum permissible step and touch potentials shall be calculated in accordance with the formula, given in IEEE-80.

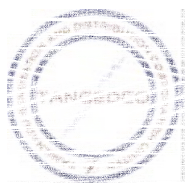
2. Conductor Material

- i. The earthing system conductors and accessories as proposed are to be as:
- (a) Conductors above ground level and in trenches : Galvanized steel
 - (b) Conductors buried in ground or embedded in concrete : Mild Steel
 - (c) Electrodes : GS Pipe / Rod
- ii. The contractor shall undertake the soil resistivity measurements at site and shall select suitable type of conductors.
- iii. The earth conductors shall be free from pitting, laminations, rust, scale and other electrical, mechanical defects.

3. Size of Conductors

The minimum sizes of earthing conductors for various electrical equipments shall be as below:

Sl.No	Equipment	Earth Conductor buried in earth	Earth conductor above ground level & in built up trenches
1.	Main earth Grid	40 mm dia. MS Rod	---
2.	Transformeryard	40 mm dia. MS Rod	---
3.	Switchyard	40 mm dia. MS Rod	---
4.	Power Transformer		75 x 10 mm GS Flat
5.	11kV / 6.6 kV / 415 V Switchgear / Equipment	---	75 x 10 mm GS Flat
6.	415 V MCC / Distribution Boards/ Distribuion Transformers	---	75 x 10 mm GS flat
7.	LV motors		
	Above 100 to 200 kW	---	75x10 mm GS flat
	Above 55 KW to 100 KW	---	50x6 mm GS flat



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

	Above 22 KW to 55 KW	---	50x6 mm GS flat
	Above 5.5 KW to 22 KW	---	25x6 mm GS flat
	Fractional HP LV Motors	---	8 SWG GS Wire
8.	Control panel & Control Desk	---	50x6 mm GS flat
9.	Push Button Station / Junction Boxes	---	8 SWG GI Wire
10.	Column, Structures, Cable tray, fence , gate and busduct enclosures	---	50x6 mm GS flat
11.	Crane, Rail, Rail tracks & other non-current carrying metal parts	---	50x6 mm GS flat

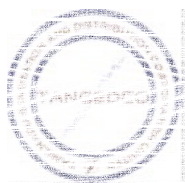
4. Soil Treatment to lower Resistivity

The soil resistivity study shall be carried out by the contractor. In order to reduce the resistivity of the soil the earth pits shall be treated with high purity electrically conductive material having ultra-low resistance value (typically, 0.001 ohm-m). The properties of the material shall be such that it does not require periodic re-watering or recharge of salt or earth enhancing compound during the life of the power plant. The material should be such that it does not reach chemicals into the adjacent soil or underground water channels and should be PH neutral. Earth enhancing material should permanently protect the encased metal components of the earthing systems. Earthing electrodes encased in high strength concrete mixed with the conductive material shall be preferred instead of electrode buried directly in the earth.

5. Rod Electrodes

Galvanized steel pipe/rod electrodes of suitable diameter and length shall be used as per the recommendation of IS-3043. For test pits electrodes shall be heavy duty type (Class – C) GI pipe of suitable diameter with perforations. For treated earth pits, GI pipe shall be provided as per IS 3043 including charcoal, salt etc. Necessary number of treated earth pits shall be provided for UTs, UATs in the transformer yard and other UATs in the main power house building and for all LT transformer Neutral & body earthing. Electrodes installed in the test pits will have disconnecting facilities.

6. Earthing of Electrical equipment on cranes and travelling machines



EPC TENDER SPECIFICATION FOR BTG PACKAGE

- i. Every electrical equipment shall have double earthing. A ring earthing system shall be provided within the crane/machine to which electrical equipment shall be connected at least at two places.
- ii. The earth ring on the crane/machine shall be connected to the plant earthing system through gantry rails. Two sets of earth collector brushes shall be provided on each side of crane/machine to connect its earth ring to the gantry rails. Each end of each gantry rail shall be bonded to the plant earthing system.
- iii. In addition, intermediate earthing bond shall also be provided on the rails at every 60 m in case of longer tracks. Flexible copper bonds shall be provided across any gap in the running gantry rails. For mobile equipment with flexible cables, one separate copper conductor of adequate size shall be provided for earthing.

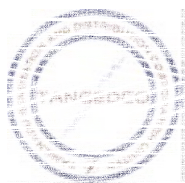
7. Equipment Earthing Leads

The size of the earthing leads shall be decided based on the type of equipment and structure to be earthed and shall be provided generally as per IS-3043.

2.2.18.5 Earthing System Layout

1. General

- i. Metallic frames of all current carrying equipment, supporting structures adjacent to current carrying conductors, structures in contact with switchyard earth, lightning protection system conductors and neutral points of various systems shall be connected to a single earthing system.
- ii. All the offsite areas shall be interconnected together by minimum two parallel conductors.
- iii. Crane rails, tracks, metal pipes and conduits shall be effectively earthed at two points. Steel RCC columns, metallic stairs, and rails etc. of the building housing electrical equipment shall be connected to the nearby earthing grid conductor by one earthing lead ensured by bonding the different sections of hand rails and metallic stairs.
- iv. For all other equipments, two earthing leads shall be used if rated voltage of equipment is above 250V. In case the rated voltage is 250 V or below, one earth lead can be used. Metallic structures adjacent to electrical equipment shall be earthed by one earthing lead.
- v. Earthing conductors in outdoor areas shall be installed at a minimum depth of 600 mm.

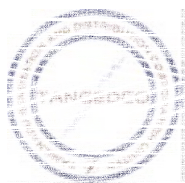


**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

- vi. Each continuous laid lengths of cable tray shall be earthed at minimum two places by G.S. flats to earthing system, the distance between earthing points shall not exceed 30 metre. Wherever earth mat is not available Contractor shall do the necessary connections by driving an earth electrode in the ground.
- vii. Portable tools, appliances and welding equipment shall be earthed by flexible insulated cable .
- viii. The cable sheaths, screens armour shall be earthed at both ends for multi-core cables. For single core cables the same shall be done at one end (switchgear end) only.
- ix. Electronic earthing shall be provided as per relevant international standard for all control systems (such as DDCMIS,PLC,SAS,EDMS,etc.,). For electronic equipment chemical earthing pit shall be provided. The earth pit shall be tested and type proven and shall be guaranteed for service life of 40 years. The chemical earth pit shall comprise pipe electrode,crystalline conductive mixture, bentonite, etc., constructed in a pit of not less than 4000mm depth. The pit shall be effective in all weather conditions and offer medium resistance. For electronic earthing system, earthing conductor shall be copper.
- x. Neutral of Service transformers shall be earthed through minimum of 400 sq.mm single core cable through two numbers treated earth pit and inturn shall be connected to station earth grid.
- xi. LV Neutral points of the following transformers shall be connected to Neutral Grounding Resistors(NGR). NGR shall be connected to earth through two numbers treated earth pit.
 - a) Unit transformers
 - b) Station Transformer
 - c) Unit , station and other Auxiliary transformers
- xii. Steel to copper connections shall be brazed type and shall be treated to prevent moisture ingress.
- xiii. Metallic sheaths and armour of all multi-core power cables shall be earthed at both equipment and switchgear end, Sheath and armour of single core power cables shall be earthed at switchgear end only.
- xiv. Earthing conductors along their run on cable trench, ladder, walls etc., shall be supported by suitable welding/cleating at intervals of 1000mm. Wherever it passes through walls, floors etc., pipe sleeves shall be provided for the passage of the conductor and both ends of the sleeve shall be sealed to prevent the passage of water through the sleeves.

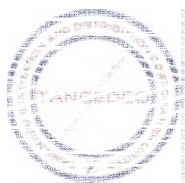


EPC TENDER SPECIFICATION FOR BTG PACKAGE

- xv. Railway tracks within the plant area shall be bonded across fish plates and connected to earthing grid at several locations.
- xvi. Electronic panels and equipments shall be grounded utilizing an insulated copper ground wire terminated at separate earth electrodes.

2. Earthing Conductor layout

- i. Main earthing conductors shall be laid in the form of a grid. Spacing between conductors, number of parallel conductors, etc., shall be decided such that step and touch potential are within safe limits.
- ii. The maximum permissible step and touch potentials shall be calculated in accordance with the formula, given in IEEE-80.
- iii. Earthing conductors shall be provided around the outside edge of fence at a distance of approximately 6000 mm. This shall be connected to the main earthing grid.
- iv. Grounding conductor around the building shall be buried in earth at a minimum distance of 1200 mm from the outer boundary of the building.
- i. Every alternate post of the fence shall be connected to earthing grid by one GS flat and gates by flexible lead to the earthed post.
- ii. Each of the earth leads of transformer neutral, lightning arrester shall be directly connected to two separate electrodes. Neutral points of HV transformer shall be earthed through NG resistors. The Contractor shall connect the NGR earthing point to earth electrodes by suitable earth conductors. Lightning protection down conductor shall be directly connected to a separate earth electrode.
- iii. All earth electrodes in turn shall be connected to main earthing system. The earth grids of different areas of the plant shall be interconnected through, test pits to enable measurement of earth resistance for each area separately.
- iv. Earthing grid design shall be done in such a manner that the grid resistance is less than one ohm.
- v. Earth pit shall be constructed as per IS: 3043. Electrodes shall be embedded below permanent moisture level. Minimum spacing between electrodes shall be atleast equivalent to twice the length of the electrode.



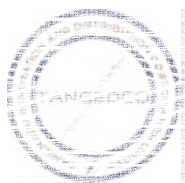
EPC TENDER SPECIFICATION FOR BTG PACKAGE

3. Earthing Conductors inside the building

- i. Main earthing conductors shall be buried in earth around the building. Minimum two taps-off from this earthing loop shall be taken inside the building and connected to the earthing grid embedded in the floor slab with approximately 50 mm concrete cover. The requirement of electrodes around the building shall be specified.
- ii. In case the building has more than one floor, each floor shall be provided with separate earth grid. These floor earthing grids shall be interconnected.
- iii. Each RCC / Steel column of the building shall be interconnected to the floor earthing grid in the ground floor.
- iv. Instrumentation system and computer system shall be provided with a dedicated earthing system suitable for the equipment. Separate electronic earthing for the PLC equipments, SAS panels and all other equipments wherever necessary shall also be provided.
- v. Earthing grids of all the buildings, outdoor yards shall be interconnected to form a single grid for the plant.
- vi. Earthing grid design shall be done in such a manner that the grid resistance is less than one ohm.
- vii. Suitable earth risers as approved by Owner shall be provided above finished floor/ground level, if the equipment is not available at the time of laying of main earth conductor.
- viii. A minimum earth coverage of 300 mm shall be provided between the ground grid conductor and the bottom of trenches, tunnels, underground pipes, foundations, railway tracks etc. The ground grid conductor shall be re-routed in case it fouls with equipment foundations.

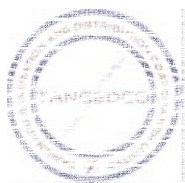
2.2.18.6 Earthing System Installation

- i. The spacing between two electrodes shall be at least equivalent to twice the length of the electrode.
- ii. Earthing conductors along their run on columns, walls, etc. shall be supported by suitable welding / cleating at interval of 1000mm and 750mm respectively. 8 SWG earth wire should be run along with lighting conduits and shall be earthed at both ends. The wire should be suitable clamped with conduit at equal interval at not more than 500 mm.



EPC TENDER SPECIFICATION FOR BTG PACKAGE

- iii. The earthing conductor crossing the road / track shall be laid in hume pipe or laid at a greater depth to avoid damage.
- iv. When earth conductor passes through floors, walls, etc., suitable pipe sleeves shall be provided and the same shall be sealed after installation.
- v. The connection between earthing pads / terminal to the earth grid shall be made short and direct and shall be free from kinks & splices.
- vi. Cable trays, metal pipes / conduits, steel columns, etc., shall not be used as earth continuity conductors.
- vii. Street lighting poles, flood light poles & towers, their junction boxes shall be connected to the earthing conductor to be run along with supply cable. This earth conductor shall be in turn connected to earth grid at two extreme points.
- viii. Flexible earth conductors shall be provided at expansion joints for earthing the gates, operating handles, etc.
- ix. Equipment bolted connection after being checked and tested shall be painted with anti-corrosive paint / compound be welded. For rust protection, the welds shall be treated with zinc chromate primer and coated with zinc rich paint.
- x. Proper earth connections for cable glands, cable boxes, cable armour, screens, etc. to be provided.
- xi. All bimetallic connections shall be treated with suitable compound to prevent moisture ingress.
- xii. The contractor shall demonstrate the effectiveness of earthing system by measurement of earth resistance, step and touch potential at different locations. Earth resistance at earth terminations shall be measured in presence of Owner's representatives. All equipment required for testing shall be furnished by contractor.
- xiii. Connections between earth leads and equipment shall normally be of bolted type. Contact surfaces shall be thoroughly cleaned before connections. Equipment bolted connections after being tested and checked shall be painted with anti-corrosive paint/compound.
- xiv. Connections between equipment earthing leads and between main earthing conductors shall be of welded type. For rust protection the welds should be treated with red lead compound and afterwards thickly coated with bitumen compound. All welded connections shall be made by electric arc welding. The overlapping of earthing conductor in welded joints should be 6 times diameter. Cleats should be



EPC TENDER SPECIFICATION FOR BTG PACKAGE

provided at both sides to increase contact area. Angles/ cleats should be welded at the point of crossing of longitudinal and transverse earthing conductors.

- xv. Resistance of the joint shall not be more than the resistance of the equivalent length of conductors.
- xvi. Back filling material to be placed over buried conductors shall be free from stones and harmful mixtures. Back filling shall be placed in layers of 150 mm. Trenches after laying earth rods should be closed with approved filling materials in layers and not with debris.

2.2.18.7 Other Requirements of Earthing System

Life expectancy	40 years
System Fault level	50kA for one second
Minimum Steel corrosion	0.3mm/year (on dia. of conductor)
Depth of burial of main earth conductor	600mm below grade level; where it crosses trenches, pipes, ducts, tunnels, rail tracks, etc., it shall be at least 300mm below them.
Conductor joints	By electric arc welding, with resistance of joint not more than that of the conductor.

2.2.18.8 Lightning Protection System

- i. The main purpose of lightning protection system are to :
 - Provide protection to structures from lightning strokes.
 - Provide a low resistance-conductive path to lightning discharge.
- ii. Lightning protection system shall be in strict accordance with IS: 2309 for the structures, equipments and buildings within the battery limits.

2.2.18.9 Conductor material

For Lightning protection, material & minimum sizes shall be as follows:

- a. Vertical air termination : 20 mm dia MS rod
- b. Horizontal air termination : 25X6 mm Galvanised steel flats
- c. Down conductor : 25X6 mm Galvanised steel flats
- d. Test link : 150x50x6 mm Galvanised steel Strip with Box
- e. Earth Electrodes : Treated earth pit with pipe electrode as per IS:3043



EPC TENDER SPECIFICATION FOR BTG PACKAGE

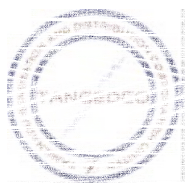
The above sizes are indicative only. Actual size shall be arrived at as per design by the Bidder.

2.2.18.10 Lightning System Layout

- i. Lightning system shall comprise of air terminations, down conductors, test links, earth electrode etc.
- ii. Air termination network consisting of vertical or horizontal conductors or combination of both shall be provided for the building. Down conductors shall follow the most direct path possible between the air terminal network and the earth termination network. Each down conductor shall be provided with a test link for testing. An earth electrode shall be connected to each down conductor.
- iii. Suitable lightning protection shall be provided to protect
 - a) Main Power House building as per IS requirement
 - b) Boiler Area, ESP area, DG room, Service building & other electrical systems.
 - c) All other miscellaneous building & electrical systems not mentioned herein but in scope of main plant (BTG) supplier.
- iv. Installation of lightning conductors on the roofs of buildings shall include construction of support, laying, anchoring, fastening and cleating of horizontal conductors, grouting of vertical rods wherever necessary, laying, fastening / cleating / welding of the down comers on the walls / columns of the building and connection to the test links to be provided above ground level.

2.2.18.11 Air Terminations

- i. The vertical air terminal rods shall be installed at the roof of buildings for MCC/Switchgear rooms, ESP Control rooms etc to protect these objects from lightning strokes.
- ii. ii) The projected length of the Air termination rod shall be as required to protect the object (on which the rod is fixed) from lightning stroke.
- iii. The air terminal rod shall be properly fixed on the top of the building/structure to withstand very high wind pressure. In case the air terminal rod is embedded at the top of roof of building, the portion embedded inside the concrete shall not touch the reinforcement bars and shall be duly insulated from them.
- iv. All the vertical air terminal rods shall be electrically connected together by means of horizontal conductors of size 25 x 6 mm galvanized steel flats. Horizontal air



EPC TENDER SPECIFICATION FOR BTG PACKAGE

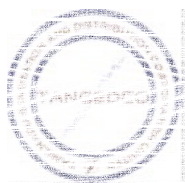
termination (i.e. G.S. Flat conductor) shall be so laid that no part of the rod shall be more than nine (9) metres from the nearest roof conductor.

2.2.18.12 Shielding Masts

- v. The shielding mast for lightning protection shall be installed at the top of steel columns cap plates of the associated building.
- vi. The shielding mast shall be made of galvanized steel rod and the height of the same shall be decided considering the zones to be protected.
- vii. Each shielding mast shall be connected to grounding grid by a down conductor 50 x 6 mm minimum. Galvanised steel flat run along the building column. In addition all building columns joints shall be electrically bonded.

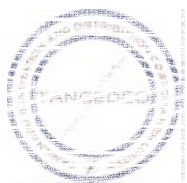
2.2.18.13 Down conductors

- i. Down conductors shall be as short and straight as practicable and shall follow a direct path to earth electrode.
- ii. Each down conductor shall be provided with a test link at 1000 mm above ground level for testing but it shall be in accessible to interference. No connections other than the one direct to an earth electrode shall be made below a test point.
- iii. All joints in the down conductors shall be welded type.
- iv. Down conductors shall be cleated on outer side of building wall, at 750 mm interval or welded to outside building columns at 1000 mm interval.
- v. Lightning conductor on roof shall not be directly cleated on surface of roof. Supporting blocks of PCC/insulating compound shall be used for conductor fixing at an interval of 1500 mm.
- vi. All metallic structures within a vicinity of two meters of the conductors shall be bonded to conductors of lightning protection system.
- vii. Lightning conductors shall not pass through or run inside GI Conduits.
- viii. Testing link shall be made of galvanized steel of size 25x 6mm.
- ix. Pulser system for lightning shall not be accepted.
- x. Hazardous areas handling inflammable/explosive materials and associated storage areas shall be protected by a system of aerial earths.



EPC TENDER SPECIFICATION FOR BTG PACKAGE

- xi. Lightning protection conductors/ air termination rods and circumferential band provided at the top position of chimney stack shall be lead coated in order to avoid melting by exposure to hot flue gases.
- xii. For tall buildings and structures, early streamer emission (ESE) type, air terminal system is preferred.
- xiii. Horizontal air termination flats provided on top of boilers, main plant building & other buildings shall be laid such that no part of the roof shall be more than 9 metres.
- xiv. Conductors of lightning protection system shall not be connected with conductors of earthing system above ground level.
- xv. Lightning protection shall have as few joint as possible and avoid sharp bends. Down conductors shall have as far as possible, no joint except at test point and end termination.
- xvi. Termination at the metallic equipments on roof should be made by suitable nuts, bolts, pressure washer and bitumen washers with good electrical conductivity.
- xvii. All lightning protection conductors shall be exposed to atmosphere unless specifically mentioned. The lightning protection in the transformeryard shall cover the following equipments in the protection zone.
 - a) Generator Transformer
 - b) Station Transformer
 - c) Unit Transformers
 - d) Auxiliary Transformers
- xviii. All areas of the power station shall be provided with lightning protection. The lightning protection system for buildings shall consist of Air termination network, Down conductors, Test link and earth electrodes.
- xix. Air termination network consisting of vertical or horizontal conductors or combination of both shall be provided on the building. Down conductors shall follow the most direct path possible between the air terminal network and the earth termination network. Each down conductor shall be provided with a test link for testing. An earth electrode shall be connected to each down conductor.
- xx. For lightning protection, material thickness of galvanizing shall be at least 610 gm / sq.mm for all galvanised steel conductor.

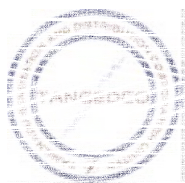


EPC TENDER SPECIFICATION FOR BTG PACKAGE

- xxi. The lightning protection system shall not come in direct contact with other equipment / systems such as cables, conduits, electrical equipment, under ground metallic ducts etc., All metallic structures within vicinity shall be bonded to the lightning protection system.
- xxii. All welded / brazed joints shall be coated with anti-corrosive paints for rust protection.
- xxiii. Lightning conductor when used above ground level and shall be connected through test link with earth electrode / earthing system. Down conductors shall be as short and straight as practical and shall follow a direct path to earth. Down conductor shall not be connected to other earthing conductors above ground level.
- xxiv. Each down conductor shall be provided with test link at 1500 mm above ground level for testing. But it shall be in accessible to interference. No connections other than the one direct to an earth electrode shall be made below a test point. All joints in the down conductors shall be welded type.
- xxv. Down conductors shall be cleated on outer side of the building wall / welded to outside building columns at 750 mm interval.
- xxvi. Lightning conductor on the roof shall be cleated on surface of roof using insulated clamps / saddles for conductor fixing at an interval of 1000 mm for horizontal run and 750 mm for vertical run.
- xxvii. Conductor of the lightning protection system shall not be connected with the conductors of the safety earthing system above ground level.
- xxviii. Installation of lightning conductors on the roofs of the buildings shall include construction of supports, laying, anchoring, fastening and cleating of horizontal conductors, grounding of vertical rods wherever necessary, laying, fastening / cleating / welding of the down comers on the walls / columns of the buildings and the connections to the test links to be provided above ground level.

2.2.18.14 Electrodes (for Lightning Protection)

- i. The electrodes shall be 40 mm diameter 3000 mm long mild steel rod. These shall be driven into the ground.
- ii. All the electrodes shall be interconnected by means of one (1) 40 mm dia mild steel rod which shall be laid under ground at a minimum depth of 1000 mm below finished grade level unless stated otherwise. This ground mats/electrode in turn shall be connected to main grounding grid.



EPC TENDER SPECIFICATION FOR BTG PACKAGE

2.2.18.15 Riser (for Lightning Protection)

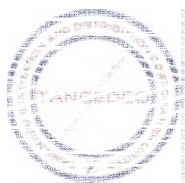
All risers connected to grounding mat shall be 40 mm mild steel rods and shall be projected 300 mm above grade level unless stated otherwise.

2.2.18.16 Jointing & Connection

- i. All ground conductor connections below ground level shall be done by electric arc welding with low hydrogen content electrode.
- ii. The projected portion of riser above ground shall be coated with two (2) coats of bitumen paints (anti-corrosive paints) with a minimum thickness of 1 mm after connection.
- iii. The joints in the lightning conductors shall be kept to a minimum and there shall be no joint in the underground portions of conductors.
- iv. All the joints shall be done by arc welding process overlapping of the conductors at straight joints shall not be less than 150 mm. The contact surfaces shall be cleaned properly before jointing.
- v. The portion of galvanized steel flats, which undergoes welding at site, shall be coated with two (2) coats of cold galvanizing anti-corrosive paint after welding.
- vi. The bolted joint of the test link shall be covered with thick coating of bitumen paint after successful testing.
- vii. The air terminal rods and shielding mast shall be coated with weather resistant anti-corrosive paint (zinc chromate followed by two coats of aluminium paint).
- viii. The steel to copper connection shall be brazed type.
- ix. The lightning protection of inflammable liquid storage tanks wherever required, shall be provided with horizontal conductors strung between tall poles covering the entire zones or with air terminal rods mounted on top of poles/structure. These horizontal conductors/vertical air terminal rods shall be connected to rod electrodes, which in turn shall be connected to station ground mat.

2.2.18.17 Quality Assurance Program

Contractor shall furnish detailed Quality Assurance Programme and Quality Plans for all



EPC TENDER SPECIFICATION FOR BTG PACKAGE

materials and accessories to be supplied and installed under the scope of the specification. The Quality Plans shall include all tests/ checks as per relevant National/International Standards and the requirements of this specification including tests listed in this section.

2.2.18.18 Inspection and Testing

1. Earth Continuity Checks.
2. Earth resistance of the complete system as well as sub system
3. The earthing and lightning conductors should be type tested as per IS 2669. Following minimum tests shall be conducted.
 - a) Freedom from defects
 - b) Uniformity in thickness
 - c) Mass pf coating
 - d) Adhesion tests
 - e) Any other applicable tests not mentioned in the specification but required.

2.2.18.19 Drawing and Documents

The following drawings and documents shall be submitted for approval during detail engineering stage.

1. Soil resistivity report
2. Design basis report for earthing and lightning protection system
3. Earthing design calculation
4. Typical installation drawings for earthing and lightning protection system
5. Electronic earthing layout and details
6. Earthing layout for Transformer yard
7. Earthing layout for power house building, boiler and ESP.
8. Earthing layout for all auxiliary plant buildings
9. Earthing layout for all non-plant buildings
10. Lightning Protection design calculation and layout

	TITLE LV MOTOR DATA SHEET - C	SPECIFICATION NO.
		VOLUME II B
		SECTION D
		REV NO. 00 DATE
		SHEET 1 OF 2

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

NAME OF VENDOR			SEAL	REV.	
NAME	SIGNATURE	DATE			

	TITLE LV MOTOR DATA SHEET - C	SPECIFICATION NO.
		VOLUME II B
		SECTION D
		REV NO. 00 DATE
		SHEET 2 OF 2

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

NAME OF VENDOR			SEAL	REV.	
NAME	SIGNATURE	DATE			

LOAD TITLE		RATING (KW / A)		UNIT (U)/STN (S)	Nos.		VOLTAGE CODE*	FEEDER CODE**	EMER. LOAD (Y)	CONT.(C)/ INTT.(I)	STARTING TIME >5 SEC (Y)	LOCATION	BOARD NO.	CABLE		BLOCK CABLE DRG. No.	CONT ROL CODE	REMA RKS	LOAD No.	VERIFICATI ON FROM MOTOR DATASHEE T (Y/N)	KKS NO
		NAME PLATE	MAX. CONT. DEMAND (MCR)		RUNNING	STANDBY								SIZE CODE	Nos						
1		2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
ANNEXURE-II																					
NOTES: 1. COLUMN 1 TO 12 & 18 SHALL BE FILLED BY THE REQUISITIONER (ORIGINATING AGENCY); REMAINING COLUMNS ARE TO BE FILLED UP BY PEM (ELECTRICAL) / CUSTOMER																					
2. ABBREVIATIONS : * VOLTAGE CODE (7):- (ac) A=11 KV, B=6.6 KV, C=3.3 KV, D=415 V, E=240 V (1 PH), F=110 V (cc): G=220 V, H=110 V, J=48 V, K=+24V, L=-24 V																					
: ** FEEDER CODE (8):- U=UNIDIRECTIONAL STARTER, B=BI-DIRECTIONAL STARTER, S=SUPPLY FEEDER, D=SUPPLY FEEDER (CONTACTOR CONTROLLED)																					
LOAD DATA (ELECTRICAL)		JOB NO.		423		ORIGINATING AGENCY		PEM (ELECTRICAL)													
		PROJECT TITLE		1X800MW NORTH CHENNAI TPP		NAME		DATA FILLED UP ON													
		SYSTEM		MILL REJECT SYSTEM		SIGN.		DATA ENTERED ON													
		DEPTT. / SECTION		MAX		SHEET 1 OF 1		REV. 00		DE'S SIGN. & DATE											

ANNEXURE III

[illegible]

Explanatory notes for filling up cable list for routing through WinPath, the cable routing program (developed by Corporate R&D) being used in PEM.

1. For the purpose of clarity, it may please be noted that the information given in regard to the cables to be routed through WinPath as per the system elaborated below is called "Cable List", while the term "Cable Schedule" applies to the cable list with routing information added after routing has been carried out.
2. The cable list shall be entered as an MS Excel file in the format as per enclosed template EXT_CAB_SCH_FORMAT.XLS. No blank lines, special characters, header, footer, lines, etc. shall be introduced in the file. No changes shall be made in the title line (first line) of the template.
3. The field properties shall be as under:
 - a. UNITCABLENO: A/N, up to sixteen (16) characters; each cable shall have its own unique, unduplicated cable number. In case this rule is violated, the cable cannot be taken up for routing.
 - b. FROM: A/N, up to sixty (60) characters; the "From" end equipment/ device description and location to be specified here. Information in excess of 60 characters will be truncated after 60 characters.
 - c. TO: A/N, up to sixty (60) characters; the "To" end equipment/ device description and location to be specified here. Information in excess of 60 characters will be truncated after 60 characters.
 - d. PURPOSE: A/N, up to sixty (60) characters; the purpose (i.e. power cable/ indication/ measurement, etc.) to be specified here. Information in excess of 60 characters will be truncated after 60 characters.
 - e. REMARKS: A/N, up to forty (40) characters; Any information pertinent to routing to be specified here (e.g., cable number of the cable redundant to the cable number being entered). Information in excess of 40 characters will be truncated after 40 characters.
 - f. CABLESIZE: A/N, 7 characters exactly as per the codes indicated below shall be specified here. The program cannot route cables described in any other way/ format.
 - g. PATHCABLENO: Field reserved for utilization by the program. User shall not enter any information here.
4. One list shall be prepared for each system/ equipment (i.e., separate and unique cable lists shall be prepared for each system).
5. The cables shall be described as per the scheme listed below:

A	NN	A	NNN
Cable	No. of cores	Cable code	Cable size
Voltage	(e.g. 01,03,3H, 07)	(See C below)	(e.g. 035,185,2.5, 0.5)
Code (see B below)			

(A) SYSTEM VOLTAGE CODES:

(ac) A = 11KV, B = 6.6KV, C = 3.3KV, D = 415V, E = 240V, F = 110V

(dc) G = 220V, H = 110V, J = 48V, K = +24V, L = -24V

(B) CABLE VOLTAGE CODES:

A = 11KV (Power cables)

Explanatory notes for filling up cable list for routing through WinPath, the cable routing program (developed by Corporate R&D) being used in PEM.

B = 6.6KV (Power cables)
C = 3.3KV (Power cables)
D = 1.1KV (LV & DC system power & control cables)
E = 0.6KV (0.5 sq. mm. Control cables)

(C) CABLE CODES

PVC Copper

A = Armoured FRLS	B = Armoured Non-FRLS
C = unarmoured FRLS	D = Unarmoured Non-FRLS

PVC Aluminium

E = Armoured FRLS	F = Armoured Non-FRLS
G = unarmoured FRLS	H = Unarmoured Non-FRLS

XLPE Copper

J = Armoured FRLS	K = Armoured Non-FRLS
L = unarmoured FRLS	M = Unarmoured Non-FRLS

XLPE Aluminium

N = Armoured FRLS	P = Armoured Non-FRLS
Q = unarmoured FRLS	R = Unarmoured Non-FRLS

S = FIRE SURVIVAL CABLES
T = TOUGH RUBBER SHEATH
U = OVERALL SCREENED
V = PAIRED OVERALL SCREENED
W = PAIRED INDIVIDUAL SCREENED
Y = COMPENSATING CABLES
I = PRE-FABRICATED CABLES
Z = JELLY FILLED CABLES



TITLE
1X800 MW NORTH CHENNAI TPP STAGE III
MILL REJECT SYSTEM (PNEUMATIC TYPE)
SPECIFIC TECHNICAL REQUIREMENTS

SPECIFICATION NO. PE-TS-423-160-A001
SECTION: I
REV 00
Sub-Section: IC
Date
Page 1 of 1

SUB-SECTION – IC

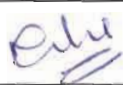
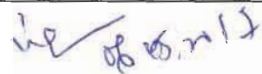
SPECIFIC TECHNICAL REQUIREMENTS (C&I)



**C&I TECHNICAL SPECIFICATION
FOR
MILL REJECT HANDLING SYSTEM**



**CONTROL AND INSTRUMENTATION DEPARTMENT
PROJECT ENGINEERING MANAGEMENT
BHARAT HEAVY ELECTRICALS LIMITED
POWER SECTOR
NOIDA**

PREPARED BY	CHECKED BY	APPROVED BY
NEHA JAIN	SEEMA KHATRI	SC SHARMA
SR. ENGR. (C&I)	DY. MGR. (C&I)	SR. MGR. (SH-I02,C&I)
		

INDEX

S. No.	DESCRIPTION
1.	TITLE SHEET
2.	INDEX SHEET
3.	SPECIFIC TECHNICAL REQUIREMENTS (C&I)
4.	LIST OF DOCUMENTS/DELIVERABLES
5.	ACTUATORS DATA SHEET
6.	FIELD & MEASURING INSTRUMENTS
7.	QUALITY ASSURANCE PLAN
8.	INSTRUMENT INTALLATION DIAGRAM
9.	VENDOR LIST
10.	MANDATORY SPARES

SPECIFIC TECHNICAL REQUIREMENT

|

Specific Technical Requirements

1. The Control of MRHS shall be through standalone DDCMIS based control system (BHEL's scope) in MRS Control room.
2. Conveying air compressor's control & operation shall be from MRHS control system. Each compressor shall have own microprocessor based control system also, which shall be further interfaced (Hardwired & redundant soft wired) with MRHS control system for overall control, operation & monitoring of compressors.
3. The make/model of various instruments/items/systems shall be subject to approval of owner/purchaser during detailed engineering stage. No commercial implication in this regard shall be acceptable. In case of any conflict and repetition of clauses in the specification, the more stringent requirements among them are to be complied with.
4. Drawings/Documents and data to be furnished after award of the contract as per deliverables list.
5. All local gauges as well as transmitters, sensors and switches for parameters like pressure, temperature, level, flow etc. as required for the safe and efficient operation and maintenance under the scope of specification shall be provided. The necessary root valves, impulse piping, drain cock, gauge-zeroing cocks, valve manifolds and all the other accessories required for mounting / erection of these local instruments shall be furnished even if not specifically asked for. The proposal shall include the necessary cables, flexible conduits, junction boxes and accessories for the above purpose. Double root valves shall be provided for all pressure tapping where the pressure exceeds 40 Kg / Cm².
6. All field instruments shall be weatherproof, drip tight, dust tight and splash proof suitable for use under outdoor ambient conditions prevalent in the subject plant. All field-mounted instruments shall be mounted in suitable locations where maximum accessibility for maintenance is achieved. The enclosures of all electronic instruments shall conform to IP-65 unless otherwise specified (Explosion proof for NEC article 500, class 1, Division 1 area & flame proof) and an anticorrosive paint shall be applied to the field mounted enclosures / instruments. All the field instruments shall also be provided with SS tag nameplate and double compression type Nickel-plated brass cable gland. Gaskets, Fasteners, Counter and mating flange shall also be included wherever required with the field instruments.
7. Components of instruments, control devices, accessories, piping etc. Which contact with steam, condensate or boiler feed water shall be manufactured from copper free materials which do not react with media at operating parameters.
8. All electrical actuators shall be conventional type of integral starter.

9. All motorized valves of 200NB or more than 200NB size shall be provided with integral motorized bypass valves on all process lines.
10. All the instruments/equipments/electrical items shall be provided & designed with maximum star rating as available in line with energy conservation policies notified by BEE, GOI at the time of supply.
11. All instruments should be supplied with valid calibration and test certificates provided by OEM. All transmitters shall be HART compatible.
12. Temperature transmitters shall be provided, wherever Temperature measurement is required for monitoring purpose.
13. Bidder to provide mandatory spares as per mandatory spares list.
14. All the instruments/drives shall be terminated on JB's/Panels in field. JB's/Panels shall be in Bidder's scope. Bidder to consider minimum 10 nos. of JB's.
15. Bidder to furnish electrical load/UPS load data during detailed engineering.
16. The instrumentation to be provided for each of the plant auxiliary & Off Site Plant systems shall be as per the technical specification document / drawings wherever provided for the respective systems as a minimum requirement for bidding purpose. However, for completeness of each of the plant auxiliary & Off Site system and its associated equipment, Bidder shall also provide all the necessary instruments to the process requirement even if it is not specifically indicated in the given technical Specification document /drawings.
17. All the instruments indicated in P&ID are minimum requirement and it is mandatory to use sensors/signals/measurements with 2 out of 3 logic for critical control & protection (Analog & Binary) Application/service and sensors with 1 out of 2 logic for all other control & interlock (Analog & Binary) application/service. Dual sensors shall be provided for instruments required for auto starting of LT driven pumps or LT driven pump tripping due to very low level of water/discharge pressure very low.
18. Dual measurement scheme for analog inputs employing two independent transmitters/ temperature element, connected to separate tapping points shall be employed for the remaining measurements used for analog control functions.
19. All the instruments/sensors/transmitters/switches meant for redundant applications shall have completely separate and independent impulse pipes/root valves etc. No redundant instrument shall share a single process tapping. There will be separate and independent tapping for every individual instrument.
20. For cable scope refer to electrical scope between BHEL and vendor defined in electrical specification.

21. All local gauges, transmitters and switches shall be mounted on suitable enclosures, racks subject to owner's approval. All transmitters shall be HART compatible.
22. Local control panel if any required for operation shall be in bidder's scope.
23. Bidder's presence is required for 3 Man days (Excluding travel time) at EDN Bangalore during FAT of DDCMIS for certifying correctness & completeness of implementation of Control logic. Intimation to attend FAT shall be informed in 2 days advance. All the expenses like boarding, lodging and travel, Air fare etc. shall be in bidder's scope.
24. Contractor's C&I representative shall be present at BHEL-PEM for 3 mandays, for preparation of Control scheme of MRHS. All the expenses like boarding, lodging and travel, Air fare etc. shall be in bidder's scope.
25. Bidder's presence is required for 15 Man days (in three visit) at site during commissioning of DDCMIS for assistance related to process correctness. Three visit with total 15 Man days (Excluding travel time) in which one visit shall be of 5 Man days each. All the expenses like boarding, lodging and travel, Air fare etc. shall be in bidder's scope.
26. Bidder must offer general tools and tackles and special calibration instruments required during start-up, trial run, operation and maintenance of the system.
27. All approval/Inspection are to be carried out by Owner or owner appointed agency only.
28. Number of pairs to be selected for Screen /Control cable (Size : 0.5 mm²)
 - a. F-Type: 2P/4P/8P/12P/24P
 - b. G-Type: 4P/8P/12P
29. Power supply for instruments, analysers etc. shall be provided at a single point which shall be decided during detail engineering. Further any electrical distribution shall be in bidder's scope. Any other voltage requirement for Instruments, analysers etc. to be arranged/derived by bidder by providing suitable control transformer.
30. These requirements are to be read in conjunction with detailed Technical specification enclosed in the specification. Further in case of any discrepancy in the requirement noted by the bidder in the specification, the same will be brought to the notice of BHEL in the form of pre- bid clarification. In absence of any pre-bid clarification, the more stringent requirement as per interpretation of Customer shall prevail without any commercial implication.

LIST OF DOCUMENTS/DELIVERABLES

|

LIST OF VENDOR DELIVERABLES FOR C&I FOR MRS (1X 800 MW NORTH CHENNAI STPP)			
SI.No.	DRAWING NO.	DRAWING/DOCUMENT TITLE	CATEGORY
1	PE-V0-423-160-I901	CONTROL & OPERATIONAL WRITE-UP FOR THE SYSTEM	A
2	PE-V0-423-160-I902	CONTROL SCHEME/LOGIC DIAGRAM(TO BE IMPLEMENTED IN DCS)	A
3	PE-V0-423-160-I903	HMI PICTURES/PLANT SCHEMATICS	I
4	PE-V0-423-160-I904	INSTRUMENT SCHEDULE with set points	A
5	PE-V0-423-160-I905	GROUPING AND TERMINATION	A
6	PE-V0-423-160-I906	I/O LIST (ANALOG & BINARY)	A
7	PE-V0-423-160-I907	DRIVE LIST/SOLENOID/ACTUATOR VALVE LIST WITH LOCATION DATA	A
8	PE-V0-423-160-I908	DATASHEETS FOR INSTRUMENTS, JBs,Analysers etc.along with catalogue	A
9	PE-V0-423-160-I909	INSTRUMENT HOOK-UP DRAWING	A
10	PE-V0-423-160-I910	QUALITY PLANS/CHECK LISTS (For all applicable instruments)	A
11	PE-V0-423-160-I911	CABLE SCHEDULE & INTERCONNECTION	I
12	PE-V0-423-160-I912	ANNUNCIATION & SOE LIST	A
NOTES:			
1. ANY OTHER DOCUMENT DECIDED DURING DETAILED ENGINEERING SHALL BE PROVIDED BY BIDDER WITHOUT ANY COMMERCIAL/TECHNICAL IMPLICATION.			
2. CONTRACTOR TO SUBMIT REUSABLE DATABASE FORMATS IN BHEL/CUSTOMER APPROVED FORMATS LIKE MS EXCEL,MS ACCESS OF DOCUMENTS LIKE INSTRUMENT SCHEDULE, I/O LIST, DRIVE LIST,FIELD JB TERMINATIONS, CABLE SCHEDULE & INTERCONNECTION, etc. SOFT COPY OF FORMATS SHALL BE PROVIDED TO SUCCESSFUL BIDDERS.			

ACTUATORS

|

	SPECIFICATION FOR MOTORISED VALVE ACTUATOR		SPECIFICATION NO.: PE-DG-412-145-1902	
			VOLUME II B	
			SECTION D	
			REV. NO. 02	DATE: 28.03.17
			SHEET 2	OF 4
Data Sheet A & B				
DATA SHEET-A (TO BE FILLED BY PURCHASER)			DATA SHEET-B (TO BE FILLED-UP BY BIDDER)	
GENERAL*	* PROJECT	2x 660 MW ENNORE SUPERCRITICAL TPP		
	OFFER REFERENCE			
	* TAG NO. SERVICE			
	* DUTY	☐ ON / OFF ☐ INCHING		
	* LINE SIZE (inlet/outlet): MATERIAL			
	* VALVE TYPE	☐ GLOBE ☐ GATE ☐ REG. GLOBE ☐ BUTTERFLY		
	* OPENING / CLOSING TIME			
	* WORKING PRESSURE			
	AMBIENT CONDITION	SHALL BE SUITABLE FOR CONTINUOUS OPERATION UNDER AN AMBIENT TEMP. OF 0-55 DEG C AND RELATIVE HUMIDITY OF 0-95%		
	VALVE SEAT TEST PRESS	BIDDER TO SPECIFY		
	REQUIRED VALVE TORQUE	BIDDER TO SPECIFY		
	ACTUATOR RATED TORQUE	BIDDER TO SPECIFY		
CONSTRUCTION AND SIZING	CONSTRUCTION	TOTALLY ENCLOSED, WEATHER PROOF, IP:68		
	MECHANICAL POSITION INDICATOR	TO BE PROVIDED FOR 0-100% TRAVEL		
	BEARINGS	DOUBLE SHIELDED, GREASE LUBRICATED ANTI-FRICTION.		
	GEAR TRAIN FOR LIMIT SWITCH/TORQUE SWITCH OPERATION	METAL (NOT FIBRE GEARS). SELF-LOCKING TO PREVENT DRIFT UNDER TORQUE SWITCH SPRING PRESSURE WHEN MOTOR IS DE-ENERGIZED.		
	SIZING	OPEN/CLOSE AT RATED SPEED AGAINST DESIGNED DIFFERENTIAL PRESSURE AT 85% OF RATED VOLTAGE. FOR ISOLATING SERVICE THREE SUCCESSIVE OPEN-CLOSE OPERATIONS OR 15 MINS. WHICHEVER IS HIGHER. FOR INCHING SERVICE - 150 STARTS/HR MINIMUM & FOR REGULATING SERVICE - 600 STARTS/HR MINIMUM.		
HANDWHEEL	* REQUIRED	☒ YES ☐ NO		
	* ORIENTATION	☐ TOP MOUNTED ☐ SIDE MOUNTED		
	*TO DISENGAGE AUTOMATICALLY DURING MOTOR OPERATION.			
ELECTRIC ACTUATOR	ACTUATOR MAKE/MODEL	BIDDER TO SPECIFY		
	MOTOR MAKE / MODEL / TYPE / RATING (KW)	BIDDER TO SPECIFY		
	@ MOTOR TYPE	SQUIRREL CAGE INDUCTION MOTOR, STARTING CURRENT LIMITED TO SIX TIMES THE RATED CURRENT- INCLUSIVE OF I.S. TOLERANCE		
	ACTUATOR APPLICABLE WIRING DIAGRAM	☐ ENCLOSED (BIDDER TO CONFIRM) A: ☐ DRG. NO. 3-V-MISC-24227 R00 B: ☐ DRG. NO. 3-V-MISC-24550 R00 C: ☐ DRG. NO. 3-V-MISC-24283 R00 D: ☐ DRG. NO. 4-V-MISC-90271 R11 E: ☐ For Thyristor based Integral starter, Bidder/Vendor to furnish wiring diagram		
	COLOUR SHADE	☐ BLUE (RAL 5012) ☐		
	PAINT TYPE (## Refer Notes)	☐ ENAMEL ☒ EPOXY ☐		
	SHAFT RPM	BIDDER TO SPECIFY		
	OLR SET VALUE	BIDDER TO SPECIFY		
	@ STARTING / FULL LOAD CURRENT	BIDDER TO SPECIFY		
	NO. OF REV FOR FULL TRAVEL	BIDDER TO SPECIFY		
	@ PWR SUPP TO MTR / STARTER	415V, 3PH, AC		
	@ CONTROL VOLTAGE REQUIREMENT	TO BE DERIVED FROM THE POWER SUPPLY TO THE STARTER ☐ 230 V ☐ 110 V		

	SPECIFICATION FOR MOTORISED VALVE ACTUATOR		SPECIFICATION NO.: PE-DG-412-145-1902	
			VOLUME II B	
			SECTION D	
			REV. NO. 02	DATE: 28.03.17
			SHEET 3	OF 4
Data Sheet A & B				
DATA SHEET-A (TO BE FILLED BY PURCHASER)			DATA SHEET-B (TO BE FILLED-UP BY BIDDER)	
	@ ENCLOSURE CLASS OF MOTOR	☒ IP 68 ☐ FLAME PROOF		
	@ INSULATION CLASS	CLASS-F TEMP. RISE LIMITED TO CLASS-B		
	@ WINDING TEMP PROTECTION	☒ THERMOSTAT (3 Nos., 1 IN EACH PHASE) ☐ -----		
	SINGLE PHASE / WRONG PHASE SEQUENCE PROTECTION	REQUIRED		
INTEGRAL STARTER	INTEGRAL STARTER	☒ REQUIRED ☐ NOT REQUIRED		
	TYPE OF SWITCHING DEVICE	☒ CONTACTORS ☐ THYRISTORS		
	TYPE	☒ CONVENTIONAL ☐ SMART (NON-INTRUSIVE)		
	STEP DOWN CONT. TRANSFORMER	☒ REQUIRED		
	OPEN / CLOSE PB	☒ REQUIRED ☐ NOT REQUIRED		
	STOP PB	☒ REQUIRED ☐ NOT REQUIRED		
	INDICATING LAMPS	☒ REQUIRED ☐ NOT REQUIRED		
	LOCAL REMOTE S/S	☒ REQUIRED ☐ NOT REQUIRED		
	STATUS CONTACTS FOR MONITORING	☒ REQUIRED ☐ NOT REQUIRED		
	INTEGRAL STARTER DISTURBED SIGNAL	REQUIRED (MOTOR THERMOSTAT TRIP, O/L RELAY OPERATED, CONT./POWER SUPPLY FAILED, PHASE LOSS, S/S IN LOCAL or OFF MODE, STOP PB OPTD, TORQUE OPEN/CLOSE CUTOFF)		
INTERPOSING RELAY/OPTO COUPLER (Applicable for integral Starter)	TYPE OF ISOLATING DEVICE	☐ INTERPOSING RELAY ☐ OPTO COUPLER ☐ EITHER		
	QUANTITY	☒ 2 NOs. ☐ 3 Nos. *		
	DRIVING VOLTAGE	☒ 20.5 – 24V DC ☐ _____ V DC		
	DRIVING CURRENT	☒ 125mA MAX ☐ _____ mA MAX		
	LOAD RESISTANCE	☒ > 192 ohms - <25 k ohms ☐ > _____ ohms - < _____ ohms		
TORQUE SWITCH (Not Applicable for Smart Actuator) (\$\$ Refer Notes)	MFR & MODEL NO.	BIDDER TO SPECIFY		
	OPEN / CLOSE	☒ 1 No. ☐ 2Nos. / ☒ 1 No. ☐ 2Nos		
	CONTACT TYPE	2 NO + 2 NC		
	RATING	5A 240V AC AND 0.5A 220V DC		
	CALIBRATED KNOBS(OPEN&CLOSE TS)	REQUIRED FOR SETTING DESIRED TORQUE		
	ACCURACY	+3% OF SET VALUE		
LIMIT SWITCH (Not Applicable for Smart Actuator) (\$\$ Refer Notes)	MFR & MODEL NO.	BIDDER TO SPECIFY		
	OPEN : INT : CLOSE	☐ 1 No. ☒ 2 Nos.	2 Nos. (ADJ.)	☐ 1 No. ☒ 2Nos.
	CONTACT TYPE	2 NO + 2 NC		
	RATING (AC / DC)	5A 240V AC AND 0.5A 220V DC		

*For inching type drives IPR 3 Nos. to be considered for inching operation.





SPECIFICATION FOR MOTORISED VALVE ACTUATOR

SPECIFICATION NO.: PE-DG-412-145-1902

VOLUME II B

SECTION D

REV. NO. 02

DATE: 28.03.17

SHEET 4

OF 4

Data Sheet A & B

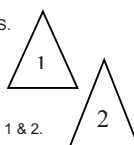
DATA SHEET-A
(TO BE FILLED BY PURCHASER)

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

POSITION TRANSMITTER	POSITION TRANSMITTER (For inching duty & other specific applications)	☒ REQUIRED ☐ NOT REQUIRED	
	MFR & MODEL NO.	BIDDER TO SPECIFY	
	TYPE	☐ ELECTRONIC (2 WIRE) R/I CONVERTER ☒ ELECTRONIC (2 WIRE) CONTACTLESS	
	SUPPLY	☒ 24V DC ☐	
	OUTPUT	☒ 4-20mA	
	ACCURACY	± 1% FS	
SPACE HEATER	@SPACE HEATER	REQUIRED	
	@ POWER SUPPLY (NON INTEGRAL)	230V AC, 1 PH., 50 Hz	
	@ POWER SUPPLY (INTEGRAL)	BIDDER TO SPECIFY	
	@ RATING		
TERMINAL BOX	ACTUATOR/MOTOR TERMINAL BOX	REQUIRED	
	ENCL CLASS ACTUATOR/MOTOR T.B.	@ ☒ IP 68 @ ☐	
	@ EARTHING TERMINAL	REQUIRED	
	PLUG & SOCKET (9 PIN) (FOR COMMD, LS/TS FEED BACK, PoT)	☐ REQUIRED ☒ NOT REQUIRED ☐ ☐ 2 NOS. ☐	
CABLE GLANDS	@ POWER CABLE GLAND	SIZE: suitable for 3Cx2.5sq mm Cu	
	@ SPACE HEATER CABLE GLAND	SIZE:-	
	OTHER CONTROL CABLE GLANDS	QUANTITY & SIZE: Cable gland suitable for 8Px0.5 sq mm & 2P x 0.5 sq mm cable.	
WEIGHT	TOTAL WEIGHT (ACTUATOR + ACCESSORIES)	BIDDER TO SPECIFY	_____ Kg.

NOTES:

1. **SCOPE:** DESIGN, MANUFACTURE, INSPECTION, TESTING AND DELIVERY TO SITE OF ELECTRIC ACTUATOR FOR INCHING OR OPEN / CLOSE DUTY.
 2. **CODES & STANDARDS:** DESIGN AND MATERIALS USED SHALL COMPLY WITH THE RELEVANT LATEST NATIONAL AND INTERNATIONAL STANDARD. AS A MINIMUM, THE FOLLOWING STANDARDS SHALL BE COMPLIED WITH:
IS-9334, IS-2147, IS-2148, IS-325, IS-2959, IS-4691 AND IS-4722
 3. ACTUATOR SHALL HAVE HARDWIRED CONTACTS FOR FOLLOWING SIGNALS (a) ACTUATOR IN LOCAL MODE (b) ACTUATOR IN REMOTE MODE
 4. BIDDER TO ENSURE AVAILABILITY OF SPARE 1NO + 1NC LIMIT SWITCH & TORQUE SWITCH.
 5. SS TAG NAME PLATE SHALL BE PROVIDED.
 6. TEMPERATURE RISE SHALL BE RESTRICTED TO 70 DEG. C FOR AMBIENT TEMPERATURE OF 50 DEG C.
 7. CABLE GLANDS OF DOUBLE COMPRESSION TYPE, Ni PLATED BRASS MATERIAL SHALL BE PROVIDED.
 8. THE TORQUE SWITCHES SHALL BE PROVIDED WITH MECHANICAL LATCHING DEVICE TO PREVENT OPERATION WHEN UNSEATING FROM THE END POSITIONS. THE LATCHING DEVICE SHALL UNLATCH AS SOON AS THE VALVE LEAVES THE END POSITION. IF SUCH PROVISION IS NOT POSSIBLE, THE TORQUE SWITCHES SHALL BE BYPASSED BY END-POSITION LIMIT SWITCHES WHICH OPENS ON VALVE LEAVING END POSITION. THESE LIMIT SWITCHES ARE ADDITIONAL TO THE NUMBER OF LIMIT SWITCHES SPECIFIED ELSEWHERE.
 9. THE MOTOR SHALL OPERATE SATISFACTORILY UNDER THE +/- 10% SUPPLY VOLTAGE VARIATION AT RATED FREQUENCY, -5% TO +3% VARIATION IN FREQUENCY AT RATED SUPPLY VOLTAGE, SIMULTANEOUS VARIATION IN VOLTAGE & FREQUENCY THE SUM OF ABSOLUTE PERCENTAGE NOT EXCEEDING 10%.
 10. THE MOTOR SHALL BE SUITABLE FOR DIRECT ON LINE STARTING.
 11. LOCAL DIGITAL POSITION INDICATOR SHALL BE PROVIDED FOR INCHING DUTY DRIVES.
 12. COMMANDS SHALL BE LATCHED AT INTEGRAL STARTER END.
 13. SWITCHES SHALL BE TERMINATED IN JB MOUNTED ON ACTUATOR.
 14. ACTUATORS FOR HAZARDOUS AREA SHALL BE CERTIFIED FLAME PROOF FOR ZONES 1 & 2.
- \$\$ TORQUE SWITCH & LIMIT SWITCH SHALL ACT INDEPENDENT OF EACH OTHER. TANDEM OPERATION IS NOT ACCEPTABLE.**
- ## EPOXY PAINT IS RECOMMENDED FOR COASTAL AREAS.**



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

FIELD & MEASURING INSTRUMENTS

|



CHAPTER-3

FIELD AND MEASURING INSTRUMENTS

2.3.3 Field & Measuring Instruments (Primary & Secondary Instruments)

2.3.3.1 General requirements

Instruments, control devices and other equipment accessories covered under this specification shall be furnished in accordance with I&C specification sheets and drawings enclosed herewith and the requirements of all applicable clauses of this specification.

The instrumentation and control equipment shall conform to all applicable codes and standards including those referred in Cl. no. 2.3.1.6 in this Volume. All equipment and systems shall also fully comply with the design criteria stated in chapter-2 of this part.

The instrumentation/control equipment and accessories shall be from the latest proven design for which the performance and high availability have been demonstrated by a considerable record of successful operation in power station service for similar applications. The bidder shall furnish sufficient evidence to fully satisfy the Owner in this regard.

For plug in type instruments, the plug & sockets shall be polarized to prevent wrong connections and have facility for secure coupling in plug-in position to prevent loose connections.

Signal/Electrical connection shall be screwed connection with double compression type Nickel-plated brass cable glands for Explosion proof area, Flame proof area and high vibration prone area.

Every instrument requiring power supply shall be provided with a pair of easily replaceable glass cartridge fuse of suitable rating. Every instrument shall be provided with a grounding terminal and shall be suitably connected to the panel grounding bus.

All field instruments shall be weatherproof, drip tight, dust tight and splash proof suitable for use under outdoor ambient conditions prevalent in the subject plant. All field-mounted instruments shall be mounted in suitable locations where maximum accessibility for maintenance is achieved. The enclosures of all electronic instruments shall conform to IP-65 unless otherwise specified (Explosion proof for NEC article 500, class 1, Division 1 area & flame proof) and an anticorrosive paint shall be applied to the field mounted enclosures / instruments. All the field instruments shall also be provided with SS tag nameplate and double compression type Nickel-plated brass cable gland. Gaskets, Fasteners, Counter and mating flange shall also be included wherever required with the field instruments.

Following minimum requirement of field instruments shall be fulfilled by Bidder (In addition, Redundancy criteria for field instruments shall be as specified elsewhere in specification): -

- a. Level switches / pressure switches / flow switches/any other process switches etc. for OLCS / Alarms / Interlocks / Protection. Pressure switches at inlet, outlet of individual pumps and discharge header of pumps for protection and auto start / stop & alarms.
- b. Level switches (Type as per Owner approval) for sump/tank level high/normal/ low/very low interlocks.
- c. Level Transmitters (Type as per Owner approval) for open sump/ tank/bunker/vessel/heaters.
- d. Stand pipes on both side of tank for all level instruments (LT, LS & LG).
- e. ~~Flow elements (Type as per Owner approval) with flow transmitter & Flow meter for flow measurement of process medium like Steam, Water, Air, Flue Gas, Fuel oil, open channel liquid, solid fuel, ash flow, DM water, Raw water, Instrument and Service air etc. as decided by owner.~~
- f. Pressure gauges and temp. Gauges at inlet and outlet of each heat exchanger and cooler.
- g. DPG, DPT & DPS across the filters/strainers.
- h. Tapping points/test points shall be provided.
- i. ~~All primary Instruments, hardwares & JB's etc. used for measurement for HFO, LDO & Turbine Lube Oil system shall be flame proof (IEC-79.1, Part I). All primary Instruments, hardwares & JB's etc. used for measurement for Hydrogen shall be intrinsically safe and explosion proof as per NEC article 500, class 1, Division 1 area I.~~
- j. All Thermocouples & RTDs (Type as per Owner approval) shall be Duplex. Thermocouples shall be provided for Services with Temperature > 200 deg C.
- k. All Field Instruments used in acid or alkaline atmosphere shall be with standard Anti corrosion coating i.e. the combination of Polyurethane and epoxy resin baked coating (ANSI/ISA-71.04).
- l. All primary instruments installed at "Minus level or Floor" shall be with protection class of IP 68.
- m. Transmitters (all type) for monitoring & controls purpose.
- n. ~~Bidder shall provide electronics weighing in motion system as per IS-11547, hermitically sealed load cell of precision strain gauge type, 100% over load protection of cell and 250% overload protection for the construction; one calibrator attachment with two Weigher.~~
- o. All field mounted push button, selector switch etc. shall be as per IEC or NEMA 4X protection.

- p. All limit switch shall be conform to IEC-60947-5-1 and shall have minimum 2SPDT/DPDT contacts.
- q. ~~At APH, temperature measuring device of different lengths forming grid shall be provided to have average temperature for variable flow of flue gas, secondary air and primary air. These temperatures may be connected to nearest remote I/O panel.~~
- r. ~~On both left and right sides of furnace, separate lines shall be laid and provided with furnace pressure transmitters having wide range than the furnace pressure transmitters used for modulating control.~~
- s. Temp. Transmitters are envisaged with RTD & Thermocouples for monitoring services / application only. However any RTD & Thermocouples are used for control, interlock & protection application, same shall be directly wired to DDCMIS/DCS using instrumentation & Extension cables respectively.
- t. As for the water flow/ steam flow measurements, necessary flow elements/ transmitters are chosen in the process line and supplied such that their algebraic summation shall be mass balanced for calculating the system efficiency.
- u. Non-contact type electronic 2-wire position transmitters shall be provided for all inching type motorised valves and dampers.
- v. ~~For CW sump level, Turbine oil tank, Ash Silo, LDO/HFO tank, DM water tanks, CS tank, Acid and alkali applications, only noncontact type level transmitters like Acoustic, Ultrasonic, and Radar based (Type as per Owner approval) shall be provided by bidders as specified in Tender Specification and as approved by owner.~~
- w. ~~For Turbine oil, HFO/LDO applications & H2 Gas application, Zener protection on power supplies shall be included.~~
- x. ~~Where the process fluids are corrosive, viscous, solid bearing or slurry type, diaphragm seals shall be provided. Parts below the diaphragm shall be removable for cleaning. The entire volume above the diaphragm shall be completely filled with an inert liquid suitable for the application. For HFO, LFO Applications, SS capillary with thin wafer element with ANSI RF flanged ends are to be provided. For hazardous area, explosions proof enclosure as described in NEC article 500 shall be provided.~~
- y. ~~Considering the type of application, wireless technology to bring signals to DDCMIS may be adopted by interfacing with OPC gateway to avoid cabling for smart level transmitters specified above at sr. no. xxi, in case used for monitoring only. However Wireless technology as adopted by Bidder shall be reliable and field proven in power plants and same shall be approved by Owner. Wirelss transmitters shall have the same minimum specification/ parameters as mentioned for wired transmitters.~~



EPC TENDER SPECIFICATION FOR BTG PACKAGE

- z. Gauges (all type) for local monitoring in field.
- aa. Each switching element including the limit and torque switches of valve actuators shall be provided with minimum two contacts i.e. 2SPDT OR DPDT.
- bb. All instruments should be supplied with valid calibration and test certificates provided by OEM.
- cc. Canopy/Enclosure shall be provided for field instruments like transmitters, switches & flow meters, etc and any other equipment to protect from direct sun light, lightning & rain.

Field instruments shall be supplied & offered as per data sheets specified below:

2.3.3.2 Transmitters, Switches, Gauges and Panel Mounted Instruments

i) Pressure, Differential Pressure, DP type Level and Flow Transmitters (PT, DPT, LT & FT)

Smart Transmitters of the electronic type shall be furnished. All Transmitter shall be installed in closed LIE in the boiler area. Similarly transmitter for TG shall also be in LIE except the transmitters located in covered area on TG floor and these shall be mounted in LIR. Transmitters shall be equipped with mounting brackets suitable for a mounting in transmitter enclosures.

In general, Transmitters are envisaged to be grouped at several places as to be decided during detailed engg. Stage. For this purpose, suitable enclosures complete with all tubing, fittings, purge meters, loop cable trays etc. shall be provided.

S.No	Features	Essential / Minimum Requirements
1	Type/Construction	Sealed capacitance/ Inductance/ Silicon resonance type
2	Material	
	Body	Die cast Aluminium with epoxy coating for air & flue gas, SS316 for other services
	Diaphragm	SS316 With Teflon seal for process requirement/process media for other services
	Measurement element	316 SS (Suitable material/coating for Hydrogen pressure transmitters/Differential pressure transmitters) the suitable material/coating shall be chosen as per the suggestion of transmitter manufacturer.
	Valves	Carbon steel for non-corrosive applications & SS316 for corrosive applications
3	Output Signal	4 to 20 m Amp. DC (Two wires) HART Compatible
4	Local Indicator	LCD indicator (5 digit) with scale of Engg. unit
5	Overall Accuracy	± 0.04% or better of Span for BTG package ± 0.065% or better of Span for BOP packages ± 0.2% or better of span for remote seal type transmitter.
6	Turn down ratio	100:1 in general

S.No	Features	Essential / Minimum Requirements
		10:1 for vacuum/very low pressure applications. 10:1 for very high pressure application. 30:1 for other applications.
7	Stability	+ 0.15% of URL for 5 years.
8	Response time	150 msec.
9	Power supply	24V DC nominal
10	Load Impedance	500 Ohms (min.)
11	Drive capability	600 Ohms nominal
12	Enclosure Class	IP-65 (Explosion proof for NEC Class-1, Division 1 area)
13	Span and Zero	Locally adjustable, non-interacting
14	Zero suppression / elevation	At least 100% of Span
15	Connection	
	Process	Half (1/2) inch NPT (F) Quarter (1/4) inch NPT with / without oval flanges
	Electrical	Suitable for Plug in type connection (Both side of transmitter), unused entry with blind plug.
16	Accessories	
	For Absolute Pressure Transmitters	Two (2) valve SS316 manifold
	For Gauge & Vacuum pressure transmitter	Three (3) valve SS316 manifold
	For DP, level & flow transmitter	Five (5) valve SS316 manifold
	For oil and corrosive liquids	Separator diaphragm seals
	For all transmitters	Mounting bracket
	Steam Service	Syphon
	Pumps Discharge service	Snubbers
17	Adjustment / calibration From hand held calibrator / centralized OWS based system / maintenance (as applicable).	From hand held calibrator/centralized OWS based system
18	IBR Requirement	For high pressure service, Process tapping and root valves are as per IBR rules and regulations

Manifold should not be mounted on the transmitter, Manifold shall be non integral and standalone type. Snubbers/Pulsation dampners shall be used where the process media is unstable for measurement such as the discharge of a pump. Over range protection shall be used where necessary. The coil syphons & condensate pots shall be used for steam services. Transmitters shall be provided with suitable drain & vent points.

~~Transmitters, smart positioner & other HART based instruments shall be supplied along with 4 Nos. of universal type hand held/portable calibrators. Temperature transmitters shall be supplied along with 4 Nos. of hand held/portable mV source generators/signal reader.~~

~~If one type of hand held type calibrator is not suitable for communicating with all types of transmitters then separate hand held calibrator will be provided.~~

Following minimum accessories shall be provided with each set:-

- a) Soft carrying case with adjustable shoulder straps & lead compartments.
- b) HART lead set.
- c) Rechargeable batteries.
- d) Battery charger.
- e) Power adaptor.
- f) Universal plug kit for power adaptor.
- g) Load resistor.
- h) Interfacing cables of each type as per requirements.
- i) Protective boot.
- j) Standard banana jack.
- k) Operation manual & software CD.
- l) Analysis & Diagnostic Software.

For flanged remote seal diaphragm:

- a) Maximum pressure rating : To meet 200 percent of process pressure
- b) Availability of seals : for both high and low pressure sides with capillary connection in case of differential pressure transmitters and
- c) Single Capillary connection for pressure transmitters.
- d) Capillary length : 6.0 m
- e) Fill fluid : Suitable oil
- f) Process connection size : 1 inch
- g) Flange size and Accessories : As per process requirement. Flange pressure rating : Required Class (ANSI)
- h) Process liquid : Sea water, Ash water, chemical, hydrogen gas, sea oil etc.,
- i) Process fluid temperature : 25°C to 60°C
- j) Diaphragm and wetted part material : Suitable for sea water, ash water and chemical applications.(offered material to be specified)
- k) Flushing option : To be made available with 1/4 inch (necessary drain and gasket suitable for sea water application to be provided)

ii) Pressure Switches (PS) & Differential Pressure Switches (DPS)

S.No	Features	Essential / Minimum Requirements
1	Applicable Standards	IS3624 - 1966/ISA-RP-8.1 except as modified in spec.
2	Materials	
	Bellows	316SS
	Bourdon tube	316SS
	Movement	316SS
	Enclosure	Die-cast aluminium with stoved enamel black finish. Epoxy coating shall be provided for corrosive atmosphere.
3	Type/Construction	Bourdon/Sealed Diaphragm Piston Actuated preferable. Indicators with contacts are not acceptable.
4	Protective Diaphragm	Teflon
5	Accuracy	± One (1) percent or better of full range



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

S.No	Features	Essential / Minimum Requirements
6	Repeatability	± 0.5(half) percent or better of full range
7	Setting & Differential	Adjustable
8	Contact	
	Number	DPDT /2 SPDT
	Type	Auto reset with internal Adjustable snap action micro switch
9	Rating	5 Amp, 240V AC / 0.2 Amp, 220V DC
10	End connection	½" NPT (F) / Manufactures Standards
11	Connection - instrument	Half (1/2) inch NPT Male Process
12	Electrical	Suitable for Plug in type connection. All the switches are internally connected and brought to the surface with Amphenol male/female connection. Cabling need not terminated inside the switch. Cable ends are to be soldered in connector and to be inserted for easy maintenance.
13	Over range protection	One Fifty (150) percent of full scale
14	Enclosure Class	IP-65 or better (Explosion/Flame proof for NEC Class-1, Division 1 area)
15	Dead band adjustment	Adjustment up to 10% at set points.
16	Accessories	
	3 / 5 valve manifold	As applicable for all switches
	Self cleaning type pulsation dampners / Snubbers (Material SS316)	Pump and compressor
	Syphon	For all steam lines
	Protective separating diaphragm	For fuel oil & corrosive liquid lines.
	Mounting	Local (in LIE/LIR for BTG package)
17	IBR Requirement	For high pressure service, Process tapping and root valves are as per IBR rules and regulations

iii) Pressure & Differential Pressure Gauges (PG & DPG)

S.No	Features	Essential / Minimum Requirements
1	Applicable Standards	IS:3602-1966, IS/3624, ASME B 40.1
2	Type / construction	
	760 mm to 1.0Kg/cm ²	Bellows/Diaphragm
	Above 1.0Kg/cm ²	Bourdon Tube
	Suction side of pumps	Compound gauge
3	Materials	
	Bellows	316SS
	Bourdon tube	316SS
	Movement	316SS
	Case Enclosure	SS 316 / Die-cast aluminium with stoved enamel black finish. Epoxy coating shall be provided for corrosive atmosphere.
4	End connection	½" NPT (M)
5	Protective Diaphragm	Teflon
6	Dial Size	150mm with shatter proof glass



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

S.No	Features	Essential / Minimum Requirements
7	Scale Details	Graduations in black lines on white dial, on white dial, 270 Deg. pointer deflection scale provided with glass cover. Smallest scale division shall be one (1) percent of full scale value or smaller. Pointer stop for all gauges.
8	Range Selection	Cover 125% of max. of scale
9	Accuracy	± One (1) percent or better
10	Instrument process connection	½" NPT Male (Back Entry)
11	Mounting Type	Local / 1/2 inch NPT Male (Back entry) mounted on local gauge board.
12	Protection Class	IP-65 or better (Explosion/Flame proof for NEC Class-1, Division 1 area)
13	Accessories	
	3 way needle valve / manifolds	For all gauges
	Self cleaning type	Pump and compressor discharge (Pulsation dampener / Snubbers (S316) lines
	Syphon	For all steam lines
	Protective separating	For fuel oil and corrosive liquid lines
14	Other Particulars	
	External Zero adjustment / Safety device	For all gauges
	Ranges 5 to 20 Kg/cm2	Rubber blow out disc with open front construction.
	Ranges above 20 Kg/cm2	Neoprene safety diaphragm at the back with solid front construction.
16	Over range protection	One Fifty (150) percent of full scale
17	Over Range Test	Test pr. For the assembly shall be 1.5 to the max. Design pr. At 38°C
18	Other Requirements	Movement mechanism shall be glycerine filled for oil services & vibration prone area.
		For Fuel oil & corrosive liquid lines diaphragm type sensors required. Armoured capillary of 10 M for Fuel oil & Corrosive liquid service.
		Contact type pressure gauges are not acceptable for interlock & protection.
		For condensate storage tank the pressure gauge in terms of 0-10000 mmwcl or suitable range having dial size of 300mm or bigger size shall be provided.
19	IBR Requirement	For high pressure service, Process tapping and root valves are as per IBR rules and regulations

2.3.3.3 Temperature Related Instruments

a) Temperature Transmitters (TT)

S.No	Features	Essential / Minimum Requirements
1	Type	SMART type configurable from control room through HART protocol (HMS System).
2	Display type	Indicating type (5 digit LCD Display),
3	Accuracy	±0.10%,



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

S.No	Features	Essential / Minimum Requirements
4	Ambient temperature error	0.1% per 10°C change
5	Input	Same transmitter shall be capable to handle Pt- 100 RTD, Thermocouples –K&R types (input type to be selectable at site through HART terminal)
6	Output	4-20 mA DC (2 wire system) HART compatible signals for analogue monitoring inputs to the distributed control system (DDCMIS), DCS & PLC.
7	Isolation	Min. 500 V AC
8	EMC compatibility	as per EN 61326
9	Operating ambient temperature	0 to 85 deg C (without indicator) 0 to 70 deg C (with indicator)
10	Protection class	NEMA 4 / IP66 or equivalent degree of protection for enclosure)/ (Explosion/Flameproof for NEC Class-1, Division 1 area)/flame proof (IEC-79.1, Part I). As applicable).
11	Material of accessories	SS316
12	Stability	± 0.1 % or ± 0.1 deg C of reading (whichever is great) for 2 years in case of RTD inputs and for 1 year in case of Thermocouples inputs.
13	Operating Voltage	16 – 48 V DC
14	Calibration	As per NIST monograph 125 for T/C & European Curve Alpha = 0.00385 for RTD.
15	Ref. Junction compensation	Provided
16	Span/zero adjustment	Locally adjustable, Non interacting
17	Auto calibration	Provided
18	Burn out protection upscale	Provided
19	Input - output isolation	Provided
20	Circuit ungrounded	Provided
21	Accessories	Mounting arrangements including Clamps etc.
22	Composite Accuracy	For head mounted and DIN-rail mounted type RTD =<0.4% of 0-250 deg C span For dual-input type: RTD =<0.25% of 0-250 deg C span
23	For head mounted and DIN-rail mounted type RTD =<0.4% of 0-250 deg C span For dual-input type: RTD =<0.25% of 0-250 deg C span	Temperature transmitters of this category shall be field mounting type & shall be capable of withstanding operating ambient temperature up to 70 deg C. These modules shall be connected to DDCMIS through field bus such as Profibus, Foundation Field bus etc. directly from the transmitter. Maximum Number of inputs per such temperature transmitter shall be eight. These shall be mounted in cabinets in non-AC areas. As an alternate, these signals from temperature transmitters can be connected to DDCMIS through standard remote I/O modules of the DCS, in which case, the temperature transmitter signals will be acquired through 4-20mA input modules in the remote I/O cabinet for connecting to DDCMIS through remote I/O bus.



EPC TENDER SPECIFICATION FOR BTG PACKAGE

Any RTD or Thermocouples shall be directly wired to DDCMIS/DCS/PLC for metal temperature application, bearing & winding temp application only.

The Temperature transmitter shall accept Universal dual inputs of all types of thermocouples & RTD, 0-5V input signals etc.

Temp. Transmitter shall be extremely stable against ambient temp variation, the accuracy figure shall be inclusive of effect due to ambient temperature variation.

~~For BFPs' differential temperature protection by 2 out of 3 logic, DTT shall be employed to deliver 4-20 mA output to DDCMIS using suction & discharge temperature measurements.~~

Temperature Transmitters shall not be used for CLCS, OLCS, interlock & protection services anywhere in the plant with RTD & Thermocouples. However RTD & Thermocouples are used for control, interlock & protection application, same shall be directly wired to DDCMIS/DCS/PLC using instrumentation & Extension cables respectively.

These transmitters shall be connected with duplex sensors and shall have bump less change over facility to second sensor in case first sensor fails. This change-over is to be alarmed.

~~Considering the monitoring application & distance involved for monitoring parameters wireless technology shall be adopted by interfacing with DDCMIS through OPC connectivity. However Wireless technology as adopted by Bidder shall be reliable and field proven in power plants and same shall be approved by Owner. Wireless transmitters shall have the same minimum specification/parameters as mentioned for wired transmitters.~~

b) Resistance Temperature Sensors (RTD) with Thermo wells

S.No	Features	Essential / Minimum Requirements
1	Applicable Standard	ASME PTC 19.3 - Latest Revision DIN EN 60751:1996, BS EN/IEC60751: 2008
2	Element	Platinum, R0=100 ohm 4-wire, Duplex for Process Temp. Measurement Platinum, R0=100 ohm 3-wire Duplex for Bearing & Winding Temp. Measurement
3	Sheath Material/ Insulation	316SS/Compacted Magnesium Oxide (Purity above 99.4%)
4	Sheath O D	8 MM
5	Gauge	18 AWG
6	Terminals	Spring loaded high temperature ceramic base with silver plated brass for high vibrating locations.
7	Calibration	As per DIN Standard – 43760/IEC 60751, Class A
8	Head	Hex Head, Die Cast Aluminium (Screwed) with galvanized SS chain
9	Response Time	6-10 Sec bare & 30 Sec. With protective sheath/thermo well
10	Accuracy	± 0.35 degree C or Class-A whichever is better.



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

S.No	Features	Essential / Minimum Requirements
11	Electrical connection	Gold plated Plug in type. Double entry – one unused entry with blind plug
12	Enclosure Class	IP-65 or better (Explosion/Flame proof for NEC Class-1, Division 1 area)
13	Response Time	Repeat and contradictory.
14	Accessories	i. Adjustable nipple-union-nipple with thermo well ii. Compression fittings/unions Flanges etc. (for flanged connections only) iii. SS 316 forged thermo well as per ASME PTC
THERMOWELL		
15	Applicable Standard	ASME PTC 19.3 TW - 2010
16	Construction	Tapered drilled from Bar stock (Straight for Air & Gas systems)
17	Material	316 SS/F11/F22/F91 - water and steam Services depending upon process parameters. Inconel for air & flue gas services For furnace zone, impervious ceramic protecting tube of suitable material along with Incoloy supporting tubes and adjustable flanges. For Mill classifier outlet long life solid sintered tungsten carbide material or better of high abrasion resistance. Bidder shall provide calculation for thermo well as per ASME – PTC-19.3 2010. “All Thermo wells in high velocity steam service shall be checked for Strouhal’s frequency limit to arrive at a safer size and design of Thermo wells”.
18	Process Connection	(i) M 33 x 2 (ii) SS316 Flanged, for Air & Gas systems, with mating flanges, fasteners, gaskets etc.
19	Extension	Threaded union (SS316) 1/2" NPT (F) with two nipples of SS 316 having 1/2"NPT(M) threads at both ends
20	Immersion length	Within ± 10 mm of centre line of pipe and as per ASME – PTC-19.3 - 2010
21	Extension neck length	Minimum 100 mm above insulation of pipe and Minimum 160 mm when there is no insulation on pipe.
22	IBR Certification	For high pressure service, Steam Temp., Fuel oil temp. measurement as per IBR rules and regulations
23	Note : Extension /Compensating/paired cable exposed to atmosphere in the conventional method melts away due to high temperature or the head shall be more than 300 mm above the top of mill or due to coal burning. Hence The terminals of temperature sensors shall not be at the top of mills itself. The temperature sensors wires are to be laid up to JB though SS tube of required diameter and the head shall be placed nearer to the JB. In case, Duplex RTDs are not provided by bidder due to system/equipment limitation, two no. simplex RTD shall be provided instead of Duplex RTD. Both Simplex RTD shall be terminated at local JB/Termination Box.	



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

c) Thermocouples (T/C with T/W) With Thermo wells

S.No	Features	Essential / Minimum Requirements
1	Applicable standard	ASME PTC 19.3- Latest Revision ANSI-MC 96.1 – 1982, IEC 584-2
2	Element	Duplex
3	Sheath	8 MM OD
4	Sheath Material	316 SS
5	Spring Loaded	Yes
6	Nipple/Union	Yes
7	Packed connector	Compacted magnesium Oxide ungrounded
8	Type	i. Type K (Chromel - Alumel) ii. Type S/R (Platinum Rhodium-Platinum) iii. Type T (Cu-CuNi) with special limits to the standards
9	Gauge	16 AWG
10	Head	Die Cast Aluminium
11	Electrical connection	one unused entry with blind plug
12	Enclosure Class	IP-65 or better (Explosion/Flame proof for NEC Class-1, Division 1 area)
Thermo well		
13	Construction	Tapered Drilled from Bar stock (Straight for Air & Gas systems)
14	Material	316 SS/F11/F22/F91 - water and steam Services depending upon process parameters. - Inconel for air & flue gas services - For furnace zone, impervious ceramic protecting tube of suitable material along with Incoloy supporting tubes and adjustable flanges. - For Mill classifier outlet long life solid sintered tungsten carbide material or better of high abrasion resistance. Bidder shall provide calculation for thermo well as per ASME – PTC-19.3 2010. “All Thermo wells in high velocity steam service shall be checked for Strouhal’s frequency limit to arrive at a safer size and design of Thermo wells”.
15	Process Connection	SS316 Flanged, for Air & Gas systems, with mating flanges, gaskets, fasteners etc.
16	Extension	Threaded union (SS316) 1/2" NPT (F) with two nipples of SS 316 having 1/2"NPT(M) threads at both ends
Accuracy (Special Class as per IEC-751/ANSI-C-96.1)		
17	(For Type K T/C)	± 1.1 deg.C (for 0 to 277 deg.C) ± 0.4 percent (for 277 to 1280 deg.C) Class-A
18	For Type S & R T/C	± 0.6 deg.C or ± 0.1%
19	For Type T T/C	± 0.5 deg.C or ± 0.4%
20	Accessories	Bolts, nuts and gaskets for flanged connections.



1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III



EPC TENDER SPECIFICATION FOR BTG PACKAGE

S.No	Features	Essential / Minimum Requirements
	Response Time (Bare Thermocouple)	
21	For SH & RH Temp. Control	4-6 Sec.
22	All other applications	10 Sec.
23	Immersion length	Within + 10 mm of centre line of pipe and as per ASME – PTC-19.3 - 2010
24	Extension neck length	Minimum 100 mm above insulation of Pipe and minimum 160 mm when there is no insulation on pipe.
25	IBR Certification	For high pressure service, Steam Temp., Fuel oil temp. Measurement as per IBR rules and regulations.
26	Note Extension/Compensating cable exposed to atmosphere in the conventional method melts away due to high temperature or the head shall be more than 300 mm above the top of mill or due to coal burning. Hence The terminals of temperature sensors shall not be at the top of mills itself. The temperature sensors wires are to be laid up to JB though SS tube of required diameter and the head shall be placed nearer to the JB. CJC Boxes are not required, Thermocouple cables shall be directly terminated at Thermocouple I/P cards only. Bidder may also provide Triplex Thermocouples as per process requirements.	

Thermocouples provided for steam services like super heater / de super heater area, where the process pipe is inside the insulation of boiler penthouse, Thermo wells are inaccessible and terminal head and connecting cable cannot withstand high temperature, for such services thermocouples shall be provided with flexible extension SS316 Sheath of 10-15 meters.

d) **Metal Temperature Thermocouples (MTE)**

S.No	Features	Essential / Minimum Requirements
1	Measuring Medium	Metal Temperature
2	Material of Thermocouple	Chromel Alumel Type K
3	Type of Thermocouple	Duplex with separate hot junctions, ungrounded
4	Insulation	Mineral Insulation Magnesium Oxide.
5	Thermocouple wire gauge	16 AWG
6	Protective sheath	SS 321
7	Protective sheath dia	8 mm O.D
8	Characteristics of Thermocouple	Special limits of error as in ANSI thermocouple MC 96.01.1975
9	Mounting accessories	½" BSP SS Sliding end connector, weld pad, clamps of heat resistant steel SS310
10	Cold end sealing	SS pot seal with color coded PTFE headed sleeve insulated flexible tails. Sealing compound Epoxy resin
11	Minimum bending radius	30 mm
12	Length of T/C	30 Mtr. (minimum)



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

S.No	Features	Essential / Minimum Requirements
13	Enclosure Class	IP-65 or better (Explosion/Flame proof for NEC Class-1, Division 1 area)

e) Temperature Switches (TS)

S.No	Features	Essential / Minimum Requirements
	Type / Construction	
1	Switch	Industrial type inert gas filled with capillary and separable thermo well and contacts directly connected to Bourdon element/vapour pressure sensing, gas filled bellows type preferred.
2	Thermo well	Bar stock
a	Enclosure Class	IP 65 or better/ (Explosion/Flame proof for NEC Class 1/2, Division 1 area)/ flame proof (IEC-79.1, Part I). As applicable.
	Material	
3	Bulb	316 SS
4	Capillary	Armoured Stainless Steel
5	Bourdon	316 SS
6	Bourdon Movement	SS 316
7	Casing	Die-cast aluminium with stoved enamel black finish Epoxy coating shall be provided for corrosive atmosphere.
8	Setting and Differential	Adjustable
9	Accuracy	± One (1) percent of setting and differential
10	Repeatability	One half (1/2) percent of setting.
	Contacts	
11	Number	DPDT/2 SPDT
12	Type	Auto reset with internal Adjustable snap action micro switch
13	Rating	5 Amp, 240V AC / 0.2 Amp, 220V DC
14	Pipe Connection	M33 x 2
15	Extension	Threaded union (SS316) 1/2" NPT (F) with two nipples of SS 316 having 1/2"NPT(M) threads at both ends
16	Thermo well	To suit Temp. switch with same design criteria as specified for RTDs.
17	Electrical	Suitable for Plug in type. All the switches are internally connected and brought to the surface with Amphenol male/female connection. Cabling need not terminated inside the switch. Cable ends are to be soldered in connector and to be inserted for easy maintenance.
	Other Particulars	
18	Capillary length	As per requirement (min 10 meters)
19	Immersion Length	Within + ten (10) mm of centre line of pipe with adjustable nuts.
20	Extension neck length	Minimum 50 mm above insulation of pipe /As per approved hook up drawings



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

S.No	Features	Essential / Minimum Requirements
21	Packing glands	Yes
22	IBR Certification	For high pressure service, Steam Temp, Fuel oil temp. measurement as per IBR rules and regulations
23	N.B	Switches designed for cross ambient operation shall be used in applications where the ambient temperature will approximate or exceed the switch set point.

f) Temperature Gauges (TG)

S.No	Features	Essential / Minimum Requirements
1	Applicable Standard	IS : 3602, BS:5235 ISA:RP:8.1 except as modified in this specification
	Type/Construction	
2	Thermometer	Industrial type, Gas in Filled type with separable thermo well
3	Thermo well	Bar stock
	Material	
4	Bulb	316 SS
5	Capillary	Armoured SS (Applicable for capillary Type)
6	Casing	SS 316/ Die-cast aluminium with stoved enamel black finish. Epoxy coating shall be provided for corrosive atmosphere
7	Dial Size	150mm with shatter proof glass
8	Scale Details	270 degree dial rotation/deflection. Graduations in black lines on white dial provided with glass cover. Smallest scale division shall be one (1) percent of full scale value or smaller. Pointer stop for all gauges
9	Accuracy	± One (1) percent or better
10	Response time	Maximum 15 seconds without thermo well and 30 seconds with thermo well
	Connection	
11	Pipe	M33 x 2
12	Thermo well	To suit instrument with same design criteria specified for RTDs.
13	Process Connection	M 33 x 2 (ii) SS316 Flanged, for Air & Gas systems, with mating flanges, fasteners, gaskets etc.
14	Extension	Threaded union (SS316) 1/2" NPT (F) with two nipples of SS 316 having 1/2"NPT(M) threads at both ends
15	Other Particulars	
16	Capillary length	5Meters/10 Meters as required
17	Immersion Length	Within + ten (10) mm of centre line of pipe with adjustable nuts.
18	Extension neck length	Minimum 50 mm above insulation of pipe /As per approved hook up drawings.
19	Stop at Maximum value	For all gauges of scale
20	Pointer	i) Externally adjustable



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

S.No	Features	Essential / Minimum Requirements
		ii) In general, Contact type Temp. gauges are not acceptable for interlock & protection. iii) Contact type Temp. gauges are acceptable for interlock & protection in case of bearing temp. Only.
21	Over range protection	150 percent (%) of full scale
22	IBR Certification	For high pressure service, Steam Temp., Fuel oil temp. measurement as per IBR rules and regulations
23	Enclosure Class	IP-65 or better (Explosion/Flame proof for NEC Class-1, Division 1 area)

g) Test Thermo wells (TW)

S.No	Features	Essential / Minimum Requirements
1	Applicable Standard	ASME PTC 19.3 TW-2010
2	Type/Construction	Machined from Bar stock
3	Material	316 SS/F11/F22/F91
	Connection	
4	Pipe	M33 x 2
5	Test Instrument	To suit test instruments
6	Accessories	Plug with chain
7	IBR Certification	For high pressure service, Steam temperature Fuel oil temperature measurement as per IBR rules and regulations. Bidder shall provide calculation for thermo well as per ASME – PTC- 19.3 TW - 2010.

Test wells shall be provided on main steam, reheat steam, extraction steam, feed water, condensate, spray water lines and other piping as required to meet ASME test requirements.

2.3.3.4 Level Instruments

a) Direct mounted level transmitter (LT)

Displacer type level transmitter shall not be used in the process anywhere in the plant.

b) Ultrasonic Level Transmitter (for Water sump/Tank level measurements)

S.No	Features	Essential / Minimum Requirements
1	Principle of Operation	Detection of reflected ultrasonic pulse
2	Measuring Ranges	Up to 30 meters (typical)
3	Signal Processing	Microprocessor Controlled Signal Processing
4	Operating Freq.	10 KHz to 50 KHz (typical)
5	Display	Head mounted alpha-numeric back lit LCD/LED
6	Calibration & Configuration	Accessible from front of panel & HART calibrator.
7	Diagnosis	On-line
8	Status	For power, Hi / Lo / V. Hi / V. Lo- level indication, fault etc.



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

S.No	Features	Essential / Minimum Requirements
9	Construction	Plug-on board
10	Power supply	240 V AC 50 Hz / 24V DC
11	Signal Output	4-20 mA DC with HART (isolated) - 600 Ohm load.
12	Hysteresis	Fully adjustable preferred
13	Output contacts	2SPDT Potential free changeover contacts @ 8A 230V AC.
14	Accuracy & Repeatability	± 0.25% of span or better
15	Resolution	± 0.1% of span
16	Temperature Compensation	To be provided with Transducer.
17	Operating temp.	Transmitter-50 deg C and Sensor – 80 deg C
18	MOC Sensor	Body- PVDF and Face – Polyurethane
19	Humidity	1% to 95% non-condensing.
20	Enclosure	IP-67 Epoxy painted die cast Aluminium or SS316L housing.
21	Cable Connection	3/4" ET
22	Mounting	2" – 4" NPT or flanged
23	Accessories	Cable gland, prefab cable, mounting accessories like EPDM seal, SS316 flanged etc. Additional separate local display unit with large Alphanumeric back light LCD/LED & to be provided for the applications which will be decided during detailed engineering. All weather canopy for protection from direct Sunlight, lightening and direct rain.

c) Capacitance type Level Transmitter

The total system shall consist of capacitance probe, pre-amplifier and transmitter.

S.No	Features	Essential / Minimum Requirements
1	Type	Capacitance type
2	Probe	a) Rod or suspended electrode. b) Rope type probes may be used only where required probe length is greater than 3 meters
3	Probe Mounting	Stainless steel 1-1/2 ANSI RF Flange / 3/4" NPT (M)
4	Material of construction	316 SS
5	Insulation	PTFE Part/Full as per service
6	Transmitter	The transmitter shall receive output of the preamplifier and convert it into 4-20 mA DC output signal.
7	Accuracy	± 1% of Full scale
8	Repeatability	± 0.5 % of Full scale
9	Load	Min 600 Ohms
10	Enclosure	Powder/Epoxy coated Die cast aluminium with neoprene gasket conforming to IP-65. (Explosion proof for NEC Class-1, Division 1 area).
11	Ambient temperature	0-60 °C.
12	Mounting	Wall / Surface



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

13	Supply voltage	240V AC, 50Hz / 24V DC
14	Response time	100 m sec or better
15	Cable connection	¾" ET
16	Accessories	Counter flange, Cable gland, prefab cable if any
17	Preferable features	Alarm output contacts with adjustable set point facility

d) Guided wave Radar / Radar Level Transmitter

S.No	Features	Essential / Minimum Requirements
1	Type	Guided wave Radar (Contact type)/Radar (Noncontact type) as finalized by owner.
2	Application	a) For Turbine Lube oil tank, HFO & LDO tank level, Condenser Hot well, LP heaters, CBD tank level, Stator water expansion level, and other Low pressure, Vacuum vessels. b) HP Heaters, Deaerators are to be appended in the existing list c) Also Bulb type with Teflon coating & drop antenna shall be used acid /chemical tank applications d) For oil tank applications, four wire transmitter shall be supplied with zener barrier protection for power supply connected to level transmitters.
3	Environment Class	Highly abrasive with Gases and Fumes
4	Orientation	Vertical
5	Probe Type	Flexible Single lead with chuck
6	Probe Material	SS 316L
7	Connection Size & Type	2" Flanged ANSI 300 lb SS316L material
8	Connection material	SS 316L
9	Accuracy	+/- 5 mm
10	Resolution	+/- 1 mm
11	Type (Transmitter)	SMART, 2 Wire
12	Operating Principle	Time Domain Reflectometry
13	Output	4-20 mA, DC with HART protocol and 600 Ω output load.
14	Electrical Connection	½" NPT
15	Enclosure Class	IP-65 or better (Explosion/Flame proof for NEC Class-1, Division 1 area)
16	Electrical Power	11-42 V DC
17	Housing material	Die Cast Aluminium
18	Vent & Drain Plug material	SS
19	Side Flange Material	SS
20	Local Display	Provided (LCD Digital)
21	Units of Measurement	Length M
22	Electromagnetic compatibility	EN-61326



EPC TENDER SPECIFICATION FOR BTG PACKAGE

e) 3-D type acoustic wave level Transmitter

S.No	Features	Essential / Minimum Requirements
1	Type	Acoustic Wave Level Transmitter (3 D type)
2	Application	One set of 3 D type Acoustic wave type level transmitter for each ESP Hopper (First field) measuring Level, Volume & Mass. Two nos. of 3 D type Acoustic wave type level transmitter for each coal bunker located above coal pulverizers measuring Level, Volume & Mass.
3	Temperature compensation	Required for high temp applications
4	Operating Principle	Non - Intrusive acoustic wave transmission & Re flection
5	Frequency Range	3 – 10 KHz
6	Measurement Range	Empty to full
7	Accuracy	+/- 0.25 % for even surface & + 0.5% for uneven surface.
8	Resolution	1 mm
9	Output	4-20mA DC with HART to corresponding control system.
Display Unit		
9	Type	Head mounted LCD Display with Engg. Units
10	Location	Suitable location at bunker / Silo operating floor area
11	Protection Class	IP 65 or better// flame proof (IEC-79.1, Part I) As applicable).
Material Of construction		
12	Housing	Polypropylene /Aluminum/SS
13	Flange	Polypropylene/Aluminum/SS
Sizes:		
14	Flange Size	2" ANSI 300 # RF SS
15	Electrical connection size	½" NPT (F)
16	Accessories	i. Double compression type Nickel Plated Cable glands ii. Suitable Mating Flange, necessary gaskets, ii. Local display unit and Suitable mounting brackets, necessary mounting hardware for Local display unit. iv. Complete software as required to have 3 D view on monitors. v. One number each Integral Operating Work station separate for ESP control room for ash handling system and for unit control room for coal bunkers. Specification of OWS shall be same as mentioned in the specification. Above OWSs shall display Average level, Maximum level, Minimum level, Volume, Mass and real time complete 3D profile of each ESP Hopper (First Field). In addition to the information available in above OWS, the bidder shall provide all required hardware and software to display the respective information on OWS provided with control system located at respective control room. 1 no. laptop each with necessary digital connectivity cable, hardware/software for configuration, calibration,



1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III



EPC TENDER SPECIFICATION FOR BTG PACKAGE

S.No	Features	Essential / Minimum Requirements
		maintenance, analysis of 3D images at the installation sites shall be supplied for coal bunker application and for ash handling application.

f) ~~Electronic Water Level Indicator~~

~~Application - HP heaters & Boiler Separator Storage tank~~

~~This electronic level indicator shall be provided by bidder, in addition to continuous level transmitter used for modulating control of respective level.~~

~~Electronic Remote level Monitoring System working on principle of difference in electrical conductivity between steam and water. The Monitoring System shall meet the requirements as indicated below.~~

~~The sensing electrodes shall be placed in equal pitch. The maximum distance (gap) between two electrode shall be 50 mm and the electrodes shall be arranged in such a way that the last and the first electrode shall not be at any alarm or trip level.~~

~~Both indication and validation system shall be supplied with double isolation valves in water, steam, drain and vent lines.~~

~~Each electronics unit shall be provided with 2x100% redundant power supply pack converters to be fed from two feeders of 24V DC or 240V AC UPS system as per system requirement. These two power supplies shall be internally fused and failure of one power supply shall not affect the performance of the system. Self-monitoring facility to detect and alarm the loss of power supply shall be provided.~~

~~The detector unit, logic units, 2x100% redundant power supply units/packs shall be housed in separate and independent cubicles for pressure vessel on each side of the tank. The Electronic unit mounted locally should have detector units, logic units etc. & shall be independent for each pressure vessel. The min enclosure rating IP 65. Indication shall be provided at field for both indication and validation system. Remote indication is to be provided for indication system at unit control panel in CCR. Local Indication should be inbuilt in local electronic unit. Electrode assembly shall have blow out and leakage proof sealing arrangement. Field proven ceramic/zirconia probes with insulation suitable for design pressure and temperature are to be provided.~~

~~The system design shall be such that it shall ensure that failure of one probe circuit shall not affect another probe circuit and failure of any electrode will not hamper the system function and operation. Further the entire system shall be of proven fail-safe design.~~

~~The logic shall be such that the trip and alarm relay circuits shall be independent for each for Low, Low-Low, High and High-High levels of tank. Monitoring of set time for trip generation~~



EPC TENDER SPECIFICATION FOR BTG PACKAGE

and provision of setting time delay shall be available in the system. Trip logic shall be independent and separate from fault finding logic.

The system shall have fault diagnostic features such as process fault, system hardware fault, probe failure, circuit board failure, shorted wire etc. Further the system shall be able to distinguish between a cable fault and an electrode fault.

The necessary relays and relay modules for the Output Contacts shall be of proven design and each contact shall be rated for 5A, 240V AC/0.25A 220V DC rating. All these contacts shall be 2SPDT type. The vessel holding electrodes shall be IBR certified. The system shall be proven and approved by Factory mutual, and equivalent to IBR.

g) Dual Path Transit Time Clamp-on Ultrasonic Flow Meter

The flow meters shall be of proven reliability, accuracy and repeatability requiring a minimum of maintenance. They shall comply with relevant international standards and shall be subject to owner's approval.

All accessories required for mounting/erection of this instruments shall be furnished, erected and installed as necessary for completeness of the system though not specifically asked for. Also the equipment shall include necessary cables, flexible conduits, junction boxes required for the purpose.

Flow meters shall be provided with suitable environment protection devices/structures such that they shall be suitable for continuous operation in the operating environment of a coal fired utility station without any loss of function or departure from the specification requirements.

Technical Requirements

S.No	Features	Essential / Minimum Requirements
1	Type	Transit time Clamp On Ultrasonic meter
2	Mounting Style	Dual path with two sets of transducers on the same pipe
3	Flow measurement	Instantaneous Flow rate as well as totalized flow.
4	Power supply	230 V AC from UPS.
5	Outputs: Analog Current Binary Communication ports	Isolated 4-20mA linear outputs for each path Contact relay outputs, 2 NO + 2 NC for alarm RS 232 C digital, Hand held terminal port
6	Display/Indication	Flow meter with LCD screen backlight based local display and keypad, If required, transmitter shall be suitably located away from the sensor for better access and visibility .
7	Recording / Totalizing / Logging	Yes. Should be able to compute cumulative flow



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

S.No	Features	Essential / Minimum Requirements
	Facilities	over intervals selectable by owner i.e., daily, weekly, monthly etc. The data shall be stored in the memory of flow computer for access in future
9	Software features	Compensation for any cross path errors . Programming, configuration, shall be possible from front panel.
10	Diagnostics	False signal tolerance , power supply failure etc
11	Protection class	IP-65 'or better, Weather protection against direct sunlight, rain etc for Flow . ' meter and suitable for Cooling water for Transducer
12	Accuracy	+/- 1%
13	Electrical connection	Plug and socket
14	Pipe location	Underground
15	Accessories	All mounting hardware required like clamping fixtures, mechanism to remove the transducers online, interconnecting cables etc All weather canopy for protection from direct sunlight and direct rain. Material of all fittings shall be SS 316.

h) Level Switches

S.No	Features	Essential / Minimum Requirements
1	Type / Construction	a) External float cage type with magnetic switch actuator for tanks and vessels. b) Electrode/Capacitance (for oil tanks) c) Displacer -Top mounted for all clean water sumps. d) Conductivity type for high Pressure and high temperature enclosed vessel like drain pot, HP heaters etc.
	Materials	
2	Body	i. Cast Carbon Steel/Die cast Aluminium suitable for specified pressure and temperature ratings ii. For corrosive liquids suitable anti-corrosive coat/lining shall be provided.
3	Float/Displacer	316 SS
4	Wire rope	316 SS
5	Differential	+/- 12 mm minimum (Adjustable)
	Contacts	
6	Number	DPDT/2 SPDT
7	Type	Snap action micro switch Auto reset with internal Adjustable
8	Rating	5 Amp 240V AC 0.2 Amp 220V DC
9	Connection - Process	One (1) inch SCRD NPT Female or One (1) inch ANSI Flanged Four (4) inch ANSI Flange for sump services.



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

10	Electrical	Suitable for Plug in type connection
11	Temperature/pressure rating	As per service conditions
12	Accessories	Counter flanges, still pipe of requisite length with anticorrosive coating for sump services.
Note: Nuclear, capacitance, or ultrasonic type level switch for bulk material applications shall be provided.		

i) Conductivity type level switch

S.No	Features	Essential / Minimum Requirements
1	Type	Conductivity discrimination
2	Mounting	Flanged – on standpipe.
3	Probe MOC	Stainless steel with high purity ceramic.
4	Probe rating	> Maximum design pressure of vessel.
5	Input	Four independent channel with selectable switching threshold for water conductivity.
6	Relay Output	Four isolated output relays for Hi, Lo, Hi-Hi, Lo-Lo.
7	Contact type & rating	2SPDT or 1 DPDT @ 5A 30V DC.
8	Faults Detection	i. Power Fail/Electrode Connection, ii. Open circuit/short circuit to ground, iii. Ground failure. iv. In built Fail Safe Logic.
9	Indicator	One Red LED for steam/ one Green LED for water/ Two no. LED one each for Process & system fault.
10	Power supply	Dual 240V AC, 50 Hz, 1Ph. From UPS
11	Enclosure	IP-65, corrosion resistant & wall mounting type.
12	Accessories	i. PTFE cable from probe to electronics unit. Electronic unit shall be separate. Head mounted electronic unit is not preferred. ii. Mounting accessories iii. standpipe iv. Washer & gasket
13	Test pressure	Two times rated pressure

j) Capacitance type level switch

S.No	Features	Essential / Minimum Requirements
1	Type	Capacitance type
2	Probe	a) Rod or suspended electrode b) Rope type probes may be used only where required probe length is greater than 3 meters.
3	Probe Mounting	Stainless steel 1-1/2 ANSI RF Flange / ¾" NPT (M)
4	Material of constructions	316 SS
5	Insulation	PTFE Part/Full as per service.
6	Enclosure	Powder/Epoxy coated Die cast Aluminium with neoprene gasket conforming to IP-65. (Explosion proof for NEC Class-1, Division 1 area).



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

7	Ambient temperature	0-60 °C.
8	Mounting	On Top
9	Supply voltage	240V AC, 50Hz from UPS/ 24V DC
10	Relay output	2SPDT
11	Contact rating	5A min. at 240V AC on resistive load
12	Response time	100 m sec or better
13	Cable connection	¾" ET
14	Accessories	Counter flange, Cable gland, prefab cable and stainless steel name plate engraved with alpha-numeric.

k) RF type level switch

S.No	Features	Essential / Minimum Requirements
A	Electronic Controller	
1	Input supply	240 V AC from UPS
2	Construction	Cast Aluminium Housing
3	Relay Output	2 Nos. Relay Changeover Potential Free Contacts(2SPDT)
4	Contact Rating:	5A at 240 V AC & 0.25 at 220 V DC
5	Class of Protection	IP-66
6	Ambient Temperature	55 Deg. C(Max)
7	Local Indication	Local LED Indications
	Green	Normal Level
	Red	Alarm Level
	Yellow	Probe Healthy
8	Cable Connection	3/4" ET(2 Nos.) for Supply and Output & 5/8" ET(1 No.) for Probe Connection
9	Repeatability	100%
B	Sensing Probe	
1	Type of Probe	Rigid
2	Material	Stainless steel SS 316
3	Probe Head Housing	Cast Aluminium
4	Insulation (B/W Active & Shield And Shield & Ground)	PTFE
5	Probe Head Protection	IP-66
6	Mounting	Side Mounted
7	Cable Connection	5/8" ET (1No.)
8	Process Connection	40 NB BSP THREADED
9	Signal Cable	Coaxial cable for Connection Between Sensing probe and electronic Controller (@ 10 Metres. Per Level Probe)
10	Application	Ash Silos

l) Level Indicators (Gauge Glass)

S.No	Features	Essential / Minimum Requirements
1	Type/Construction	a) Reflex b) Tubular (For tanks open to atmosphere only)
2	Material:	



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

S.No	Features	Essential / Minimum Requirements
a)	Glass	Tempered borosilicate resistant to thermal shock
b)	Case	Carbon steel
c)	Integral cocks	i) Forged carbon steel with drain valves stainless steel internals ii) Rubber lined corrosion resistant 316 stainless steel (for Demineralised and Osmosis water service)
d)	Fittings	i) Forged carbon steel ii) Rubber lined 316 steel/PVC for corrosive liquids Demineralised and Osmosis water service) iii) 304 Stainless Steel for non-corrosive liquids
e)	Packing	Teflon
3	Dial size/scale	150 mm /1.5 Meters maximum length with
4	Scale details	Aluminium/SS316 scale Graduated in mmwcl
5	Connection	25 Nb/40 Nb ANSI Flanged
6	Accessories	a) Integral cocks b) Drain valves c) Bolts, nuts and gaskets d) Illuminating lamps as required e) Periscope as required
7	Tests	Tested at two hundred (200) percent of the maximum process pressure
8	Other details	For larger lengths, additional gauge glasses shall be provided with minimum of 50 mm overlap.

m) Float & Board type level gauge

S.No	Features	Essential / Minimum Requirements
1	Type of Instrument	Mechanical Type (Float Operated)
2	Service/ Application	As per service requirement
3	Measuring Range	as per requirement
4	Material Specification	
a	Float Material	SS316 having 2 nos. Guide wires
b	Float Wire Pulley	Shall comprise of 2 nos. Cast Aluminium Pulley housing Assembly with SS 304 pulley and pulley shaft. Steel ball bearings shall be provided in pulley housing for easier float movement. Float wire material shall be SS316L. Between 2 pulleys, 1" NB G.I. short pipe with tentative length as per P&ID
c	Guide wire Assembly	CS chamber with spring and adjuster having 1" Class 150 ANSI RF MS flange. Guide wire rope shall be SS316L.
d	Counter Weight	MS counter – weight with Aluminium Pointer and Brass assembly Pull Chain.
e	Scale	SS 316/Aluminium material in mm with 1 % accuracy.
5	Nozzle Details	For float wire pulley assembly, one tapping and for guide



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

S.No	Features	Essential / Minimum Requirements
		wire assembly two tapping at the top of the tank; Size 1" NB (Top Mounting Type)
6	Process Connection	Flanged as per ANSI B 16.5 to suit 1" NB nozzle (Nozzle length - 150 mm for float wire, 100 mm for guide wire)
7	Accessories (to be supplied with the instrument)	
a	Counter flange	All mating Flanges, Nozzle
b	Mounting Accessories	All mounting accessories
c	Tag Plate	To be provided (material SS316)

2.3.3.5 Flow Instruments

a) Mass flow meter

S.No	Features	Essential / Minimum Requirements
	Sensor	
1	Measuring Principle	Coriolis Mass flow.
2	Primary Element	Flow Tube of 316SS or better
3	Heating Arrangement	Integral with Flow meter
4	Temperature Control	To be provided.
5	For Heating Process Connection	ANSI RF Flanged and rating as per process requirement.
6	Drain	Self-draining facility
7	Accessories	Counter flanges, Mounting nuts, bolts, gaskets etc.
	Transmitter	
8	Measured quantities	Mass Flow rate, Total Mass Flow, Density, Temperature as minimum.
9	Input Signal Processing	Digital Processing.
10	Display	Digital Display (LCD)
11	Output	2 Nos. isolated output of HART, 4-20mA DC selectable from four measured quantities
12	Load	< 600 ohms
13	Power supply	240V AC, 50 Hz. From UPS
14	Accuracy	0.15% of measured value for Liquid & 0.5% of measured value for Gas
15	Repeatability	0.05%
16	Housing	IP 65 (Explosion proof for NEC Class-1, Division 1 area)
17	Hazardous duty Version	FM Standards.
18	Nameplate	Tag number, service engraved in stainless steel tag plate
19	Accessories	a) As required for field mounting, Handheld configurator & complete Software, External zero adjustment facility b) Mounting U-bolts, nuts, bolts, prefab cable etc.
20	Application	HFO main line, LDO lines, HFO recirculation lines etc.
21	Fault Signal	Instrument fault signal through DPDT/2 SPDT for Diagnostics shall be provided and connected to DDCMIS.



1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III



EPC TENDER SPECIFICATION FOR BTG PACKAGE

S.No	Features	Essential / Minimum Requirements
		into time based flow rate indication & provide totalized flow also.
3	Sensing plate	316 SS
4	Sensing head	Sensing mechanism shall be mounted outside the process flow line.
5	Enclosure	316 SS
6	Enclosure protection	IP 67 class
7	Accuracy	+/-1%
8	Repeatability	+/- 0.2%
9	Drift	Both zero & span + 2% / month
10	Output	4-20mA DC isolated, load 600 ohm (min)
11	Digital communication	yes, (HART) facility
12	Power supply	240 V AC, 50Hz, UPS
13	Ambient condition	Temperature -600 C, RH-95% Environment – Highly Dusty
14	Accessories	Shall be complete with all the accessories including digital display for flow rate, integral vents, baffles for air separation, etc. whichever required for satisfactory operation.
15	Note:- 1. The above on line flow meter shall not create any obstruction on flow. 2. User's list shall be submitted to support on proven satisfactory performance for similar process application.	

2.3.3.6 Instrument air system

The instrument Air Supply System for various pneumatic Control & Instrumentation devices like pneumatic actuators, power cylinders, I/P converters, pneumatically operated valves etc. shall be complete in all respect with necessary Air Filter Regulators, valves, piping/tubing etc.. Each pneumatic instrument shall have an individual air shut off valve. The pressure-regulating valve shall be equipped with an internal filter, a 50 mm pressure gauge and a built in filter-housing blow down valve.

Clean, dry, oil free instrument Quality air of the following quality shall be provided by bidder for various pneumatic instruments/control drives & accessories:-

1. Nominal pressure : 7Kg/cm² gauge
2. Range of pressure : 3.5 to 8.5 Kg/cm²(g)
3. Dewpoint - 40 deg.C at NTP : + 2°C at the above pressure.
4. Maximum particle size : 5 microns

Pneumatically operated equipment offered by the Bidder shall be designed to operate with the above air supply and adequately cater to their respective duty within the full range of pressure variation. Wherever required, moisture separator with auto drain valve for vital instruments / actuator / analyzer may be provided in the airline by bidder.



EPC TENDER SPECIFICATION FOR BTG PACKAGE

The Bidder shall indicate system wise requirement of instrument air along with his proposal and same shall be included in the compressor capacity as supplied. Filter shall be of minimum 5-micron size & sintered bronze material.

On collection of water in the drains of instrument air lines, mechanical automatic drains and periodically solenoid operated drains (with electronic timer - 15m, 30m, 60m and 2 Hours & Timing adjustable) are to be provided.

For mechanical type & Electrical type, the locations to be provided in the instrument air lines of boiler area, Chimney area, turbine area etc., shall be decided during detailed Engineering.

Bulk header nearby the crowded applications shall be provided and from this bulk header individual air lines with necessary isolation valves are laid to the application.

These bulk header are to be provided with mechanical / electronic based automatic Drains. Individual moisture separator for O₂ analyser or vital application shall be provided nearby the instrument so as to enhance the cell life or the performance of vital final control elements.

2.3.3.7 Air Filter Regulator (AFR)

Air filter regulator along with gauges shall be provided in each of the

- Air supply line to valve positioners / power cylinders
- Air supply line to electric to pneumatic converters.
- Air supply line to pneumatic interlocked block valves.
- Constant bleed type AFR with an accuracy of + 1.0 % inlet pressure range of 5-10 kg/ cm² and suitable spring ranges (AFR) for use with positioners in control valves, control damper, E/P convertors and shut off valves with sintered phosphor bronze filter element; Filtering particles above five microns. IP 65 Weather and water proof enclosure. Material of accessories will be SS316. Body material of filter regulator shall be Die Cast Aluminum or SS316.

2.3.3.8 Electro-Pneumatic Convertors (E/P)

Two wire type E/P convertors with an accuracy of +0.25% accepting 4-20 mA dc signals from control system and converting to 0.2 to 1 kg/cm² air pressure to operate valve positioner of all final control elements; Housed in cast aluminium casing (with polyurethane paint); NEMA 4 or equivalent degree of protection for enclosure. Material of accessories will be SS. E/P convertors shall have fail freeze (stay put) feature also. Process connection shall be 1/4" NPT (F) and Electrical connection shall be 1/2" NPT (F). Zero/span adjustment facility shall be provided. The E to P convertors shall **retain the pneumatic signal (last value) even in failure of control signal** and shall have **self volume boosters**. Necessary air lock devices and pressure switches for air pressure low alarming shall be provided.



EPC TENDER SPECIFICATION FOR BTG PACKAGE

2.3.3.9 Solenoid Valves

Solenoid valves shall be provided with control valves / pneumatic control valves hooked up with process interlock requirements and where direct tripping is involved. The number of ways for solenoid valve shall be provided as indicated below:

- a. Two (2) way solenoid valves shall be provided, where process line of less than 50 mm with low pressure and temperature application.
- b. Three (3) way solenoid valve shall be provided commonly, where the pressure is admitted or exhausted from a diaphragm valve or single acting cylinder, e.g., Pneumatic operated spray water block valve.
- c. Four (4) way solenoid valve shall be provided for operating double acting cylinders, e.g., pneumatically operated on-off type dampers.
- d. For operation of the fuel oil corner nozzle valves, fuel oil trip valves etc., double coil solenoid valve (latch coil & relatch coil) shall be adopted. Single coil usage requires always power and loss of power leads to closure of above valves resulting the unit trip or loss of generation.
- e. Solenoid Valve coils shall be Class-H high-temperature or Class-F construction as applicable and shall be designed for continuous duty. Three-way solenoid valves shall be designed for universal operation so that the supply air may be connected to any port. Solenoid enclosures shall be NEMA-4)/ (Explosion proof for NEC Class-1, Division 1 area)/ flame proof (IEC-79.1, Part I) as applicable). Body material of solenoid valve shall be Brass or SS316 with epoxy paint as decided during engineering by owner. Material of wetted parts shall be SS316 only. Leakage class shall be class VI (Bubble tight)..
- f. All solenoid shall be with Varistors, LED indication, surge suppress diode and circuits.
- g. Solenoid valve shall operate on 24V DC, UPS 240V AC or 220V DC as per system requirements.

2.3.3.10 Power Cylinders (Pneumatic)

S.No	Features	Essential / Minimum Requirements
1	Mounting Type	a) Fixed position mounting (End mounting). b) Trunnion mounting
2	Control Signal	a) 0.2 to 1 Kg/Sq. cm. from I/P converter for modulating purposes. 24V/48VDC operated solenoid valve operating on pneumatic line. b) The Pilot solenoid will have separate coils for open closing purpose.
3	Supply Air	0-7 Kg / Cm2.
4	Selection	Based upon thrust / torque, stroke length, angular movement, full-scale travel time, repeatability, space factor etc. Provision for air-to-open and air-to-close



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

S.No	Features	Essential / Minimum Requirements
		operation.
5	Casing	IP-65.
6	Accessories (as required)	a) Air lock relay b) Hand wheel. c) Air filter regulator with gauge. d) Volume Booster. e) Limit Switches. f) Positioner with Input, Output and supply pressure gauges. g) Pilot Solenoid Valve (Double Coil type) h) Position Transmitter (4-20 mA DC linear output, LVDT or non-contact type).
7	Fail-safe operation	Stay put, open or close position on pneumatic / electrical power supply failure as per process safety criteria.
8	Repeatability	Better than 0.5% of full travel.
9	Hysteresis	Less than 1% of full travel.
10	Material	Internal part's material and material of accessories shall be SS316 only.
	In case of loss of mA signal. Manual adjustment shall be made through available manual knob and locked at required position for sufficient required process fluid flow.	

2.3.3.11 Non - Nucleonic (Vibration) type Density Meter (For DM Plant)

S.No	Features	Essential / Minimum Requirements
1	Type	Non - Nuclear type radiation
2	Application	Liquid Density measurement
	Detector	
3	Orientation	As per requirement
4	Case Material	SS 316/ Cast Aluminium alloy
5	Wetted part material	SS 316
6	Operating Principle	Vibration Density measurement
	Convertor	
7	Output	4-20 mA DC isolated.
8	Electrical Connection	½" NPT
9	Enclosure Class	IP 65
10	Local Display	Digital 5 digit, density display with temp. Compensation.
11	Accuracy	+/- 1%
12	Response time	< 1 minute
13	Power Supply	240 V AC, +/- 10%, 50 Hz. From UPS

2.3.3.12 Junction Box

S.No.	Features	Essential/Minimum Requirements
1	Type of Enclosure	Dust tight, Flame Proof / Weatherproof and Waterproof, generally conforming to IP 65.



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

S.No.	Features	Essential/Minimum Requirements
2	Material	16 SWG sheet steel hot-dip galvanized / Cast aluminium LM6.
3	Type of Cover	Solid unhinged with retention chain
4	Mounting	Indoor / Outdoor
5	Cable Entry	Downwards
6	Cable Glands	Double compression type – Nickel plated brass with PVC hoods.
7	Terminals	Phoenix / Wago (screw less cage clamp type spring loaded)
8	Gasket	Neoprene
9	Grounding	Two terminals for body and shield ground
10	Number of Drain Holes	Two at bottom capped.
11	Door	Hinged, lockable type
12	Color	In General same as provided for control panels, and for special services, To be decided during detailed engineering & subject to owner's approval.
13	Note: i. Suitable mounting clamps and other accessories shall be in scope of bidder. ii. The brackets, bolts, nuts, screws, glands, lugs required for erection shall be of brass, included in bidder scope of supply. High voltage & insulation resistance test shall also be conducted. iii. M6 Ni plated Brass earthing stud shall be provided (external 2 nos. internal 1 no.) iv. Gasket (Normal)- Neoprene thickness 6.0 mm	

2.3.3.13 Interposing Relays (IPR)

Electromagnetic type IPRs with modular design, plug-in type connections, suitable for channel/DIN rail mounting in cabinets; coil rating 24V D.C; 2 set of silver plated change over contacts rated for 0.5A 220 V DC/8 A 240 V AC. Freewheeling diode across relay copper coil and self reset type status LED indicator flag (electronic) shall be provided. Manual forcing/override facility is required. The test voltage for relay shall not be less than 4 KV with operating temperature from as per ambient temperature condition at site. The relay shall have the necessary approvals like V0 inflammability class in accordance with UL94", IEC60664/IEC60664A/DIN VDE 0110. Facility to stimulate IPR manually shall be provided. The VA burden of relays shall be suitable to match the capacity of output modules. Interposing relay & sockets for mounting the interposing relay shall be of same make only.

The operating temperature of the Relay & Sockets shall be from –20 deg. C to 60 deg. C. The operating/release time of the relay shall not be more than 10/5 ms respectively.

The relay and DIN Rail sockets shall have the necessary approvals like UL/VDE and V0/V2 inflammability class in accordance with UL94", IEC60664/IEC60664A/ DINVDE0110.

Facility to stimulate IPR manually shall be provided. The VA burden of relays shall be suitable to match the capacity of output modules. Interposing relay & sockets for mounting the interposing



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

relay shall be of same make only and sockets shall have the plug in RC circuits/Varistors, required for EMI suppression.

2.3.3.14 Recorders (Chartless)

S.No.	Features	Essential/Minimum Requirements
1	Type	Micro-processor based, Digital TFT display type
2	No. of Channels	Six (6) Points & Forty Eight (48) point).(Simultaneous parameter display preferred)
3	Input Signal	Fully configurable multi range (Programmable) universal (input)
4	Recording method	Continuous with different colour, for each channel
5	Display colour	Desired display color using RGB value
6	Bar graph facility	To be provided
7	Digital indication	To be provided
8	Accuracy	+/- 0.1 % for reading for DCV Input And 0.1 Deg for TC/RTD input
9	Programmability	Front key board
10	Data Storage	hard disk/ Flash Memory
11	Data Retrieval	Compact 4 GB flash Memory card and USB port with 8 GB USB drive.
12	Scan rate	< 100 m secondor less for individual channel. Selection of scan time for individual channel is required.
13	No. of Alarm relays with change over Contacts	6 Nos
14	Backup Battery	To be provided.
15	Communication	Ethernet connectivity for remote viewing in PC & file transfers to PC
16	Software to be supplied along With instrument	Software required for data archives from chartless recorder though Ethernet, remote viewing in PC through Ethernet, file transfer through Ethernet to PC.
17	External Storage media	Compact USB flash drive & Compact flash memory card with high capacity to be provided.
18	Math Function	General Arithmetic function, Summation for each channel and group of channels, Statistical operations like Average Maximum, Minimum etc.,
19	Ethernet Cable with Connectors	50 metres for each recorder
20	For virtual memory of chartless recorder	Provision of Modbus Protocol and its communication interface card in Chartless recorders for reading/writing of measurements/data from third party system/ electronic modules through digital communication. The recorder shall carry 48 or More channels of virtual measurements through data communication from third party system/ electronic modules
21	Color laser Multi function printer	1 No. A3 size color laser Multi Function printer for Print, Scan & Copy for complete set. 1 No. lap top computer with necessary CR application software to integrate with CR



EPC TENDER SPECIFICATION FOR BTG PACKAGE

2.3.3.33 Push buttons (PB)/ ILPBs for ON/OFF, OPEN/CLOSE, START/STOP

S.No.	Features	Essential/Minimum Requirements
1	Type	Momentary/Miniaturized Suitable for mosaic grid 24x48 Mm with 2 PB and 3 coloured LED
2	Contact Configuration	2 NO + 2 NC
3	Contact Material	Hard Silver Alloy
4	Contact Rating	500V / 10 A
5	Insulation Voltage	2 KV for 1 minute between terminals and earth
6	Lamp Rating :- a) Voltage b) Watt	240 V AC 2 Watt (approx.)
7	Colour	
	i. Red	ON/Start/Open ILPB, energized, running, Start, valve open LED/Lamp, OFF/Stop/Close PB, Emergency trip push buttons with red flap / hinged Transparent acrylic cover.
	ii. Green	OFF/Stop/Close ILPB, de-energized, stopped, valve closed LED/Lamp, ON/Start/Open PB
	iii. Light yellow	Abnormal, discrepancy LED/Lamp

2.3.3.34 Push Button for Control DESK

Momentary mosaic grid mounted 24x48 mm size, single PB 18x40 mm Colours for DESK RELEASE - Yellow, Desk Lamp test - Blue, Desk Acknowledgement – Green

2.3.3.35 Push Button for Sequence Start/Release

Momentary (Miniaturised) suitable for mosaic grid 24x48 mm3 PB + 5 LED

2.3.3.36 Push buttons for annunciation

S.No.	Features	Essential/Minimum Requirements
	Contacts	
1	Number & Type	As per requirement
2	Breaking capacity	1 Amp, 220V DC 10 Amp, 600V AC Different colours for Accept/Ack. - Green, reset Grey, Lamp test – Blue, System Test – Yellow & Audio Ack. - Black.

2.3.3.37 Hydrogen Gas System Instruments / Analysis

i) Hydrogen Gas Hygrometer

S.No.	Features	Essential/Minimum Requirements
A	Performance	



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

S.No.	Quantity of root valves	Size of stub and root valve	Service Condition
Pressure and Differential Pressure Measurement			
(i)	2	25NB	≥ 40 bar (g) OR 425°C
(ii)	1	15NB	< 40 bar (g) AND 425°C .
Level Measurement			
(a)	Level Gauge & Switch		
(i)	2	25NB	≥ 40 bar(g) OR 425°C
(ii)	1	25NB	< 40 bar(g) AND 425°C
(b)	Level transmitter (displacement type)		
(i)	2	40NB	>40 bar(g) OR 425°C
(ii)	1	40NB	<40 bar(g) AND 425°C
(c)	Stand pipe for level measuring instrument		
(i)	2	80 NB	≥ 40 bar(g) OR 425°C
(ii)	1	80 NB	< 40 bar(g) AND 425°C
Flow Measurement			
(i)	2	25NB	≥ 40 bar(g) OR 425°C
(ii)	1	25NB	< 40 bar(g) AND 425°C
Sampling system measurement (Steam and Water Service)			
(i)	2	25 NB	≥ 40 bar(g) OR 425°C
(ii)	1	25 NB	< 40 bar(g) AND 425°C



EPC TENDER SPECIFICATION FOR BTG PACKAGE

2.5.3.6 Calibration of Instruments

The Bidder shall carry out the calibration of instruments as indicated below by submitting the test procedure and quality assurance plan for the Owner's approval. Bidder shall also prepare detailed checklist/calibration sheets for each of the systems/equipment clearly indicating the step-by-step procedures to be carried out for calibration pre commissioning, loop checking, powering and commissioning.

The calibration of all instruments shall be checked and calibration records prepared for the Owner's use. If the instruments require recalibration, Bidder shall recalibrate the instruments and revise the calibration records and submit to the Owner.

2.5.3.7 Tests to be performed for Field Instruments

S.No	Tests to be performed
1.	Pressure Gauges
	Calibration Hydro test (1.5 times max. pr.)
2.	Pressure switches
	Calibration test / Hydro test / Contact rating test / Accuracy test / Repeatability
3.	Differential Pressure Gauges
	Calibration test / Hydro test / Leak test / Over range test / Accuracy test / Repeatability test.
4.	Differential Pressure Switches
	Calibration test / Hydro test / Contact rating test / Leak test / Accuracy test / Repeatability test.
5.	Thermometers
	Calibration / Material test / Accuracy test / Bore concentricity : $\pm 5\%$ of wall thickness / Hydrostatic test for TW (1.5 times max. pr.)
6.	Temperature switch
	Calibration / Material test / Accuracy test / Bore concentricity: 1.5% of wall thickness / Hydrostatic test for TW (1.5 times max. pr.) / Contact rating test.
7.	Resistance temperature detector assembly.
	Calibration / Material test / Bore concentricity test / Insulation test ($\leq 500 \text{ M}\Omega$ at 500V DC) As per ISA, Hydro test for TW. Bore concentricity: $\pm 5\%$ of wall thickness, Accuracy test.
8.	Thermocouple assembly
	Calibration / Material test, Insulation test ($\geq 500 \Omega$ at 500 V, DC) as per ISA, Hydro static test (1.5 times max. pr.), Bore concentricity: $\pm 5\%$ of wall thickness.
9.	Thermo wells
	Material test / Bore concentricity: $\pm 5\%$ of wall thickness / Hydrostatic test for TW (1.5 times max. pr.)
10.	Level Gauges



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

S.No	Tests to be performed
	Hydrostatic test / Material test / Seat leakage test / Ball check test.
11.	Level switches (Magnetic)
	Material test / Contact rating test / Hydro test / Calibration test.
12.	Flow Switch
	Material test / Hydro static test (1.5 times max. pr.) / function test.
13.	Flow glasses
	Material test / Hydrostatic test (1.5 times max. pr.) / function test.
14.	Variable area flow meters
	Calibration test / Material test / Hydrostatic test (1.5 times max. pr.)
15.	Flow element
	100% Radiography test / Hydro test / Calibration test, IBR Certificate.
	Calibration test for flow element shall be witnessed by Owner.
16.	Control valves / Pneumatic block valve / Pressure regulating valve – Refer chapter 10.
17.	Position transmitters
	Calibration / hysteresis and Accuracy test
18.	Electro Pneumatic Convertors
	Calibration test / Accuracy test
19.	Solenoid valves
	Hydro test / Seat leakage test / CV test / Coil insulation test
20.	Air filter regulators
	Calibration test / Accuracy test
21.	Junction Boxes
	Test for degree of protection / Material test
22.	Tests for terminal blocks
	Test for moulding for flame resistant, Non-hygroscopic and Decarbonised / Insulation test between terminals / Insulation between terminal block and frame.
23.	Thermocouple extension cable
	Thermo-e.m.f characteristic / Continuity test / Measurement on capacitance, inductance and loop resistance / Insulation resistance / High voltage test as per latest IS / Tensile and elongation test / Oxygen index test / Any other test applicable.
24.	Mass flow meter
	Performance test / Calibration test / Hydrostatic test.
25.	Boiler Level Gauge
	Hydrostatic test / Material test / Seat leakage test / IBR Certificate
26.	pH / Conductivity measurement / Silica / Dissolved oxygen analysers:
	Calibration test, Accuracy test
27.	Sample cooler :



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

S.No	Tests to be performed
	Hydro test, IBR Certificate
28.	Sampling racks :
	Hydro test, IBR Certificate for tubes and fittings.
29.	SO₂ / NO_x analyser / SPM analyser:
	Calibration test, accuracy test
30.	Interposing relay
	Functional test, temperature rise test, H.V test, Insulation test
31.	Transmitter Racks :
	Hydro test, air leak test for piping / tubing and fittings. IBR certification as required for tubing / piping and fittings.
32.	Pressure Transmitter
	Calibration test / Hydro test / Leak test / Over range test / Accuracy test / Repeatability test.
33.	Differential pressure transmitter
	Calibration test / Hydro test / Leak test / Over range test / Accuracy test / Repeatability test.
34.	Temperature Transmitter
	Calibration test / Accuracy test / Ambient temperature error test
35	Pneumatic Block Valves
	a) IBR certificate form III C b) Hydrostatic test : ANSI B 16.34 c) Seat leakage test : As per ANSI B 16-104 d) CV test: As per ISA procedure e) Magnetic particle test ANSI B 16.34 special class (applicable for pr.>70 bar & temp< 400 Deg.C) f) Liquid penetration test: ANSI B 16.34 special class (applicable for pr.>70 bar & temp< 400 Deg.C) g) Radiography test: ANSI B 16.34 special class h) Calibration and Hysteresis test i) Actuator leakage test
36.	Pressure Regulating Valve
	a) IBR certificate form III C b) Hydrostatic test : ANSI B 16.34 c) Seat leakage test : As per ANSI B 16-104 d) CV test: As per ISA procedure e) Magnetic particle test ANSI B 16.34 special class (applicable for pr.>70 bar & temp< 400 Deg.C) f) Liquid penetration test: ANSI B 16.34 special class (applicable for pr.>70 bar & temp< 400 Deg.C) g) Radiography test: ANSI B 16.34 special class h) Calibration and Hysteresis test i) Actuator leakage test
37.	Local Panels :
	Visual inspection, wiring & continuity check, H.V. and I.R. tests on panels, checking of bill of materials, functional tests.
38	Wiring Termination & Accessories



EPC TENDER SPECIFICATION FOR BTG PACKAGE

S.No	Tests to be performed
	Routine test: Conductor resistance test / High voltage test / Impulse dielectric test / insulation test / Humidity test / Temperature rise test on power circuits / short time current test on power circuits.
	Type test: Annealing test / Test for insulation and sheath / Flame retardency test - a) Oxygen index, b) Flammability / Test for acid gas generation / test for water absorption / wet dielectric test
39	Marshalling / System cabinets
	Verification of degree of protection / Electrical tests as detailed under wiring Termination & accessories / Type test and routine test as per relevant Indian standards.
	Notes:
	1. Test Certificates in addition to inspection at manufacturers works shall be furnished for all the instruments for Owner's review. 2. Above Test to be witnessed shall be finalized by Owner. 3. In addition to above test, test as per approved QAP shall also be witnessed by owner

i) Testing Types

The BIDDER shall furnish the Type test reports of all type tests as per relevant standards and codes. As well as other specifics test indicated in the specification. A list of such test are given for various equipment in table titled, Type Test Requirement for C&I System and under the item special requirement for solid state requirements/systems. For the balance equipments/instruments type test may be conducted as per manufacturer standards or if required by relevant standards.

- 1) Out of these test listed, the bidder / sub vendor / manufacturer is required to conduct certain type test specifically for this contract (and witnessed by employer or his authorized representative). Even if the same have been conducted earlier as clearly indicated subsequently such tests.
- 2) For the rest, submission of type test, results, and certificates shall be acceptable provided following points
 - a) The same have been carried out by the bidder/ sub vendor on exactly the same model/rating of equipment. (For control valves this shall be same size, type & design).
 - b) There has been no change in the components from the offered equipments and tested equipments.
 - c) The test has been carried out as per the latest standards along with amendments as on the date of bid opening.
- 3) In case the approved equipment is different from the one on which the type test had been conducted earlier or any of the above grounds, then the tests have to be repeated and the cost of such tests shall be borne by the bidder/sub-vendor within the quoted price and no extra cost will be payable by the owner on this account.



EPC TENDER SPECIFICATION FOR BTG PACKAGE

As mentioned against certain items, the test certificates for some of the items shall be reviewed and approved by the main bidder or his authorized representative and balanced have to be approved by the employer. The schedule of conduction of type test/submission of reports shall be submitted and finalized during preaward discussion.

For the type test to be conducted, bidder shall submit detailed test procedure for approval by owner. This shall clearly specify test setup, instruments to be used, procedure, and acceptance norms (wherever applicable). , recording of different parameters, intervals of recording precaution to be taken etc. for the test to be carried out.

ii) Special Requirements for Solid State Equipments /Systems

The minimum type test report, over and above the requirements of above clause which are to be submitted for each of the major C&I systems like DDCMIS, DCS etc. shall be as indicated below:

Surge Withstand Capability (SWC) for solid state equipments/equipments

1. All solid state systems/equipments shall be able to withstand the electrical noise and the surges as encountered in actual service conditions and inherent in the power plant. All the solid states systems /equipments shall be provided with all required protection that needs the surge withstand capability as defined in ANSI 37.90.1/IEEE 472. Hence, all front end cards which receive external signals like analog input and output modules, Binary input and output modules etc. including power supply, data highway, data links shall be provided with protection that meets the surge withstand capability as defined in ANSI 37.90.1/IEEE 472. Complete details of the features incorporated in the electronic system to meet this requirement the relevant test carried out, the test certificates, etc. shall be submitted along with the proposal. As an alternative to the above, suitable class of EN 61000-4-12 which is equivalent to ANSI 37.90.1/IEEE 472 may also be adapted for SWC test.
2. The dry heat test as per IEC-68-2-2 or equivalent
3. Damp heat test as per IEC 68-2-3 or equivalent
4. Vibration test as per IEC 68-2-6 or equivalent
5. Electrostatic Discharge test as per EN 61000-4-2 or equivalent
6. Radio frequency immunity test as per EN 61000-4-6 or equivalent
7. Electromagnetic Field Immunity test as per EN 61000-4-3 or equivalent

Test listed at Item no 5, 6, 7 above are applicable for electronic cards only as defined under item no. 1 Above

iii) Type Test Requirements for C&I Systems

S.No	Item	Test Requirement	Standard	Test to be specifically conducted	Owners approval required on test certificate
------	------	------------------	----------	-----------------------------------	--



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

S.No	Item	Test Requirement	Standard	Test to be specifically conducted	Owners approval required on test certificate
1	Electrical metering instruments	As per standards	IS 1248	No	Yes
2	Thermocouple	Degree of Protection Test	IS - 13947	No	No.
3	Junction Box	Degree of Protection Test	IS - 13947	Yes	Yes
4	RTD	As per standards	IEC-60751	No	No
5	Electronic Transmitter	As per standards	BS 6447 / IEC 60770	No	Yes
6	E / P convertor	As per standards	Manufacturing standard	No	Yes
7	Instrumentation cable (Twisted and shielded) (Refer Vol. II, Chapter 8)				
8	Battery	As per standard	IS 10918	Yes	YES
9.	Voltage stabiliser	Over load test	Approved procedure	No	YES
		Temp. rise test without redundant fans	Approved procedure	No	YES
		Input voltage variation test	Approved procedure	No	YES
10	DDCMIS				
	CLCS system	Model Test	Approved procedure	No	No
	BMS & MFT	Safety requirement	VDE0116, SEC 8.7	No	YES
11	Conductivity type level switch	Degree of protection test	IS 13947	No	No
12	Local gauges	Degree of protection test	IS 13947	No	No
13	Process actuated switches	Degree of protection test	IS 13947	No	No
14	Control valves	CV test	ISA 75.02	No	YES
15	LIE / LIR	Degree of	IS 13947	YES	YES
16	Flue gas O2 analyser, other Flue	Degree of protection test	IS 13947	No	YES
17	Flow nozzles & Orifice plates	calibration	ASMEPTC BS 1042	YES	YES

Note:

Ambient Temperature (outside cabinets)	Atmosphere & Pressure	Relative Humidity (RH)	Required Protection Class
Outdoor Locations			
55 degree C max.	Dirty Air @ Atmospheric Pressure	100 % Max.	IP 66***
4 degree C min.	Dirty Air @ Atmospheric Pressure	5 % Min.	IP 66***
Indoor Locations			
55 degree C max.	Air @ Atmospheric Pressure	95 % Max.	IP 54**
4 degree C min.	Air @ Atmospheric Pressure	5 % Min.	IP 54**
Air Conditioned Areas			
24±5 degree C (normal)	Air @ Atmospheric Pressure	95 % Max.	IP 32
50 degree C max.*	Air @ Atmospheric Pressure	5 % Min.	IP 32
* During air conditioning failure. ** For non-ventilated enclosures. For ventilated enclosures, protection class shall be IP 42. *** With a suitable canopy at the top to prevent ingress of dripping water.			

- b) Distribution boxes, junction boxes, cold junction compensation boxes, terminal boxes and all other field mounted equipment to be furnished as per this specification shall have weather protection conforming to IP 65.
- c) The design of panels, cabinets, enclosures and packaging density of components mounted therein shall be such that the temperature rise does not exceed 10 deg. C above the ambient under the worst conditions.
- d) The panels housing electronic hardware shall be provided with flame and smoke detectors by bidder.
- e) Enclosures for peripheral equipments like printers, etc. shall take care of noise and shall ensure minimum possible noise disturb to the working personnel.
- f) For Hazardous areas the protection class shall be in accordance with the requirements of the relevant NEC code for the location.
- g) ~~Workstations, OWS, EWS, Servers, Network Switches, Printers, and other peripherals, maximum temperature limit shall be 40 deg. C. For LVS the same shall be around 30 deg. C.~~
- h) ~~For remote I/O cabinets mounted in non-AC areas, panel redundant AC shall be provided.~~
- i) Specific requirements due to corrosive applications and corrosive environment at project site shall also be considered by bidder.
- j) Delivery of all electronic panels from the manufacturer's works are subject to readiness of respective work fronts or readiness of fully covered stores.



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

Guards, barriers and access doors, covers of plates shall be marked to indicate the hazard, which may occur upon removal of such devices. Danger or caution signs shall be used to warn of specific hazards such as voltage or current. The marking shall be permanently affixed to the equipment.



STANDARD CHECK LIST FOR C&I INSTRUMENTS (for Maux Pkgs)

CHECK LIST FOR FLOW SWITCH

Sl. No.	Test / Checks	Quantum of check	Reference Doc. / Acceptance Norms	Agency **			Remarks
				M	C	B	
1	CHECK FOR	100%	APPROVED SPEC./ DATA SHEETS	P	W	V	
	TYPE						
	RANGE						
	MODEL / TAG No.						
	END CONNECTION						
	DIMENSIONS						
	SIZE						
2	ACCURACY & REPEATABILITY (WET CALIBRATION)	100%		P	W	V	
3	HV / IR	100%		P	W	V	
4	CONTACT RATING / No. OF CONTACTS	RANDOM		P	W	V	
5	MATERIAL TC FOR BODY, WET PARTS, SENSING ELEMENT	ONE / LOT		P	W	V	
6	ACCESSORIES AS APPLICABLE	100%		P	W	V	
7	DEGREE OF PROTECTION	ONE / LOT		P	W	V	
8	OVER PRESSURE TEST	100%		P	W	V	

Legend :

** M = Manufacturer / Sub-contractor, C = Contractor / Nominated Inspecting Agency, B = BHEL,
P = Perform, W = Witness, V = Verification

Note :

- Quantum of check shall be as below :
100 % - By Manufacturer
- Manufacturer to maintain calibrated instrument having better accuracy than the item under test. Inspecting engineer shall check the same.
- Manufacturer to carry out routine test for 100%
- Contractor to provide compliance certificate for tests/checks verified by contractor and submit the same alongwith test certificates to be verified by BHEL.



STANDARD CHECK LIST FOR C&I INSTRUMENTS (for Maux Pkgs)

CHECK LIST FOR TEMPERATURE SWITCH

Sl. No.	Test / Checks	Quantum of check	Reference Doc. / Acceptance Norms	Agency **			Remarks
				M	C	B	
1	CHECK FOR	100%	APPROVED SPEC./ DATA SHEETS	P	W	V	
	TYPE						
	MODEL/TAG NO.						
	RANGE/SCALE						
	END CONNECTION						
2	DIMENSIONS CHECK	100%		P	W	V	
3	ACCURACY	100%		P	W	V	
4	SWITCHING DIFFERENTIAL	100%		P	W	V	
5	CONTACT RATING / No. OF CONTACTS	RANDOM		P	W	V	
6	MATERIAL TC FOR BULB, CAPILLARY, ARMOUR	ONE / LOT		P	V	V	
7	HV / IR	RANDOM		P	W	V	
8	DEGREE OF PROTECTION	TYPE TEST		P	V	V	
9	THERMOWELLS						
	DIMENSIONS, PROCESS CONN	100%		P	W	V	
	MATERIAL TC	ONE / LOT		P	V	V	
	HYD TEST	100%		P	W	V	
	IBR CERTIFICATE, IF APPLICABLE			P	V	V	
10	REPEATABILITY	100%		P	V	V	
11	HYSTERESIS	100%		P	V	V	
12	ACCESSORIES AS APPLICABLE	SEE NOTE-1 BELOW		P	W	V	

Legend :

** M = Manufacturer / Sub-contractor, C = Contractor / Nominated Inspecting Agency, B = BHEL,
P = Perform, W = Witness, V = Verification

Note :

- Quantum of check shall be as below :
100 % - By Manufacturer
- Manufacturer to maintain calibrated instrument having better accuracy than the item under test. Inspecting engineer shall check the same.
- Contractor to provide compliance certificate for tests/checks verified by contractor and submit the same alongwith test certificates to be verified by BHEL.
- Manufacturer to carry out routine test for 100%



STANDARD CHECK LIST FOR C&I INSTRUMENTS (for Maux Pkgs)

CHECK LIST FOR PRESSURE SWITCH

Sl. No.	Test / Checks	Quantum of check	Reference Doc. / Acceptance Norms	Agency **			Remarks
				M	C	B	
1	CHECK FOR	SEE NOTE-1 BELOW	APPROVED SPEC./ DATA SHEETS	P	V	V	
	1.1 MODEL NO/TAG NO						
	1.2 RANGE						
	1.3 END CONN						
	1.4 NO. OF CONTACT						
2	CALIBRATION			P	V	V	
	2.1 REPEATABILITY						
	2.2 SET POINT ADJUSTMENT						
	2.3 DIFFERENTIAL						
3	OVER PR & LEAK TEST				P	V	V
4	ELECT. INSULATION/HV TEST	ONE		P	V	V	
5	REVIEW OF TC FOR MATERIALS OF	FOR LOT		V	V	V	
	5.1 SENSOR						
	5.2 MOVEMENT						
	5.3 PROCESS CONNECTION						
	5.4 HOUSING						
6	REVIEW OF TC FOR DEGREE OF PROTECTION	TYPE TEST		V	V	V	
7	REVIEW OF TC OF MICROSWITCH	FOR LOT		V	V	V	

** M = Manufacturer / Sub-contractor, C = Contractor / Nominated Inspecting Agency, B = BHEL, P = Perform, W = Witness, V = Verification

Note :

- Quantum of check shall be as below :
100 % - By Manufacturer
- Manufacturer to carry out ROUTINE TEST on 100 %.
- Contractor to provide compliance certificate for tests/checks verified by contractor and the same alongwith test certificates to be verified by BHEL



STANDARD CHECK LIST FOR C&I INSTRUMENTS (for Maux Pkgs)

CHECK LIST FOR ANALYTICAL INSTRUMENTS

Sl. No.	Test / Checks	Quantum of check	Reference Doc. / Acceptance Norms	Agency **			Remarks
				M	C	B	
1	CHECK FOR	SEE NOTE-1 BELOW	APPROVED SPEC./ DATA SHEETS	P	V	V	
	VISUAL						
	MAKE, MODEL No.						
	POWER SUPPLY						
	TYPE						
2	DIMENSIONS CHECK			P	V	V	
3	FUNCTIONAL CHECK			P	V	V	
4	LEAKAGE TEST			P	V	V	
5	HV / IR TEST			P	V	V	
6	LINEARITY			P	V	V	
7	RESPONSE TIME			P	V	V	
8	ENCLOSURE CLASS			P	V	V	
9	ACCESSORIES, AS APPLICABLE			P	V	V	
10	ACCURACY / CALIBRATION			P	V	V	
11	ALARM CONTACT TEST			P	V	V	
12	ANALOG OUTPUT CHECK			P	V	V	
13	BURN-IN TEST OF ELECTRONIC PARTS	1/LOT		P	V	V	
14	IN-BUILT INDICATOR, ZERO, SPAN, RANGE SCALE SELECTION ETC	SEE NOTE-1 BELOW		P	V	V	

Legend :

** M = Manufacturer / Sub-contractor, C = Contractor / Nominated Inspecting Agency, B = BHEL,
P = Perform, W = Witness, V = Verification

Note :

- Quantum of check shall be as below :
100 % - By Manufacturer
- Manufacturer to maintain calibrated instrument having better accuracy than the item under test. Inspecting engineer shall check the same.
- Contractor to provide compliance certificate for tests/checks verified by contractor and submit the same alongwith test certificates to be verified by BHEL.



STANDARD CHECK LIST FOR C&I INSTRUMENTS (for Maux Pkgs)

CHECK LIST FOR TRANSMITTER

Sl. No.	Test / Checks	Quantum of check	Reference Doc. / Acceptance Norms	Agency **			Remarks
				M	C	B	
1	CHECKS FOR	SEE NOTE-1 BELOW	APPROVED SPEC./ DATA SHEETS	P	W	V	
	VISUAL.						
	MODEL/TAG No						
2	PROCESS CONNECTION			P	W	V	
3	ACCURACY			P	W	V	
4	REPEATABILITY			P	W	V	
5	HYSTERESIS			P	W	V	
6	EFFECT OF TEMP VARIATION ON ACCURACY			P	W	V	
7	SPAN / ZERO ADJUSTMENT	ONE / TYPE		P	W	V	
8	EFFECT OF SUPPLY VOLTAGE VARIATION			P	W	V	
9	EFFECT OF LOADING (500 OHM METERS)			P	W	V	
10	HIGH PRESSURE TEST	SEE NOTE-1 BELOW		P	W	V	
11	BURN-IN TEST	ONE / TYPE		P	W	V	
12	DEGREE OF PROTECTION			P	W	V	
13	ACCESSORIES AS APPLICABLE	SEE NOTE-1 BELOW		V	V	V	

Legend :

** M = Manufacturer / Sub-contractor, C = Contractor / Nominated Inspecting Agency, B = BHEL, P = Perform, W = Witness, V = Verification

Note :

- Quantum of check shall be as below :
100 % - By Manufacturer
- Manufacturer to maintain calibrated instrument having better accuracy than the item under test. Inspecting engineer shall check the same.
- When material corelation are not available manufacturer's compliance to be provided.
- Contractor to provide compliance certificate for tests/checks verifid by contractor and submit the same alongwith test certificates to be verified by BHEL.



STANDARD CHECK LIST FOR C&I INSTRUMENTS (for Maux Pkgs)

CHECK LIST FOR TEMPERATURE ELEMENT

Sl. No.	Test / Checks	Quantum of check	Reference Doc. / Acceptance Norms	Agency **			Remarks
				M	C	B	
1	CHECK FOR TYPE	SEE NOTE-1 BELOW	APPROVED SPEC./ DATA SHEETS	P	W	V	
	MODEL No./TAG No.						
	PROCESS CONNECTION						
2	STABILITY			P	W	V	
3	INSULATION RESISTANCE			P	W	V	
4	ENCLOSURE CLASS			P	W	V	
5	RESPONSE TIME			P	W	V	
7	ACCURACY			P	W	V	
8	HYDROSTATIC TEST			P	W	V	
9	ELECTRICAL CHARACTERISTIC OF SENSOR (CONTINUITY OF T/C WIRES & INSULATION RESISTANCE OF RTD LEADS w.r.t. BODY			P	W	V	
10	TEMP CURVES / CHARTS			P	V	V	
11	AMBIENT TEMP. EFFECT CHECK			P	W	V	
12	HV TEST			P	W	V	

Legend :

** M = Manufacturer / Sub-contractor, C = Contractor / Nominated Inspecting Agency, B = BHEL, P = Perform, W = Witness, V = Verification

Note :

- Quantum of check shall be as below :
100 % - By Manufacturer
- Manufacturer to maintain calibrated instrument having better accuracy than the item under test. Inspecting engineer shall check the same.
- Contractor to provide compliance certificate for tests/checks verified by contractor and submit the same alongwith test certificates to be verified by BHEL.
- IBR certificate to be provided, if applicable

[illegible]

** M = Manufacturer / Sub-contractor, C = Contractor / Nominated Inspecting Agency, B = BHEL,
P = Perform, W = Witness, V = Verification

1. Quantum of check shall be as below :
100 % - By Manufacturer
2. Manufacturer to maintain calibrated instrument having better accuracy than the item under test. Inspecting engineer shall check the same.
3. Manufacturer to carry out ROUTINE TEST on 100 %.
4. Contractor to provide compliance certificate for tests/checks verified by contractor and the same alongwith test certificates to be verified by BHEL



STANDARD CHECK LIST FOR C&I INSTRUMENTS (for Maux Pkgs)

CHECK LIST FOR SOLENOID VALVES

Sl. No.	Test / Checks	Quantum of check	Reference Doc. / Acceptance Norms	Agency **			Remarks
				M	C	B	
1	CHECK FOR	SEE NOTE-1 BELOW	APPROVED SPEC./ DATA SHEETS	P	W	V	
	TYPE						
	MAKE						
	MODEL No.						
2	MATERIAL (BODY. PLUNGER/TRIM)			P	W	V	
3	PORT SIZE			P	W	V	
4	CABLE CONNECTION SIZE			P	W	V	
5	ENCLOSURE CLASS			P	W	V	TYPE TEST CERTIFICATE TO BE FURNISHED BY VENDOR
6	No. OF COILS & INSULATION CLASS			P	W	V	TEST CERTIFICATE TO BE FURNISHED FOR INSULATION CLASS BY VENDOR
7	POWER SUPPLY CHECK			P	W	V	
8	IR / HV TEST			P	W	V	
9	FUCTIONAL TEST			P	W	V	

Legend :

** M = Manufacturer / Sub-contractor, C = Contractor / Nominated Inspecting Agency, B = BHEL, P = Perform, W = Witness, V = Verification

Note :

- Quantum of check shall be as below :
100 % - By Manufacturer
- Manufacturer to maintain calibrated instrument having better accuracy than the item under test. Inspecting engineer shall check the same.
- Contractor to provide compliance certificate for tests/checks verifid by contractor and submit the same alongwith test certificates to be verified by BHEL.



STANDARD CHECK LIST FOR C&I INSTRUMENTS (for Maux Pkgs)

CHECK LIST FOR TEMPERATURE GAUGE

Sl. No.	Test / Checks	Quantum of check	Reference Doc. / Acceptance Norms	Agency **			Remarks
				M	C	B	
1	CHECK FOR	SEE NOTE-1 BELOW	APPROVED SPEC./ DATA SHEETS	P	W	V	
	DIAL SIZE						
	MODEL NO./TAG NO./TYPE						
	RANGE/SCALE						
	END CONNECTION						
2	CALIBRATION			P	W	V	
	ACCURACY						
	REPEATABILITY						
	HYSTERESIS						
3	OVER TEMP. TEST			P	W	V	
4	AMBIENT TEMP. COMPENSATION CHECK	1 OF TYPE	P	V	V		
5	REVIEW OF TC FOR MATERIALS OF	FOR LOT	V	V	V		
	SENSOR						
	MOVEMENT						
	PROCESS CONNECTION						
	THERMOWELL						
	HOUSING		V	V	V		
6	REVIEW OF TC FOR DEGREE OF PROTECTION	TYPE TEST		V	V		
7	THERMOWELL	SEE NOTE-1 BELOW	AS PER APPD DWG		V	V	
	MATERIAL TC & DIMN. CHECK						
	HYD.TEST						
	OVER RANGE TEST						

Legend :

** M = Manufacturer / Sub-contractor, C = Contractor / Nominated Inspecting Agency, B = BHEL, P = Perform, W = Witness, V = Verification

Note :

- Quantum of check shall be as below :
100 % - By Manufacturer
- Manufacturer to maintain calibrated instrument having better accuracy than the item under test. Inspecting engineer shall check the same.
- Manufacturer to carry out ROUTINE TEST on 100 %.
- IBR certificate to be provided if called for in specn.
- Contractor to provide compliance certificate for tests/checks verified by contractor and submit the same alongwith test certificates to be verified by BHEL.



STANDARD CHECK LIST FOR C&I INSTRUMENTS (for Maux Pkgs)

CHECK LIST FOR PRESSURE & DP GAUGE

Sl. No.	Test / Checks	Quantum of check	Reference Doc. / Acceptance Norms	Agency **			Remarks
				M	C	B	
1	CHECK FOR	SEE NOTE-1 BELOW	APPROVED SPEC./ DATA SHEETS	P	W	V	
	SENSOR TYPE						
	DIAL SIZE						
	MODEL NO/TAG NO						
	RANGE/SCALE						
	SWITCH CONTACT RATING & NOS.						
	END CONNECTION						
2	CALIBRATION			P	W	V	
	ACCURACY						
	REPEATABILITY						
	SET POINT ADJUSTMENT						
3	OVER PRESSURE & LEAK TEST	P		W	V		
4	OPERATION OF PRESSURE. RELIEF DEVICE	ONE		P	W	V	
5	REVIEW OF TC FOR	FOR LOT		V	V	V	
	MATERIALS OF SENSOR						
	MOVEMENT						
	PROCESS CONNECTION						
	HOUSING						
6	REVIEW OF TC FOR DEGREE OF PROTECTION	TYPE TEST	V	V	V		
7	ACCESSORIES AS APPLICABLE	SEE NOTE-1 BELOW	V	V	V		

Legend :

** M = Manufacturer / Sub-contractor, C = Contractor / Nominated Inspecting Agency, B = BHEL, P = Perform, W = Witness, V = Verification

Note :

- Quantum of check shall be as below :
100 % - By Manufacturer
- Manufacturer to maintain calibrated instrument having better accuracy than the item under test. Inspecting engineer shall check the same.
- Manufacturer to carry out ROUTINE TEST on 100 %.
- When material correlation is not available, MFR's compliance to be provided
- Contractor to provide compliance certificate for tests/checks verified by contractor and submit the same alongwith test certificates to be verified by BHEL.



STANDARD CHECK LIST FOR C&I INSTRUMENTS (for Maux Pkgs)

CHECK LIST FOR LEVEL GAUGE

Sl. No.	Test / Checks	Quantum of check	Reference Doc. / Acceptance Norms	Agency **			Remarks
				M	C	B	
1	CHECK FOR	SEE NOTE-1 BELOW	APPROVED SPEC./ DATA SHEETS / DRWGS	P	W	V	
	TYPE						
	MODEL/ TAG NO.						
	DAIL SIZE						
	RANGE/SCALE						
	END CONNECTION						
2	DIMENSIONS, PROCESS CONNECTION	ONE / LOT		P	W	V	
3	ACCURACY			P	W	V	
4	MATERIAL TC FOR			P	V	V	
	BODY ISO.						
	VALVE						
	GAUGE GLASS						
5	HYD. TEST	SEE NOTE-1 BELOW		P	W	V	
6	ACCESSORIES AS APPLICABLE			P	W	V	

Legend :

** M = Manufacturer / Sub-contractor, C = Contractor / Nominated Inspecting Agency, B = BHEL,
P = Perform, W = Witness, V = Verification

Note :

- Quantum of check shall be as below :
100 % - By Manufacturer
- Manufacturer to maintain calibrated instrument having better accuracy than the item under test. Inspecting engineer shall check the same.
- Manufacturer to carry out ROUTINE TEST on 100 %.
- Contractor to provide compliance certificate for tests/checks verified by contractor and submit the same alongwith test certificates to be verified by BHEL.

[illegible]

** M = Manufacturer / Sub-contractor, C = Contractor / Nominated Inspecting Agency, B = BHEL, P = Perform, W = Witness, V = Verification

1. Quantum of check shall be as below :
100 % - By Manufacturer
2. Manufacturer to maintain calibrated instrument having better accuracy than the item under test. Inspecting engineer shall check the same.
3. Manufacturer to carry out ROUTINE TEST on 100 %.
4. Contractor to provide compliance certificate for tests/checks verified by contractor and the same alongwith test certificates to be verified by BHEL

INSTRUMENT INSTALLATION DIAGRAM

|

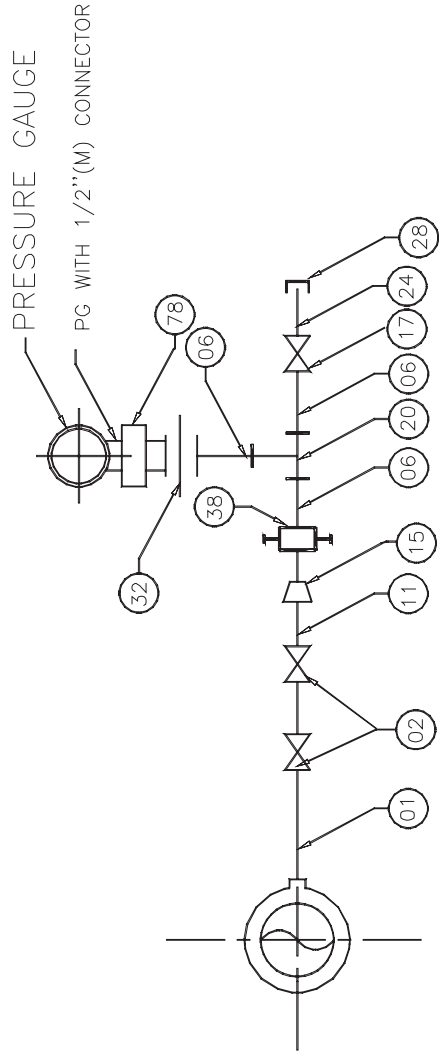


FIG-A STEAM/LIQUID SERVICE

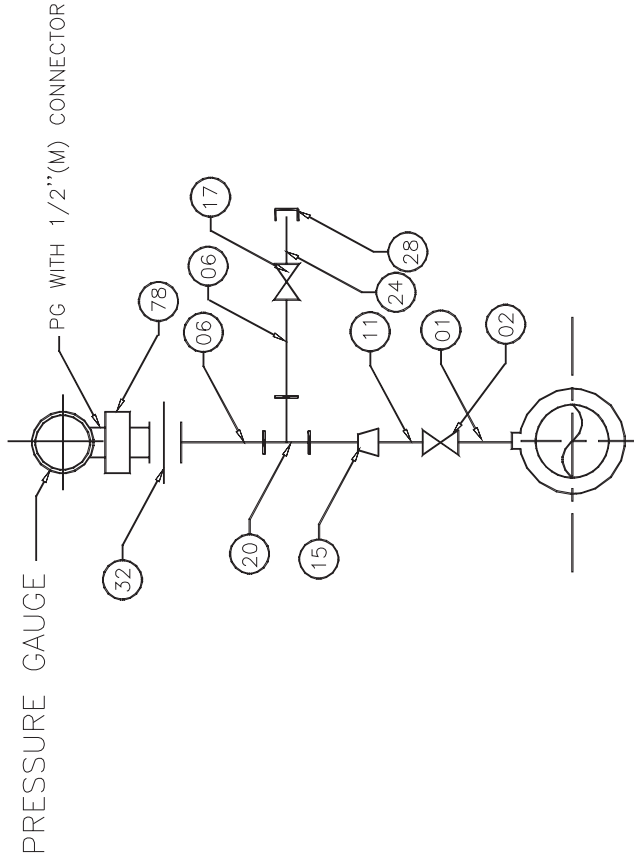


FIG-B AIR SERVICE

TAG NO.	DESCRIPTION	QTY.	
		A	B
78	1/2"NPT(F)X1/2"NPT(M) SNUBBER/ PULSATION DAMPER	1	1
38	3-WAY GAUGE VALVE WITH 1/2" NB SW	1	-
32	1/2"NPS, 3 PIECE PIPE UNION WITH 1/2"NPT(F) SCREWED	1	1
28	1/2"NPT (F) CS CAP	1	1
24	1/2"NPS, SCH-80/160 X 1/2"NPT(M) CS/AS NIPPLE	1	1
20	1/2"SW EQUAL TEE, CS/AS	2	1
17	1/2"SW CS/AS GLOBE VALVE	1	1
1	1/2" / 3/4" / CS/AS NIPPLE OF MTL. SAME AS THAT OF MAIN PIPE(AS PRE PROCESS REQ.)	AS REQ.	
15	1"TO 1/2"SW REDUCER	1	1
11	1"NPS SCH-80/160 CS/AS PIPE	1	1
6	1/2"NPS, SCH-80/160 CS/AS PIPE	AS REQ.	
2	1/2"/3/4"/1"ROOT VALVE - SW GLOBE VALVE	2	1

NOTE

TAMIL NADU GENERATION AND DISTRIBUTION CORPORATION LIMITED

		LAHMEYER INDIA		LAHMEYER INTERNATIONAL (INDIA) PVT. LTD. CONSULTING ENGINEERS, GURGAON, INDIA	
		CONTRACT NO. :		PROJECT : 1 X 800MW - NCTPP - STAGE - III	
		PREPARED NAME :		ENMORE & PUZHODHAKKAM VILLAGE, CHENNAI, TAMILNADU	
		DESIGNED BY :		DRAWING TITLE :	
		CHECKED BY :		INSTRUMENT DRAWING FOR PRESSURE GAUGE FOR STEAM/LIQUID/AIR SERVICE	
		APPROVED BY :		DRAWING NO. :	
		SHEET SIZE : A4		LI-GE015066-I-45786-004	
		SCALE : 1:1		REV. SHEET	
		PROJECTION mark UN 3:1 = 1:		00 1 OF 1	
		Notes: 1. To others and the use or communication of the contents thereof, are forbidden, without the written permission of Lahmeyer International (India) Pvt. Ltd.			
		2. Copies of this drawing, and giving it to others, without the written permission of Lahmeyer International (India) Pvt. Ltd., are prohibited.			
		3. The registration of a utility model or design, is not possible without the written permission of Lahmeyer International (India) Pvt. Ltd.			

Protection must be provided for the gauges and the use or communication of the contents thereof, are forbidden without express authority. Officers are liable to the payment of damages. All rights are reserved in the event of the grant of a patent of the registration of a utility model or design.

1

2

3

4

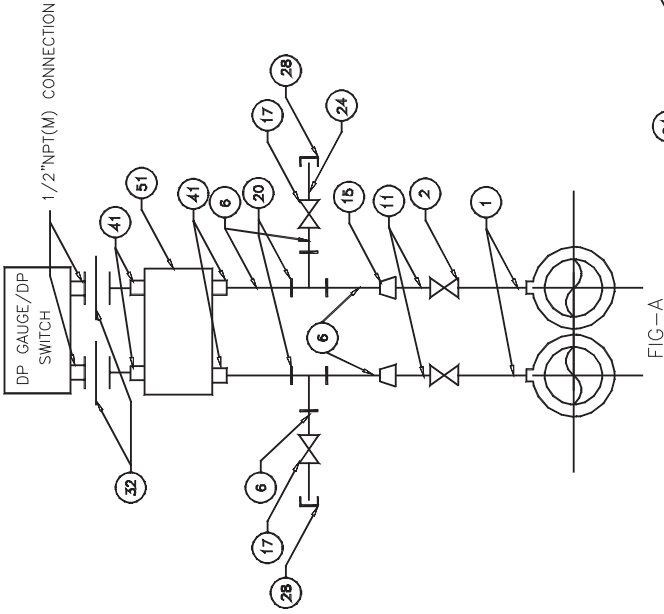


FIG-A

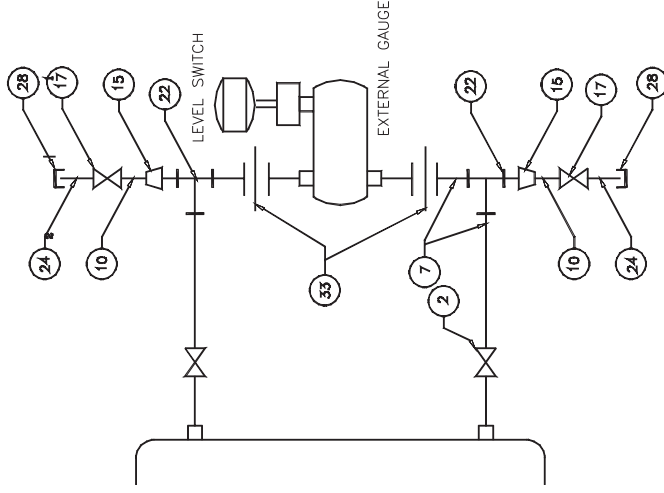


FIG-B

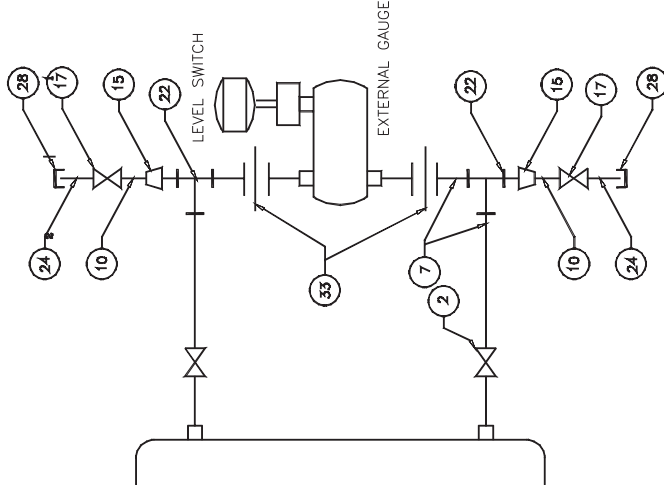


FIG-C

NOTE

TAG NO.	DESCRIPTION	QTY.		
		A	B	C
78	1/2"NPT(F)X1/2"NPT(M) SNUBBER/ PULSATION DAMPER	1	-	-
38	3-WAY GAUGE VALVE WITH 1/2" NB SW	1	-	-
32	1/2"NPS, 3 PIECE PIPE UNION WITH 1/2"NPT(F) SCREWED	1	-	-
28	1/2"NPT (I) CS CAP	1	2	2
24	1/2"NPS, SCH-80/160 X 1/2"NPT(M) CS/AS NIPPLE	1	2	2
17	1/2"SW EQUAL TEE, CS/AS	1	-	-
15	1/2"SW CS/AS GLOBE VALVE	1	2	2
1	1/2" / 3/4" / CS/AS NIPPLE OF MTL. SAME AS THAT OF MAIN PIPE(AS PRE PROCESS REQ.)	AS REQ.		
15	1"TO 1/2"SW REDUCER	1	2	2
11	1"NPS SCH-80/160 CS/AS PIPE	1	-	-
6	1/2"NPS, SCH-80/160 CS/AS PIPE	AS REQ.		
2	1/2"/3/4"/1"ROOT VALVE - SW GLOBE VALVE	2	2	2
33	1"SW EQUAL PIPE UNION	-	2	2
22	1"SW EQUAL TEE CS/AS	-	1	2
10	1/2"NPS, SCH 80/160 CS/AS NIPPLE	-	2	2
7	1"NPS, SCH 80/160 CS / AS PIPE	AS REQ.		
33	1"SW EQUAL PIPE UNION	2	2	2

NOTE:-
WITH VALVE SIZE 1/2"SW NIPPLE PIECE IS NOT REQUIRED

TAMIL NADU GENERATION AND DISTRIBUTION CORPORATION LIMITED

LAHMEYER INDIA		LAHMEYER INTERNATIONAL (INDIA) PVT. LTD. CONSULTING ENGINEERS, GURGAON, INDIA	
CONTRACT NO. :		PROJECT : 1 X 800MW - NCTPP - STAGE - III	
PREPARED BY :		ENQUIRE & PUZHODHAKKAM VILLAGE, CHENNAI, TAMILNADU	
DESIGNED BY :		DRAWING TITLE :	
CHECKED BY :		INSTRUMENT DRAWING FOR DP GAUGE / SWITCH & LEVEL SWITCH	
APPROVED BY :		DRAWING NO. :	
SHEET SIZE :		LI-GE015066-I-45786-013	
SCALE :		REV. : 00	
SHEET NO. :		1 OF 1	

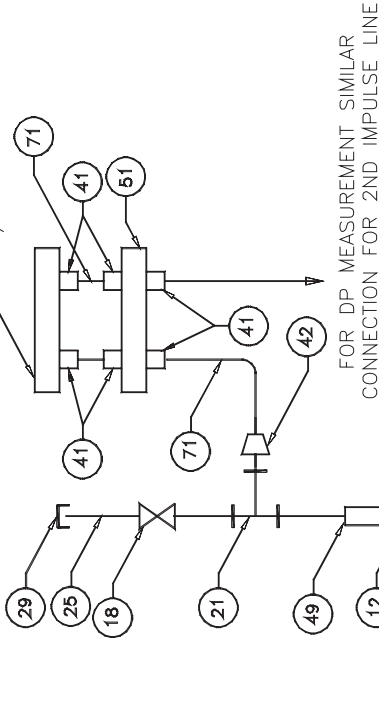
1

2

3

4

PR/DP TRANSMITTER/SWITCH



SLOPE-1:10

2

1

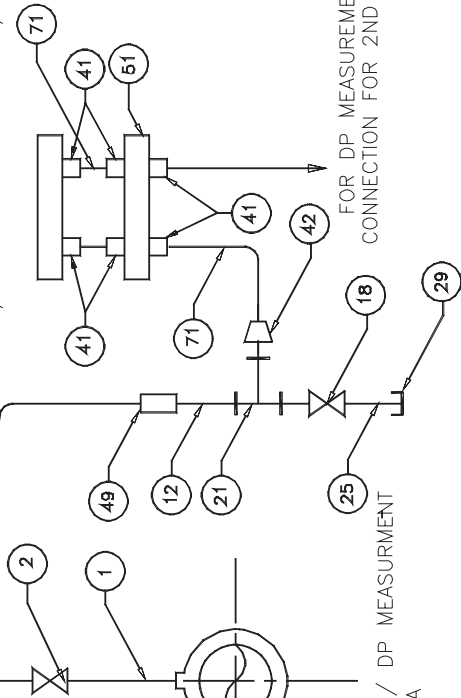
2

1

AIR PRESSURE / DP MEASUREMENT

FIG-B

PR/DP TRANSMITTER/SWITCH



FOR DP MEASUREMENT SIMILAR CONNECTION FOR 2ND IMPULSE LINE

AIR PRESSURE / DP MEASUREMENT

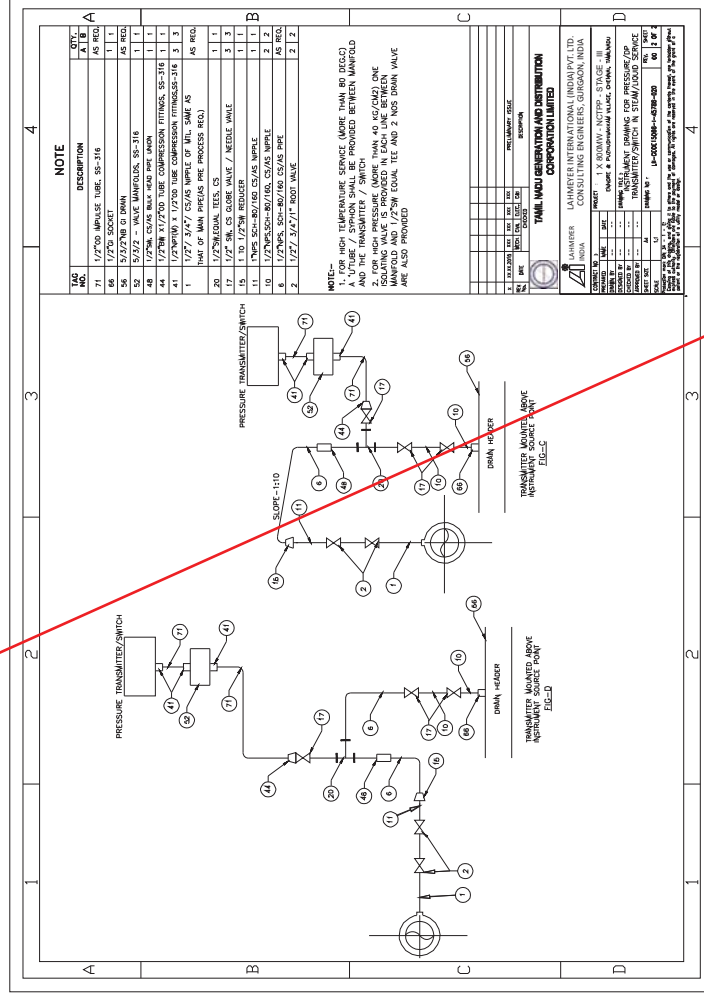
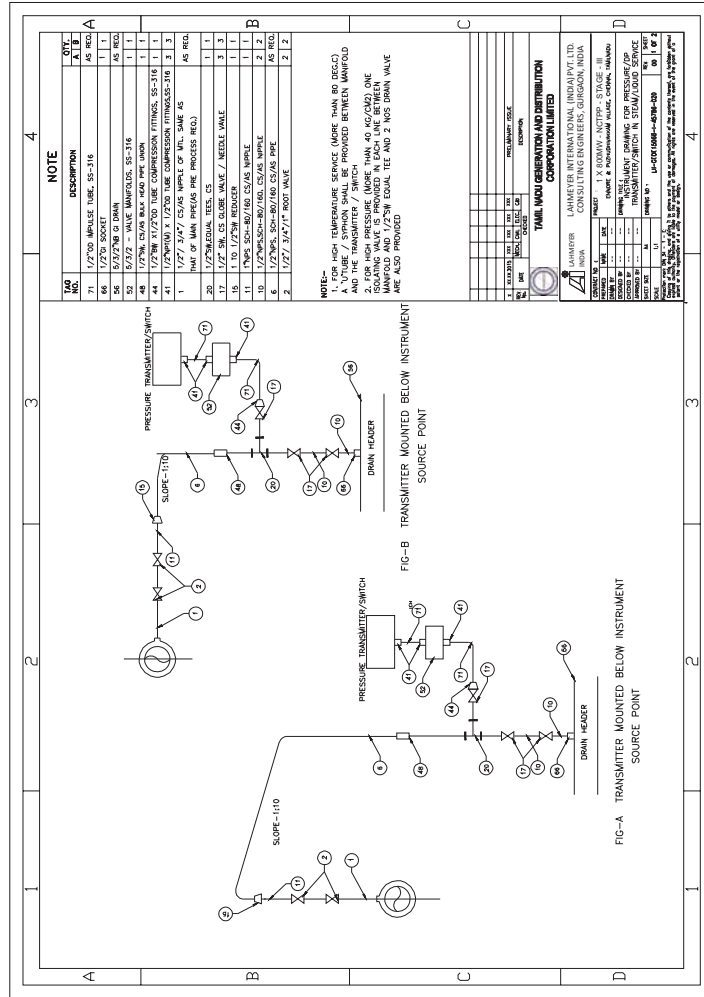
FIG-A

1

2

3

4



Ambient Temperature (outside cabinets)	Atmosphere & Pressure	Relative Humidity (RH)	Required Protection Class
Outdoor Locations			
55 degree C max.	Dirty Air @ Atmospheric Pressure	100 % Max.	IP 66***
4 degree C min.	Dirty Air @ Atmospheric Pressure	5 % Min.	IP 66***
Indoor Locations			
55 degree C max.	Air @ Atmospheric Pressure	95 % Max.	IP 54**
4 degree C min.	Air @ Atmospheric Pressure	5 % Min.	IP 54**
Air Conditioned Areas			
24±5 degree C (normal)	Air @ Atmospheric Pressure	95 % Max.	IP 32
50 degree C max.*	Air @ Atmospheric Pressure	5 % Min.	IP 32
* During air conditioning failure. ** For non-ventilated enclosures. For ventilated enclosures, protection class shall be IP 42. *** With a suitable canopy at the top to prevent ingress of dripping water.			

- b) Distribution boxes, junction boxes, cold junction compensation boxes, terminal boxes and all other field mounted equipment to be furnished as per this specification shall have weather protection conforming to IP 65.
- c) The design of panels, cabinets, enclosures and packaging density of components mounted therein shall be such that the temperature rise does not exceed 10 deg. C above the ambient under the worst conditions.
- d) The panels housing electronic hardware shall be provided with flame and smoke detectors by bidder.
- e) Enclosures for peripheral equipments like printers, etc. shall take care of noise and shall ensure minimum possible noise disturb to the working personnel.
- f) For Hazardous areas the protection class shall be in accordance with the requirements of the relevant NEC code for the location.
- g) ~~Workstations, OWS, EWS, Servers, Network Switches, Printers, and other peripherals, maximum temperature limit shall be 40 deg. C. For LVS the same shall be around 30 deg. C.~~
- h) ~~For remote I/O cabinets mounted in non-AC areas, panel redundant AC shall be provided.~~
- i) Specific requirements due to corrosive applications and corrosive environment at project site shall also be considered by bidder.
- j) Delivery of all electronic panels from the manufacturer's works are subject to readiness of respective work fronts or readiness of fully covered stores.



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

Guards, barriers and access doors, covers of plates shall be marked to indicate the hazard, which may occur upon removal of such devices. Danger or caution signs shall be used to warn of specific hazards such as voltage or current. The marking shall be permanently affixed to the equipment.

QUALITY ASSURANCE PLAN

|

QUALITY ASSURANCE AND TESTING AND GUARANTEES

2.5 Quality Assurance Plan

2.5.3 General Requirement

All equipment furnished under this specification shall be subject to test by authorized quality assurance personnel of the Bidder, representatives of the Owner during manufacture, erection and on completion. Bidder's quality assurance personnel for these shop and site tests shall be identified in advance and shall be acceptable to the Owner. The approval of the Owner or passing of such inspection of tests will not, however, prejudice the right of the owner to reject the equipment if it does not comply with the specifications when erected or fails to give complete satisfaction in service.

The Bidder shall furnish details of shop and site tests proposed to be conducted by him at various stages to meet the specification requirements for each type of instrument/system along with his proposal. Bidder shall also furnish details of his proposed shop and site quality assurance organization for this contract. Bidder shall prepare a detailed shop and site 'Quality Assurance Programme' to meet the requirements of these specifications for Owner's approval. This document shall also contain the formats for reports and maintenance of test records specification of test equipment to be used for site tests.

All equipment and systems furnished under this specification shall be subjected to shop & site tests in accordance with the Quality Assurance Program approved by the Owner and shall be adequate to ensure full compliance with these specification, all applicable codes & standards and detailed engineering drawings and documents approved by the Owner.

The Bidder shall provide all required test equipment and simulation devices for performing all shop and site tests. All tests equipment shall be of reputed make, required accuracy class and shall be recently calibrated. The record of calibration of test equipment shall be made available to the Owner on demand.

The cost of all tests as per the requirements of this specification and approved quality assurance programme shall be included in Bidder's lump sum price for this package and no extra price shall be payable by the Owner for conducting any test as per the intent and requirements of this specification.

All approval/Inspection are to be carried out by the Owner only.

2.5.3.1 Testing Method

i) Shop Test

Shop tests shall include all tests to be carried out at Bidder's works at of this sub-bidder and at works where raw materials used for manufacture of equipment is produced.

Individual components, instruments and devices furnished in accordance with specification sheets, and I&C device list enclosed with these specifications shall be shop tested by manufacturer prior to shipment. The manufacturer shall conduct these tests for certifying compliance with published specifications for the equipment and provide test results to the Owner in writing. These tests and test certificates shall be in accordance with the agreed 'QA' programme for major systems/equipments. However, manufacturer's standard methods shall be followed if details of tests for any equipment are not covered under this agreed 'QA Programme'. Whenever tested quality material is specified and wherever called upon by Indian Boilers Regulations or by the design code, the test pieces are to be prepared and tested to Owner's satisfaction.

In the event of Owner being furnished with certified particulars of tests, which have been carried out by the suppliers of material, the Owner may, at his discretion, dispense with these tests.

ii) Material Tests

Whenever tested quality material specified and whenever called upon by Indian Boilers Regulations or by design code, the test pieces, are to be prepared and tested to Owner's satisfaction.

In the event of Owner being furnished with certified particulars of tests, which have been carried out by the suppliers of material, the Owner may, at his discretion, dispense with these tests.

iii) Test at Manufacturer's Works

Works tests are to include electrical, mechanical performance and hydraulic tests in accordance with relevant IS, IBR or any other approved standard or any other tests called for by the Owner under these specifications to ensure that the equipment being supplied fulfils the requirements of these specifications. For equipments not covered by any IS or other approved standards, the tests to be carried out shall be in accordance with Bidders' quality assurance programme approved by the Owner.

Control systems, monitoring systems, control panels instrument enclosures, and power supply systems shall be shop tested according to unique requirements specified in the applicable section of these specifications for each item and quality assurance program approved by the owner.

All shop tests shall be performed prior to shipment and the Owner shall be given the opportunity to witness these tests. The Bidder shall notify the Owner regarding readiness for shop test at least 10 days before the scheduled date if the tests to be conducted within Indian and at least 60 days before the schedule date if the test is to be conducted abroad.

iv) Factory Tests

2.5.3.6 Calibration of Instruments

The Bidder shall carry out the calibration of instruments as indicated below by submitting the test procedure and quality assurance plan for the Owner's approval. Bidder shall also prepare detailed checklist/calibration sheets for each of the systems/equipment clearly indicating the step-by-step procedures to be carried out for calibration pre commissioning, loop checking, powering and commissioning.

The calibration of all instruments shall be checked and calibration records prepared for the Owner's use. If the instruments require recalibration, Bidder shall recalibrate the instruments and revise the calibration records and submit to the Owner.

2.5.3.7 Tests to be performed for Field Instruments

S.No	Tests to be performed
1.	Pressure Gauges
	Calibration Hydro test (1.5 times max. pr.)
2.	Pressure switches
	Calibration test / Hydro test / Contact rating test / Accuracy test / Repeatability
3.	Differential Pressure Gauges
	Calibration test / Hydro test / Leak test / Over range test / Accuracy test / Repeatability test.
4.	Differential Pressure Switches
	Calibration test / Hydro test / Contact rating test / Leak test / Accuracy test / Repeatability test.
5.	Thermometers
	Calibration / Material test / Accuracy test / Bore concentricity : $\pm 5\%$ of wall thickness / Hydrostatic test for TW (1.5 times max. pr.)
6.	Temperature switch
	Calibration / Material test / Accuracy test / Bore concentricity: 1.5% of wall thickness / Hydrostatic test for TW (1.5 times max. pr.) / Contact rating test.
7.	Resistance temperature detector assembly.
	Calibration / Material test / Bore concentricity test / Insulation test ($\leq 500 \text{ M}\Omega$ at 500V DC) As per ISA, Hydro test for TW. Bore concentricity: $\pm 5\%$ of wall thickness, Accuracy test.
8.	Thermocouple assembly
	Calibration / Material test, Insulation test ($\geq 500 \text{ }\Omega$ at 500 V, DC) as per ISA, Hydro static test (1.5 times max. pr.), Bore concentricity: $\pm 5\%$ of wall thickness.
9.	Thermo wells
	Material test / Bore concentricity: $\pm 5\%$ of wall thickness / Hydrostatic test for TW (1.5 times max. pr.)
10.	Level Gauges

S.No	Tests to be performed
	Hydrostatic test / Material test / Seat leakage test / Ball check test.
11.	Level switches (Magnetic)
	Material test / Contact rating test / Hydro test / Calibration test.
12.	Flow Switch
	Material test / Hydro static test (1.5 times max. pr.) / function test.
13.	Flow glasses
	Material test / Hydrostatic test (1.5 times max. pr.) / function test.
14.	Variable area flow meters
	Calibration test / Material test / Hydrostatic test (1.5 times max. pr.)
15.	Flow element
	100% Radiography test / Hydro test / Calibration test, IBR Certificate.
	Calibration test for flow element shall be witnessed by Owner.
16.	Control valves / Pneumatic block valve / Pressure regulating valve – Refer chapter 10.
17.	Position transmitters
	Calibration / hysteresis and Accuracy test
18.	Electro Pneumatic Convertors
	Calibration test / Accuracy test
19.	Solenoid valves
	Hydro test / Seat leakage test / CV test / Coil insulation test
20.	Air filter regulators
	Calibration test / Accuracy test
21.	Junction Boxes
	Test for degree of protection / Material test
22.	Tests for terminal blocks
	Test for moulding for flame resistant, Non-hygroscopic and Decarbonised / Insulation test between terminals / Insulation between terminal block and frame.
23.	Thermocouple extension cable
	Thermo-e.m.f characteristic / Continuity test / Measurement on capacitance, inductance and loop resistance / Insulation resistance / High voltage test as per latest IS / Tensile and elongation test / Oxygen index test / Any other test applicable.
24.	Mass flow meter
	Performance test / Calibration test / Hydrostatic test.
25.	Boiler Level Gauge
	Hydrostatic test / Material test / Seat leakage test / IBR Certificate
26.	pH / Conductivity measurement / Silica / Dissolved oxygen analysers:
	Calibration test, Accuracy test
27.	Sample cooler :

S.No	Tests to be performed
	Hydro test, IBR Certificate
28.	Sampling racks :
	Hydro test, IBR Certificate for tubes and fittings.
29.	SO2 / NOx analyser / SPM analyser:
	Calibration test, accuracy test
30.	Interposing relay
	Functional test, temperature rise test, H.V test, Insulation test
31.	Transmitter Racks :
	Hydro test, air leak test for piping / tubing and fittings. IBR certification as required for tubing / piping and fittings.
32.	Pressure Transmitter
	Calibration test / Hydro test / Leak test / Over range test / Accuracy test / Repeatability test.
33.	Differential pressure transmitter
	Calibration test / Hydro test / Leak test / Over range test / Accuracy test / Repeatability test.
34.	Temperature Transmitter
	Calibration test / Accuracy test / Ambient temperature error test
35	Pneumatic Block Valves
	a) IBR certificate form III C b) Hydrostatic test : ANSI B 16.34 c) Seat leakage test : As per ANSI B 16-104 d) CV test: As per ISA procedure e) Magnetic particle test ANSI B 16.34 special class (applicable for pr.>70 bar & temp< 400 Deg.C) f) Liquid penetration test: ANSI B 16.34 special class (applicable for pr.>70 bar & temp< 400 Deg.C) g) Radiography test: ANSI B 16.34 special class h) Calibration and Hysteresis test i) Actuator leakage test
36.	Pressure Regulating Valve
	a) IBR certificate form III C b) Hydrostatic test : ANSI B 16.34 c) Seat leakage test : As per ANSI B 16-104 d) CV test: As per ISA procedure e) Magnetic particle test ANSI B 16.34 special class (applicable for pr.>70 bar & temp< 400 Deg.C) f) Liquid penetration test: ANSI B 16.34 special class (applicable for pr.>70 bar & temp< 400 Deg.C) g) Radiography test: ANSI B 16.34 special class h) Calibration and Hysteresis test i) Actuator leakage test
37.	Local Panels :
	Visual inspection, wiring & continuity check, H.V. and I.R. tests on panels, checking of bill of materials, functional tests.
38	Wiring Termination & Accessories

S.No	Tests to be performed
	Routine test: Conductor resistance test / High voltage test / Impulse dielectric test / insulation test / Humidity test / Temperature rise test on power circuits / short time current test on power circuits.
	Type test: Annealing test / Test for insulation and sheath / Flame retardency test - a) Oxygen index, b) Flammability / Test for acid gas generation / test for water absorption / wet dielectric test
39	Marshalling / System cabinets
	Verification of degree of protection / Electrical tests as detailed under wiring Termination & accessories / Type test and routine test as per relevant Indian standards.
	Notes:
	1. Test Certificates in addition to inspection at manufacturers works shall be furnished for all the instruments for Owner's review. 2. Above Test to be witnessed shall be finalized by Owner. 3. In addition to above test, test as per approved QAP shall also be witnessed by owner

i) Testing Types

The BIDDER shall furnish the Type test reports of all type tests as per relevant standards and codes. As well as other specifics test indicated in the specification. A list of such test are given for various equipment in table titled, Type Test Requirement for C&I System and under the item special requirement for solid state requirements/systems. For the balance equipments/instruments type test may be conducted as per manufacturer standards or if required by relevant standards.

- 1) Out of these test listed, the bidder / sub vendor / manufacturer is required to conduct certain type test specifically for this contract (and witnessed by employer or his authorized representative). Even if the same have been conducted earlier as clearly indicated subsequently such tests.
- 2) For the rest, submission of type test, results, and certificates shall be acceptable provided following points
 - a) The same have been carried out by the bidder/ sub vendor on exactly the same model/rating of equipment. (For control valves this shall be same size, type & design).
 - b) There has been no change in the components from the offered equipments and tested equipments.
 - c) The test has been carried out as per the latest standards along with amendments as on the date of bid opening.
- 3) In case the approved equipment is different from the one on which the type test had been conducted earlier or any of the above grounds, then the tests have to be repeated and the cost of such tests shall be borne by the bidder/sub-vendor within the quoted price and no extra cost will be payable by the owner on this account.

As mentioned against certain items, the test certificates for some of the items shall be reviewed and approved by the main bidder or his authorized representative and balanced have to be approved by the employer. The schedule of conduction of type test/submission of reports shall be submitted and finalized during preaward discussion.

For the type test to be conducted, bidder shall submit detailed test procedure for approval by owner. This shall clearly specify test setup, instruments to be used, procedure, and acceptance norms (wherever applicable). , recording of different parameters, intervals of recording precaution to be taken etc. for the test to be carried out.

ii) Special Requirements for Solid State Equipments /Systems

The minimum type test report, over and above the requirements of above clause which are to be submitted for each of the major C&I systems like DDCMIS, DCS etc. shall be as indicated below:

Surge Withstand Capability (SWC) for solid state equipments/equipments

1. All solid state systems/equipments shall be able to withstand the electrical noise and the surges as encountered in actual service conditions and inherent in the power plant. All the solid states systems /equipments shall be provided with all required protection that needs the surge withstand capability as defined in ANSI 37.90.1/IEEE 472. Hence, all front end cards which receive external signals like analog input and output modules, Binary input and output modules etc. including power supply, data highway, data links shall be provided with protection that meets the surge withstand capability as defined in ANSI 37.90.1/IEEE 472. Complete details of the features incorporated in the electronic system to meet this requirement the relevant test carried out, the test certificates, etc. shall be submitted along with the proposal. As an alternative to the above, suitable class of EN 61000-4-12 which is equivalent to ANSI 37.90.1/IEEE 472 may also be adapted for SWC test.
2. The dry heat test as per IEC-68-2-2 or equivalent
3. Damp heat test as per IEC 68-2-3 or equivalent
4. Vibration test as per IEC 68-2-6 or equivalent
5. Electrostatic Discharge test as per EN 61000-4-2 or equivalent
6. Radio frequency immunity test as per EN 61000-4-6 or equivalent
7. Electromagnetic Field Immunity test as per EN 61000-4-3 or equivalent

Test listed at Item no 5, 6, 7 above are applicable for electronic cards only as defined under item no. 1 Above

iii) Type Test Requirements for C&I Systems

S.No	Item	Test Requirement	Standard	Test to be specifically conducted	Owners approval required on test certificate
------	------	------------------	----------	-----------------------------------	--

S.No	Item	Test Requirement	Standard	Test to be specifically conducted	Owners approval required on test certificate
1	Electrical metering instruments	As per standards	IS 1248	No	Yes
2	Thermocouple	Degree of Protection Test	IS - 13947	No	No.
3	Junction Box	Degree of Protection Test	IS - 13947	Yes	Yes
4	RTD	As per standards	IEC-60751	No	No
5	Electronic Transmitter	As per standards	BS 6447 / IEC 60770	No	Yes
6	E / P convertor	As per standards	Manufacturing standard	No	Yes
7	Instrumentation cable (Twisted and shielded) (Refer Vol. II, Chapter 8)				
8	Battery	As per standard	IS 10918	Yes	YES
9.	Voltage stabiliser	Over load test	Approved procedure	No	YES
		Temp. rise test without redundant fans	Approved procedure	No	YES
		Input voltage variation test	Approved procedure	No	YES
10	DDCMIS				
	CLCS system	Model Test	Approved procedure	No	No
	BMS & MFT	Safety requirement	VDE0116, SEC 8.7	No	YES
11	Conductivity type level switch	Degree of protection test	IS 13947	No	No
12	Local gauges	Degree of protection test	IS 13947	No	No
13	Process actuated switches	Degree of protection test	IS 13947	No	No
14	Control valves	CV test	ISA 75.02	No	YES
15	LIE / LIR	Degree of	IS 13947	YES	YES
16	Flue gas O2 analyser, other Flue	Degree of protection test	IS 13947	No	YES
17	Flow nozzles & Orifice plates	calibration	ASMEPTC BS 1042	YES	YES

Note:



TITLE
1X800 MW NORTH CHENNAI TPP STAGE III
MILL REJECT SYSTEM (PNEUMATIC TYPE)
STANDARD TECHNICAL REQUIREMENTS

SPECIFICATION NO. PE-TS-423-160-A001
SECTION: II
REV 00
Sub-Section **Date MAY 2017**

SECTION – II

STANDARD TECHNICAL SPECIFICATION

SUB-SECTION IIA – Standard Technical Requirement (Mechanical)



TITLE 1X800 MW NORTH CHENNAI TPP STAGE III MILL REJECT SYSTEM (PNEUMATIC TYPE) STANDARD TECHNICAL REQUIREMENTS	SPECIFICATION NO. PE-TS-423-160-A001	
	SECTION: II	
	REV 00	
	Sub-Section: II A	Date MAY 2017

Mill Discharge Spout and Pyrite Hopper

- Each coal mill has a discharge spout with a pneumatic cylinder operated knife gate valve for discharging rejects into a pyrite hopper of adequate capacity. This hopper shall serve to store the mill rejects between each operating cycle of dense phase system. Minimum effective storage capacity shall be 2-3 times the effective (batch capacity) of the conveying vessel.
- Each pyrite hopper shall be provided with a knife gate valve of approved design at the bottom, adequately sized manhole/inspection door, sizing grid and emergency chute with Knife gate valve and reject quenching arrangement (water spray) shall be provided. Any platform/ structural support (as per IS 2062 Gr A/B) required to maintain the above equipment before transporter vessel's inlet valve. Necessary explosion vent (rupture disc with MOC Aluminium) of proven design shall be provided in each pyrite hopper.
- Each emergency chute shall be provided with a knife gate valve to transfer mill rejects from pyrite hopper to ground or to Owner's trolley. Necessary access and platform shall be provided. Limit switches shall be provided to indicate the valve position on control panel.
- Each pyrite hopper shall be provided with 4 level switches – one to start the operating sequence and the other to indicate the hopper above grid chocked condition.
- Open & Close Limit switches shall be provided in all KGVs and these limit switches shall be interlocked with MRS control system. Solenoid box cum local control panel shall be provided. Same shall house system start stop, vessel pressure indication, probe over ride, purge button so that system can be locally optd. It shall be possible to operate individual vessel from local pneumatic panel for few cycles in emergency.
- Following control modes shall be provided
- Remote mode: System shall be controlled through MRS control System.
- Local Mode:
 - a) Energized mode: Manual override shall be selected from MRS control System. System logic shall be executed in MRS control system itself.
 - b) De-energized mode: MRS control system shall be delinked and system (individual stack up assembly) shall be operated manually.
- The sizing grid shall be provided inside the pyrite hopper to prevent oversized mill rejects, tramp iron etc. from entering the conveying vessel. The arrangement for collecting bigger pieces of coal rejects from the grid includes, among others, Knife Gate Valve, chute work etc. Bigger pieces of coal rejects shall roll down from the grid and through KGVs, chute work etc. Bigger pieces of coal rejects shall roll down from the grid and can be removed through the over sized seized reject removal gate (to be provided preferably at the bottom of inspection door) be discharged to Owners trolley. The arrangement shall be finalized during detail engineering. The grid shall be made of minimum 10 mm dia.



TITLE
1X800 MW NORTH CHENNAI TPP STAGE III
MILL REJECT SYSTEM (PNEUMATIC TYPE)
STANDARD TECHNICAL REQUIREMENTS

SPECIFICATION NO. PE-TS-423-160-A001
SECTION: II
REV 00
Sub-Section: II A **Date** MAY 2017

CONVEYING VESSEL

1.0 GENERAL

This specification covers the PURCHASER'S general requirement of design, materials, constructional features, manufacture, inspection and testing at VENDOR'S works and/or his sub vendor's works of Conveying Vessel and accessories specified hereinafter.

2.0 CODES AND STANDARDS

- 2.1** The design, material, construction, manufacture, inspection and performance of the Transporter and accessories, shall comply with all statutory regulations and safety codes currently applicable in the locality where the equipment will be installed. The equipment shall also conform to the latest applicable Indian/British/USA/DIN Standards.
- 2.2** The material of construction and other works of the Transporter and accessories shall in general conform to the following standards/codes but will be subjected to any modification and requirement as specified in Section C of Technical Speciation.
- i) Transporter Vessel – Mild Steel to IS 2062 (Gr. A min); Construction as per IS-2825 / BS5500/ASME SEC-VIII, Div-1
 - ii) Material Handling Valve – As indicated in Sec-C of the specification
 - iii) Flange – MS as per ANSI B 16.5
- 2.3** Where the above standards are in conflict with the stipulations of this specification, this specification supersedes them. In case of any further conflict in this matter, the decision of the Engineer will be final and binding.

3.0 DESIGN REQUIREMENTS

- 3.1** The dense phase pneumatic conveying system shall be designed for low velocity for conveying of materials as indicated in Section C.
- 3.2** The system shall consist of dome shaped vessels made of Carbon Steel complete with pneumatically operated dome/metering valves capable of closing through a solid head of material to make a pressure tight seal.
- 3.3** The bottom of vessel shall have transition bend and a control air supply system to the side of the conveying vessel.
- 3.4** Airtight seal system shall be provided between the transporter and the feeding point.
- 3.5** Transporter shall be equipped with **air strainer** to prevent pipe scale /dirt from causing pressure regulator malfunctioning.
- 3.6** Automatic drain filter and oil fog lubricator set shall be fitted into the air line to dome valve/metering valve for use with pneumatic controls.
- 3.7** Any air line stop valve fitted in the air supply line of transporter shall be of ball type to avoid any restriction to air flow, when open.

4.0 CONSTRUCTIONAL FEATURES

- 4.1** The transporter vessel shall be fabricated from mild steel plate to the design of vendor. The vessel shall be of welded structure and shall be provided with necessary supporting structure. The vessel shall be airtight/leak proof in fully assembled condition. Conveying vessel shall be designed and tested as per IS 2825 vessel. Temperature of mill reject coming into the conveying vessel shall be considered as 200 °C. Conveying vessel shall be designed for a pressure 10% above the maximum pressure encountered in the

	TITLE 1X800 MW NORTH CHENNAI TPP STAGE III MILL REJECT SYSTEM (PNEUMATIC TYPE) STANDARD TECHNICAL REQUIREMENTS	SPECIFICATION NO. PE-TS-423-160-A001	
		SECTION: II	
		REV 00	
		Sub-Section: II A	Date MAY 2017
vessel. The conveying vessel shall be constructed with tested quality mild steel plates. They shall withstand the abrasive & hot condition of the mill rejects and operating air pressure. The conveying vessel shall be supported independently on steel columns. The vessel shall have suitably located and adequately numbered air connections for supply of compressed air for conveying mill rejects through pipes to overhead bin. 4.2 Dome/Metering valve shall be of manufacturer’s standard construction and will be easily openable and closeable type. All joints will be flanged with asbestos free or silicon rubber gaskets suitable for 200 °C. 4.3 All bends will be of long radius cast bends (R = 5D). Conveying pipes will be of mild steel heavy duty type. 5.0 TESTING AND INSPECTION 5.1 The purchaser shall have free access to those parts of manufacturer’s works which are concerned with the fabrication of the steel work and shall be afforded with all reasonable facilities at all stages of preparation, fabrication and trial assemblies for satisfying himself that the fabrication is being undertaken in accordance with the provisions of this specification 5.2 Should any structure or part of a structure be found not to comply with any of the provision of this specification, it shall be liable to rejection. No structure or part of the structure, once rejected shall be resubmitted for inspection/test except in cases where the purchaser or his authorized representative considers the defect as rectifiable defects which may appear during fabrication shall be made with the consent of and according to the procedure laid down by the purchaser, the purchaser may, at his discretion, check the test results obtained at the manufacturer’s works by independent tests at the Government test house or elsewhere, and should not be found to be unsatisfactory shall be rejected. The costs of such tests shall be borne by the contractor. 5.3 Scope of inspection shall include but not limited to the following: i) Material used in the fabrication shall be with manufacturer’s test certificate with proper correlation for physical properties and chemical analysis. In the absence of correlation actual tests shall be done. ii) Welders shall be qualified as per ASME Standard. Only qualified welders shall be employed for the fabrication purpose. iii) Electrodes shall be of makes approved by BHEL. iv) All fillet welds, root run and trial run of butt welds shall be subjected to visual dye penetrating test with no linear indication. Acceptable norm for dye-penetrating test shall be as per Appendix-8 of ASME SEC. VII Div. 1. v) Special tests like NDT as per relevant code will be carried out for fabrication items. vi) Chemical analysis and hardness tests of linear plates shall be carried out. vii) Dimension shall be maintained as per approved drawings.			

402 of 433



TITLE 1X800 MW NORTH CHENNAI TPP STAGE III MILL REJECT SYSTEM (PNEUMATIC TYPE) STANDARD TECHNICAL REQUIREMENTS	SPECIFICATION NO. PE-TS-423-160-A001	
	SECTION: II	
	REV 00	
	Sub-Section: II A	Date MAY 2017

MILL REJECT BUNKER AND ACCESSORIES

1.0 GENERAL

- 1.1 This specification covers the PURCHASER'S general requirement of design, manufacture, fabrication, assembly, inspection, testing and delivery to site or mill reject bunker and accessories specified.

2.0 CODES AND STANDARDS

- 2.1 The design, material, construction, manufacture, inspection, testing and performance of the mill reject bunker shall comply with all statutory regulations and all safety codes currently applicable in the locality where the equipment will be installed.

- 2.2 The material of construction and other works of the mill reject bunker shall in general conform to the following standards /codes but will be subject to any modification and requirements as specified in the specification.

- | | | | |
|----|--|---|--------------------|
| a) | Structural steel | : | IS-2062 Gr A (min) |
| b) | Rolled Steel Beams, Channels and Angle Sections | : | IS-808 |
| c) | Scheme of Symbols for Welding | : | IS-813 |
| d) | Covered Electrodes for Metal Arc Welding of Structural Steel | : | IS-814 |
| e) | Code of practice for use of Metal Arc Welding for general Construction in Mild Steel | : | IS-816 |
| f) | Code of practice for inspection of Welds | : | IS-822 |
| g) | Code of practice for use of structural steel in general building construction | : | IS-800 |
| h) | Dimension for steel plate, sheet and Strip for structural and general Engineering purposes | : | IS-1730 |
| i) | Recommendation for metal arc welding | : | IS-9575 |

- 2.3 Where the above standards are in conflict with the stipulations of this specification, the specification supercedes them. In case of any further conflict in this matter, the decision of the ENGINEER shall be final binding.

3.0 DESIGN REQUIREMENT

- 3.1 The coal mill reject bunker shall be fabricated of mild steel plate with adequate stiffeners welded on. The bunker shall be supported on the concrete foundation provided by the purchaser. Foundation bolts, gratings etc. shall be provided by the bidder.
- 3.2 The reject bunker shall be complete with twin sector discharge gate, stainless steel liners, flanged connections, platforms, gratings/chequered plates, access staircase, hand railings etc. The equipment shall be designed and equipped for outdoor operation, complete with all accessories.

	TITLE 1X800 MW NORTH CHENNAI TPP STAGE III MILL REJECT SYSTEM (PNEUMATIC TYPE) STANDARD TECHNICAL REQUIREMENTS	SPECIFICATION NO. PE-TS-423-160-A001	
		SECTION: II	
		REV 00	
		Sub-Section: II A	Date MAY 2017

4.0

CONSTRUCTIONAL FEATURES

4.1

The bunker shall be of welded structure and shall be provided with necessary supporting structure. Flanged opening shall be provided at the bottom of the bunker for attaching the twin sector gate. The inclined part of the bunker shall be designed with a valley angle of not less than 60 deg. To the horizontal. The design of the bunker shall be such that the problem of formation of arch is eliminated. The inside surface shall be provided with liner MOC as specified elsewhere in the specification. Explosion diaphragm/Pressure relief valve shall be provided to release air from the bunker in case pressure inside the bunker exceeds 1 .0 kg/cm²(g)

4.2

Vendor shall furnish all steel work required for support and access for operation and maintenance. This shall include platforms, grating/chequered plates, stairways, hand railings, base plates, foundation bolts etc. Purchaser will provide only the foundation with pockets. The bunker shall have shed over it and shall be provided with monorail & hoist for equipment handling.

4.3

The storage bunker shall be so arranged that any 10 ton capacity truck can be conveniently loaded under it by an operator standing on the platform.

4.4

Access and platform shall be provided with 32 mm thick MS grating & 32 mm MS GI pipe hand railing.

4.5

The storage bunker shall be provided with filter bags as specified elsewhere in the specification. Filter bags shall be suitably treated to minimize the chances of filter catching fire. It shall be possible to plug opening for damaged bag filters, if any, to facilitate un-interrupted operation. Suitable explosion vents shall be provided for the bag filter unit. Sequential cleaning cycle shall be initiated with pressure drop signal across the bag filter once sufficient cleaning air pressure is available. Solenoid/pneumatic valves shall be provided for this purpose. Bag cleaning mechanism shall be automatic and shall comprise of solenoid valves. Air nozzles shall be provided just above the filter to facilitate individual cleaning of each bag.

4.6

The terminal boxes for terminating reject conveying pipes shall be of steel construction with necessary deflector or impingement plate to take care of impact and wear due to high velocity reject particles discharging into the bunker.

5.0

INSPECTION AND TESTING

5.1

The purchaser shall have a free access at all reasonable times to these parts of manufacturer's works which are concerned with the fabrication of the steel work and shall be afforded all reasonable facilities at all stages of preparation, fabrication and trial assemblies for satisfying himself that the fabrication is being undertaken in accordance with the provisions of this specification.

5.2

Should any structure or part of a structure be found not to comply with any of the provisions of this specification, it shall be liable to rejection. No structure or part of structure, once rejected shall be resubmitted for inspection/ test except in cases where the purchaser or his authorized representative considers the defect as rectifiable. Defects which may appear during fabrication shall be made good with the consent of and according to the procedure laid down by the purchaser. The purchaser may, at his discretion, check the test results obtained at the manufacture's works by independent tests at the government test house or elsewhere and should the material so tested be found to be unsatisfactory shall be rejected. The cost of such tests shall be borne by the contractor.

5.3

Examination of material of construction, verification, correlation and identification with material test certificate.

5.4

Ensuring that the relevant weld procedure and welder qualifications tests are in accordance with fabrication code.

5.5

Inspection during fabrication at appropriate stage including fit up. Witness of dye penetrant testing at root and final run for all groove welds and final run for fillet welds as per ASTM E 165. All surfaces examined shall be free of:

404 of 433

	TITLE 1X800 MW NORTH CHENNAI TPP STAGE III MILL REJECT SYSTEM (PNEUMATIC TYPE) STANDARD TECHNICAL REQUIREMENTS	SPECIFICATION NO. PE-TS-423-160-A001	
		SECTION: II	
		REV 00	
		Sub-Section: II A	Date MAY 2017
a) Relevant linear indications (Linear indications are those indications in which length is more than three times the width and only indication with major dimension greater than 1.6 mm shall be considered relevant). b) Four or more rounded defects in a line separated by 1.6 mm or less (edge to edge). Rounded indications are those where length less than three times the width. 5.6 Any other tests as specified in the fabrication code. 5.7 Dimensional check match marking as per approved drawings. 6.0 SCOPE OF INSPECTION FOR RACK AND PINION GATE 6.1 Examination of materials of construction, verification, correlation/testing and identification of material with test certificate for important items like body, drives, warm shaft, rack & pinion, wheel etc. 6.2 Dye Penetration check on drive shaft & warm shaft as per IS-3658 and there shall be no surface defects. 6.3 Dimensional check 6.4 For chain proof load shall be carried out. 6.5 Hardness of rubber component 6.6 Check for overall dimension, completeness, no load working after assembly. 6.7 Clearing, marking and painting.			

405 of 433



TITLE
1X800 MW NORTH CHENNAI TPP STAGE III
MILL REJECT SYSTEM (PNEUMATIC TYPE)
STANDARD TECHNICAL REQUIREMENTS

SPECIFICATION NO. PE-TS-423-160-A001
SECTION: II
REV 00
Sub-Section: II A
Date MAY 2017

AIR RECEIVER

1.0 GENERAL

This standard specification covers the design, material of construction, features, manufacture, inspection & testing at VENDOR'S and/or his sub-vendors' works, suitable painting and packing requirements of air receiver

2.0 CODES & STANDARDS

As far as possible, the design, manufacture and performance of air receivers shall be in accordance with the latest applicable Indian/British/American/DIN standards.

The latest editions of the following shall be followed in particular:

IS: 2825 – Code for unfired pressure vessels

ASME – Section-VIII, Division-1

BS – 487-Fusion welded steel air receivers

IS: 7938 – Air receivers for compressed air installation

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

3.0 DESIGN AND CONSTRUCTION

3.1 The air receivers shall be vertical self-supporting cylindrical vessels with supporting stands for resting on the civil foundation.

3.2 Other design parameters and design internal pressure of the receiver shall be as per the data specification sheet, if any, enclosed. The receiver shall be designed as per IS:7938.

3.3 Receivers shall be of welded construction with a minimum number of joints. Longitudinal seams in adjacent section of shell shall not be in the same line.

3.4 Receivers shall be provided with gasket inspection openings. Receivers below 500 mm diameter shall have at least two inspection holes. For receivers of larger diameter, manhole of minimum 450 mm diameter shall be provided. These openings shall be placed as far as possible from any welded seam and in no instance shall pierce any seam.

3.5 All welding shall be performed in accordance with relevant codes. Filler material that will deposit weld metal with a composition and structure as near as that of the material being welded shall be used. All welding electrodes shall be got approved by the Owner. The electrodes shall be dried in ovens immediately before use to ensure freedom from porosity. All the circumferential and longitudinal butt welds of the air receiver shall be subjected to spot radiography. Tee joints and dished welding shall be subjected to 100% radiography.

3.6 All other welding on the air receiver, including fillet weld and nozzle connection shall be DP tested as per IS: 2825 (Para 8.7.11).

3.7 Each finished receiver complete with all welded attachments shall be hydraulically tested at 150% of the design pressure. The test pressure shall be maintained for at least 30 minutes. All joints shall be gentle hammered during the test.

**TITLE****1X800 MW NORTH CHENNAI TPP STAGE III
MILL REJECT SYSTEM (PNEUMATIC TYPE)****STANDARD TECHNICAL REQUIREMENTS**

SPECIFICATION NO. PE-TS-423-160-A001

SECTION: II

REV 00

Sub-Section: II A

Date MAY 2017

- 3.8** Receivers shall be provided with relief valve of the capacity and set pressure of the same at least 10% above working pressure. The spring in the relief valve in service for pressure up to and including 250 psi shall not be reset for any pressure more than 10% above or below the design set pressure. For higher pressures, the spring shall not be reset for any pressure more or below 5% design set pressure.
- 3.9** Each air receiver shall be complete with drain connection of 25 mm NB with a trap station consisting of a trap, strainer, isolation and bypass valves.
- 3.10** The receiver shall be provided with necessary number of nozzles. The orientation of the nozzles shall be subjected to the approval of the Owner.
- 3.11** Local instruments like pressure gauge, switch and temp. gauge of suitable range shall be supplied. Please refer specification for conveying air compressor for other instrumentation required.
- 3.12** The vendor will have all welding procedures & welders qualified in accordance with the relevant codes prior to commencing any welding at the works. These tests shall be witnessed by customer/client representative.

Check List for Operation & Maintenance Manual

Project name :

Project number :

Package Name :

PO reference :

Document number :

Revision number :

Sl.no. & Sections	Description	Tick (√)if included in Manual			Remarks
		Yes	No	Not Applicable	
1.	Cover page				
1.1	Project Name				
1.2	Customer/consultant Name				
1.3	Name of Package				
1.4	Supplier details with phone, FAX ,email address , Emergency Contact number				
1.5	Name and sign of prepared by , checked by & approved by				
1.6	Revision history with approval Details				
2.0	Index				
2.1	showing the sections & related page nos All the pages should be numbered section wise				
3.0	Description of Plant/System				
3.1	Description /write up of operating principle of system equipment/ associated sub-systems & accessories/controls system , operating conditions, performance parameters under normal , start up and special cases				
3.2	Equipment list and basic parameter with Tag numbers				
3.3	Data sheets approved by Customer/for information and catalogues provided by original manufacturer				
3.4	Associated other packages and Interface /terminal points				
3.5	P&ID & Process Diagrams				
3.6	GA Layout drawings, As-built drawings , Actual photograph of items/system (Drawings of A2 & bigger sizes are to be attached in the last)				
3.7	Single line/wiring diagrams				
3.8	Control philosophy /control write-ups				

4.0	Commissioning Activities (if not covered in separate document i.e. erection manual, commissioning manual)				
4.1	Pre-Commissioning Checks				
4.2	handling of items at site				
4.3	Storage at site				
4.4	Unpacking & Installation procedure				
5.0	Operation Guidelines for plant personal/user/operator				
5.1	Interlock & Protection logic along with the limiting values of protection settings for the equipment along with brief philosophy behind the logic, drawings etc. to be provided.				
5.2	Start up, normal operation and shut down procedure for equipments along with the associated systems in step by step mode. Valve sequence chart, step list, interlocks etc. with Equipment isolating procedures to be mentioned.				
5.3	Do's & Don't of the equipments.				
5.4	Safety precautions to be taken during normal operation. Safety symbols, Emergency instructions on total power failure condition/lubrication failure/any other condition				
5.5	Parameters to be monitored with normal values and limiting values				
5.6	Trouble shooting with causes and remedial measures				
5.7	Routine operational checks, recommended logs & records				
5.8	Changeover schedule if more than one auxiliary for the same purpose is given				
5.9	Painting requirement and schedule				
5.10	Inspection, repair , Testing and calibration procedures				
6.0	Maintenance guidelines for plant personal				
6.1	List of Special Tools and Tackles required for Overhaul/Trouble shooting including special testing equipment required for calibration etc.				
6.2	Stepwise dismantling and re-assembly procedure clearly specifying the tools to be used, checks to be made, records to be maintained, clearances etc. to be mentioned. Tolerances for fitment of various components to be given.				

6.3	Preventive Maintenance & Overhauling schedules linked with running hours/calendar period along with checks to be given				
6.4	Long term maintenance schedules especially for structural, foundations etc.				
6.5	Consumable list along with the estimated quantity required during commissioning, normal running and during maintenance like Preventive Maintenances and Overhaul. Storage/handling requirement of consumables/self-life.				
6.6	List of lubricants with their Indian equivalent, Lubrication Schedule, Quantity required for each equipment for complete replacement is to be given				
6.7	List of vendors & Sub-vendors with their latest addresses, service centres ,Telephone Nos., Fax Nos., Mobile Nos., e-mail IDs etc.				
6.8	List of mandatory and recommended spare parts list				
6.9	Tentative Lead time required for ordering of spares from the equipment supplier				
6.10	Guarantee and warranty clauses				
7.0	Statutory and other specific requirements considerations.				
8.0	List of reference documents				
9.0	Binding as per requirement				

SITE STORAGE AND PRESERVATION GUIDELINES

FOR

MECHNANICAL BOPs

(Doc No: PE-DC-SSG-A001 REV.00)



PROJECT ENGINEERING MANAGEMENT, POWER SECTOR
BHARAT HEAVY ELECTRICALS LIMITED-NOIDA

CONTENT

- 1 SCOPE OF THE DOCUMENT
- 2 PURPOSE OF STORAGE & PRESERVATION
- 3 MEASURES TO BE TAKEN FOR STORAGE AND PRESERVATION
 - a) GENERAL STORAGE REQUIREMENTS
 - b) GENERAL PRESERVATION REQUIREMENTS
 - c) GENERAL INSPECTION REQUIREMENTS
- 4 TYPE OF STORAGE FOR VARIOUS EQUIPMENT
5. CONCLUSION
6. STACKING ARRANGEMENT FOR PLATES AND STRUCTURAL STEEL

1. SCOPE OF THE DOCUMENT

This guideline is prepared in intent to provide proper site storage and preservation of the Mechanical, Electrical and C & I items / equipment supplied under various bought out packages/items. This storage procedure shall be followed at different power plant sites by concerned agency for storage and preservation from the date of equipment received at site until the same are erected and handed over to the customer.

2. PURPOSE OF STORAGE & PRESERVATION

Many of the items may be required to be kept in stores for long period. It shall therefore be essential that proper methods of storage and preservation be applied so that items do not deteriorate, loose some of their properties and become unusable due to atmospheric conditions and biological elements.

3. MEASURES TO BE TAKEN FOR STORAGE, HANDLING & PRESERVATION

a) GENERAL STORAGE REQUIREMENTS

1. To the extent feasible, materials should be stored near the point of erection. The storage areas should have adequate unloading and handling facilities with adequate passage space for movement of material handling equipment such as cranes, fork lift trucks, etc. The storage of materials shall be properly planned to minimise time loss during retrieval of items required for erection.
2. The outdoor storage areas as well as semi-closed stores shall be provided with adequate drainage facilities to prevent water logging. Adequacy of these facilities shall be checked prior to monsoon.
3. The storage sheds shall be built in conformity with fire safety requirements. The stores shall be provided with adequate lights and fire extinguishers. 'No smoking' signs shall be placed at strategic locations. Safety precautions shall be strictly enforced.
4. Adequate lighting facility shall be provided in storage areas and storage sheds and security personnel positioned to ensure enforcement of security measures to prevent theft and loss of materials.
5. Adequate number of competent stores personnel and security staff shall be deployed to efficiently store and maintain the equipment / material.
7. The equipment shall be stored in an orderly manner, preserving their identification slips, tags and instruction booklets, etc., required during erection. The storage of materials shall be equipment-wise. Loose parts shall be stored in sheds on racks,

preserving the identification marks and tags in good condition. The group codes shall be displayed on the racks

6. At no time shall any materials be stored directly on ground. All materials shall be stored minimum 200 mm above the ground preferably on wooden sleepers

b) GENERAL PRESERVATION REQUIREMENTS

1. All special measures to prevent corrosion shall be taken like keeping material in dry condition, avoiding the equipment coming in contact with corrosive fluid like water, acid etc.
2. Materials which carry protective coating shall not be wrapped in paper, cloth, etc., as these are liable to absorb and retain moisture. The material shall be inspected and in case of signs of wear or damages to protective coating, that portion shall be cleaned with approved solution and coated with an approved protective paint. Complete record of all such observations and protective measures taken shall be maintained.
3. Generally equipment supplied at site are properly greased or rust protective oil is applied on machined/ fabricated components. However periodic inspection shall be carried out to ensure that protection offered is intact.
4. While handling the equipment, no dragging on the ground is permitted. Avoid using wire rope for lifting coated components. Use polyester slings (if possible) otherwise protective material (e.g. clothes, wood block etc.) should be used while handling the components with rope / slings
5. For Equipment supplied with finished paint, touch paint shall be done in case any surface paint gets peeled off during handling. Otherwise such surfaces shall necessarily be wrapped with polythene to avoid any corrosion. Further for equipment wherein finish coat is to be applied at site, site to ensure that equipment is received with primer coat applied.
6. It shall be ensured by periodic inspection that plastic inserts are intact in tapped holes, wherever applicable.
7. Pipes shall be blown with air periodically and it shall be ensured that there is no obstruction.
8. Silica gel or approved equivalent moisture absorbing material in small cotton bags shall be placed and tied at various points on the equipment, wherever necessary.
9. Heavy rotating parts in assembled conditions shall be periodically rotated to prevent corrosion/jamming due to prolonged storage.

10. All the electrical equipment such as motors, generators, etc. shall be tested for insulation resistance at least once in three months and a record of such measured insulation values shall be maintained.
11. Following preservatives/preservation methods can be used depending upon type of equipment
 - a. Rust preventive fluid (RPF)
 - b. Rust protective paints
 - c. Tarpaulin covers, in case of outdoor storage
 - d. De-oxy aluminate for weld-ments

c) GENERAL INSPECTION REQUIREMENTS

1. Period inspection of materials with specific reference to –
 - Ingress of moisture and corrosion damages.
 - Damage to protective coating.
 - Open ends in pipes, vessels and equipment -
 - In case any open ends are noticed, same shall be capped.
2. Any damages to equipment / materials.
 - In case of any damages, these shall be promptly notified and in all cases, the repairs / rectification shall be carried out.
 - Any items found damaged or not suitable as per project requirements shall be removed from site. If required to store temporarily, they shall be clearly marked and stored separately to prevent any inadvertent use.

4. TYPE OF STORAGE FOR VARIOUS EQUIPMENT

The types of storage are broadly classified under the following heads:

i **Closed storage with dry and dust free atmosphere. (C)**

The closed shed can be constructed by using cold-rolled / tubular components for structure and corrugated asbestos sheets / galvanised iron sheets for roofing. Brick walls / asbestos sheets can be used to cover all the sides. The floor of the shed can be finished with plain cement concrete suitably glazed. The shed shall be provided with proper ventilation and illumination.



ii **Semi-closed storage. (S)**

The semi closed shed can be constructed by using cold-rolled / tubular components for structure and corrugated / asbestos sheets for roofing. The floor shall be brick paved. If required a small portion of sides can be covered to protect components from rainwater splashing onto the components.





iii Open storage (O)

The open yard shall be levelled, well consolidated to achieve raised ground with the provision of feeder roads for crane approach along with access roads running all sides. One part of the open yard shall be stone pitched, levelled and consolidated with raised ground suitable for storing / stacking heavier and critical components with due space to handle them by cranes etc . Adequate number of sleepers, concrete block etc. to be provided to make raised platforms to stack critical materials.

A separate yard to be identified as “scrap yard” slightly away from main open yard to store wooden/steel scraps, which are to be disposed off. This is required to avoid mix up with regular components as well as to avoid fire hazard.

Some of the components, which are having both machined & un-machined surfaces and are bulky, shall be stored in open storage area on a raised ground and suitably covered with water proof / fire retardant tarpaulin.



The equipment listed below shall be stored and inspected as per requirement mentioned in the table below.

Sl. No.	Description of the equipment	Type of Storage	Check for	Remarks
Raw material /mechanical items like pipes, plates, structure sections etc.)				
1.	Steel pipes (lined/unlined)	S	Damage , paint, corrosion, rubber lining peeling	Provide end cap
2.	MS Plates	S	Damage, paint, corrosion	
3.	SS Plates	S	Damage	
4.	Non-metallic pipes	S	Damage, cracks	Provide end cap
5.	Stainless steel pipes	S	Damage ,	Provide end cap
6.	MS sections, beams	S	Damage, paint, corrosion	
7.	Cable trays	S	Damage, condition of preservations	
8.	Insulation sheets	S	Damage	
9.	Insulation	C	Damage, packing	
10.	Hangers Rods	S	Damage, paint, packing	
11.	Tubes	S	Damage, paint , packing	Provide end cap
12.	Hume pipes	O	Damage	
13.	Castings	O	Damage, paint, corrosion	
Fabricated mechanical items (pressure vessels, tanks etc.)				
14.	Pressure vessels (unlined)	O	Damage, paint, corrosion,	Covered nozzles
15.	Atmospheric storage tanks (unlined)	O	Damage, paint, corrosion	Covered nozzles

Sl. No.	Description of the equipment	Type of Storage	Check for	Remarks
16.	Pressure vessels (lined)	S	Damage, paint, corrosion, rubber lining	
17.	Atmospheric storage tanks(lined)	S	Damage, paint, corrosion, rubber lining	
18.	Support structures	O	Damage , paint, corrosion	
19.	Flanges	C	Damage , paint, corrosion	
20.	Fabricated pipes	S	Damage , paint, corrosion	Provide end cap
21.	Vessels internals	C	Damage , paint, corrosion ,packing	
22.	Grills	S	Damage , paint, corrosion	
23.	Angles	S	Damage , paint, corrosion	
24.	Bridge mechanism/clarifier mechanism	O	Damage , paint, corrosion	
25.	Cranes, rails	S	Damage , paint, corrosion	
26.	Stair cases	O	Damage , paint, corrosion	
27.	Ladders/handrails	O	Damage , paint, corrosion	
28.	Fabricated ducts	S	Damage , paint, corrosion	
29.	Isolation Gates	O	Damage , paint, corrosion	
30.	Fabricated boxes/panels	S	Damage , paint, corrosion	
Mechanical components like valves, fittings, cables glands, spares etc.)				
31.	Valves	S	Damage , packing	

Sl. No.	Description of the equipment	Type of Storage	Check for	Remarks
32.	Fittings	S	Damage , packing	Provide end cap
33.	Cable glands	C	Damage , packing	
34.	Tools & tackles	C	Damage , packing	
35.	Nut , bolts, washers,	C	Damage , packing	
36.	Gasket & Packings	C	Damage , packing	
37.	Copper tubes	C	Damage , packing, corrosion	Provide end cap
38.	SS tubing	C	Damage , packing	Provide end cap
Rotating assemblies (pumps, blowers, stirrers, fans, compressors etc.)				
39.	Pumps	S	Damage , packing, corrosion	Shaft rotation
40.	Blowers/Compressors	S	Damage , packing, corrosion	Shaft rotation
41.	Agitators/stirrers/radial launders	C	Damage , packing, corrosion	Shaft rotation
42.	Rollers for chlorine tonner mounting	C	Damage , packing, corrosion	
43.	Centrifuge	S	Damage , packing,	
44.	Gear box	C	Damage , packing, corrosion	
45.	Bearings	C	Damage , packing, corrosion	
46.	Fans	S	Damage , packing, corrosion	
47.	Dosing skids	S	Damage , packing, corrosion	
48.	Pump assemblies	S	Damage , packing, corrosion	
49.	Air washers(INTERNALS)	S	Damage , packing	
50.	Air conditioners (split)	C	Damage , packing	

Sl. No.	Description of the equipment	Type of Storage	Check for	Remarks
51.	Elevators(CONTAINERIZED)	O	Damage , packing, corrosion	
52.	Chillers/VA machines	S	Damage , packing	
53.	Air handling Unit/Package unit	S	Damage , packing	
54.	Chlorinators & Evaporators	C	Damage , packing	
55.	Ejectors	C	Damage , packing	
56.	Electrolyser	C	Damage , packing	
Miscellaneous items like chain pulley blocks, hoists etc.				
57.	Chain pulley blocks	S	Damage, Packing	
58.	Electric hoists	S	Damage, Packing	
59.	Fire extinguishers	C	Damage, expiry date	
60.	Fork Lift Truck	S	Damage, Packing	
61.	Hydraulic Mobile Crane	O	Damage, Packing	
62.	Mobile Pick Up & Carry Crane	O	Damage, Packing	
63.	Motor boats	O	Damage, Packing	
64.	Safety showers	S	Damage, Packing	
65.	Diffusers/dampers	S	Damage, Packing	
Chemicals and consumables (acid, alkali, paints, oils, reagents and special chemicals)				
66.	Hydro Chloric Acid (HCl)	Store in canes/ storage tank in dyke area	Date of production/ leakage/fumes	hazardous chemical
67.	Sulphuric acid (H ₂ SO ₄)	Store in canes/ storage tank in dyke area	Date of production/ leakage/fumes	hazardous chemical

Sl. No.	Description of the equipment	Type of Storage	Check for	Remarks
68.	Sodium hydroxide (NaOH)	Store in canes/ storage tank in dyke area	Date of production/ leakage/ fumes/ breather	hazardous chemical ,breather to be checked for air ingress
69.	Sodium hypo chlorite	To be stored under shed	Date of production/ leakage/ fumes	hazardous chemical ,self-life normally 15-30 days after which strength of chemical decays
70.	Ammonia	S	Date of production/ leakage/ fumes	Store in closed storage tanks, hazardous chemical
71.	CW treatment chemicals	S	Date of production , Self-life	Store in closed canes
72.	RO/UF cleaning chemicals	S	Date of production , Self-life	Store in closed canes
73.	Lime	C	Damage to packing , seepage	Prevent moisture, rain
74.	Alum bricks	C	Damage to packing	Prevent moisture, rain
75.	Poly electrolyte	S		Store in closed storage tanks
76.	Laboratory chemicals(powder)	C	Damage, Packing self- life	
77.	Laboratory chemicals(liquid)	C	Damage, Packing self- life	
78.	Lubrication oils	C	Leakage	
79.	Paints	S	Leakage ,air tightness	
80.	Sand	O	Damage of packing	No hooks
81.	Salt (NaCl)	C	Damage of packing, water ingress	Prevent moisture, rain
82.	Anthracite	S	Damage of packing	
83.	Activated carbon	S	Damage of packing	

Sl. No.	Description of the equipment	Type of Storage	Check for	Remarks
84.	Thermal insulation	S	Damage of packing	
85.	Cement	C	Damage of packing	Prevent moisture, rain
86.	Gravels	O	Damage of packing	
87.	ION exchange resins	C	Damage , packing	Refer manufacturer guidelines
88.	RO membranes	C	Damage , packing	Refer manufacturer guidelines
89.	UF membranes	C	Damage , packing	Refer manufacturer guidelines
90.	Cleaning chemicals	C	Damage , packing	Refer manufacturer guidelines
91.	Chemicals for analysers/calibration	C	Damage , packing	Refer manufacturer guidelines
Electrical and C & I items (motors, cables etc.)				
92.	Motors	C	Damage , packing	
93.	Cable drums	O	Damage	
94.	Control Panel /control desk, UPS ,JB	S	Damage, Packing	
95.	Instruments(gauges/analysers)	C	Damage	
Special items		As per Manufacturer's item, like Hydrogen cylinders, Ozonator, Analyser, Chlorine dioxide generators etc.		

5. CONCLUSION

Concerned storage agency at site should make sure that loss in equipment performance and wear & tear are minimised through proper storage and preservation. The above are broad guidelines and cover major equipment / materials. However specific storage practices shall be followed as per manufacturer recommendation. All the necessary measures even in addition to the ones mentioned above, if found necessary, should be taken to achieve the objective.

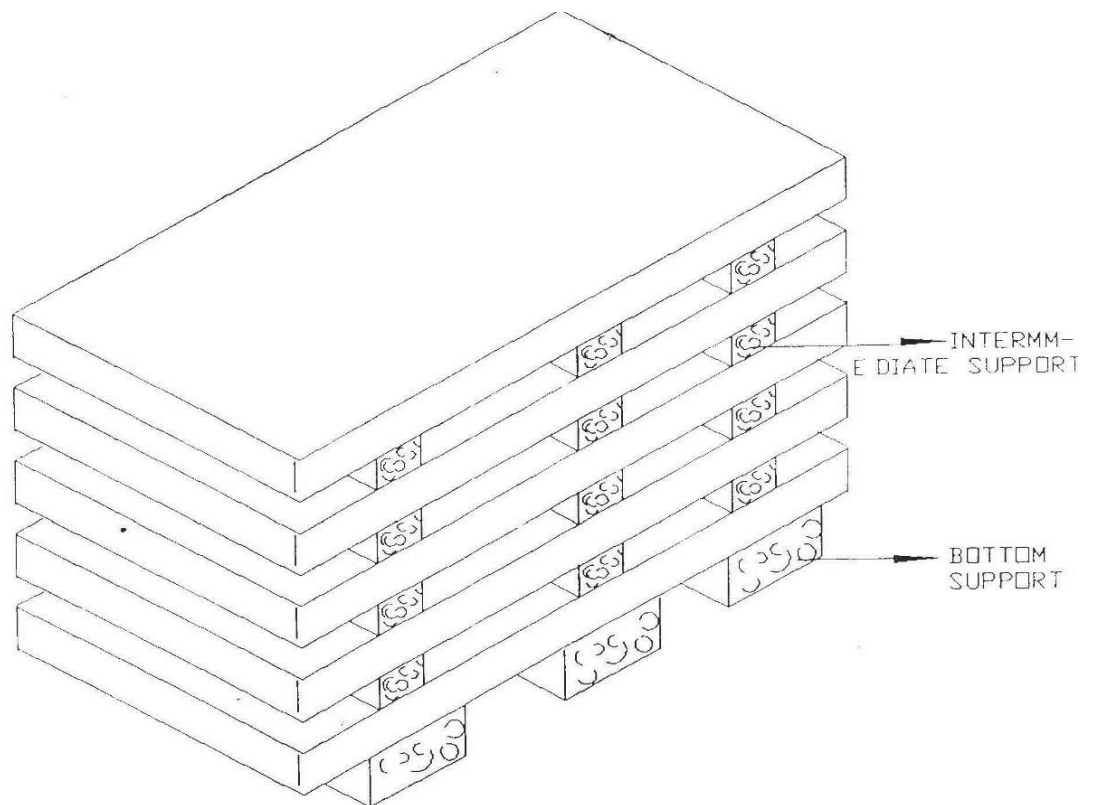


Figure – 1 – PLATE STACKING ARRANGEMENT

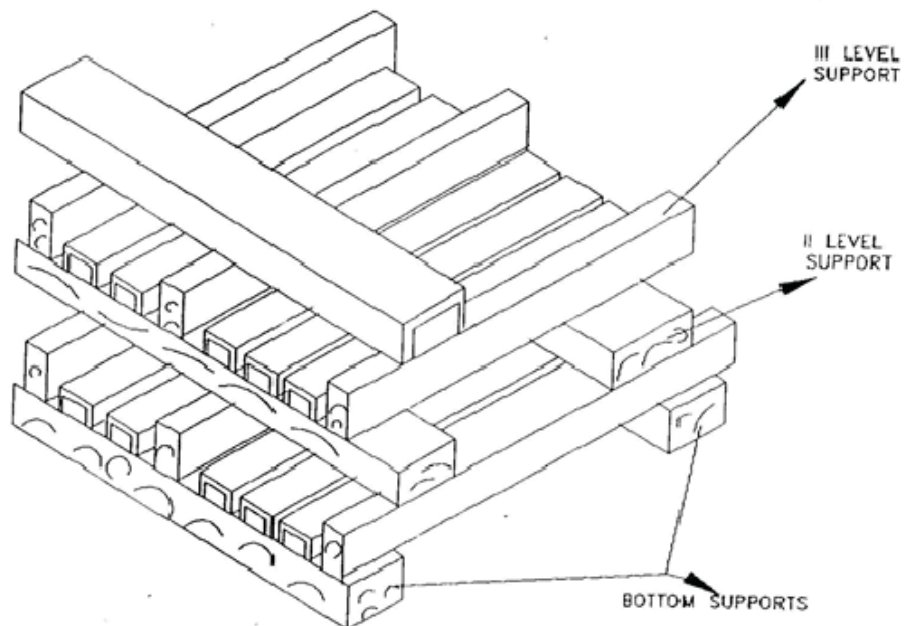


Figure – 2 – STRUCTURAL STEEL STACKING ARRANGEMENT

**TITLE****1X800 MW NORTH CHENNAI TPP STAGE III
MILL REJECT SYSTEM (PNEUMATIC TYPE)****STANDARD TECHNICAL REQUIREMENTS**

SPECIFICATION NO. PE-TS-423-160-A001

SECTION: III

REV 00

Sub-Section

Date MAY 2017

SECTION – III**DOCUMENTS TO BE SUBMITTED ALONG WITH THE BID**

**TITLE****1X800 MW NORTH CHENNAI TPP STAGE III
MILL REJECT SYSTEM (PNEUMATIC TYPE)****STANDARD TECHNICAL REQUIREMENTS**

SPECIFICATION NO. PE-TS-423-160-A001

SECTION: III

REV 00

Sub-Section

Date MAY 2017

DRAWINGS/ DOCUMENTS TO BE SUBMITTED WITH THE BID

Bidder shall submit the following drawings/documents along with their bid:

- a) Pre qualification requirement (PQR) documents
- b) Signed and stamped copy of Compliance cum Confirmation Certificate
- c) **Deviation schedule** with reference to specific clauses of the specification along with reason for such deviation in the “Cost of Withdrawal” format attached in the GCC.
- d) Signed and stamped copy of Utility requirement sheet of Section-III.
- e) Filled electrical load list
- f) Un-priced copy of price format indicating quoted/ not applicable against each row / column
- g) Filled guaranteed power consumption format

OFFER WILL BE CONSIDERED AS INCOMPLETE IN ABSENCE OF ANY OF ABOVE DOCUMENTS.

DOCUMENT OTHER THAN ABOVE, IF ANY, SUBMITTED WITH THE OFFER WILL NOT FORM PART OF CONTRACT AND ACCORDINGLY WILL NOT BE CONSIDERED FOR BID EVALUATION.



TITLE:

**1X800 MW NCTPS STAGE-III TPS
TECHNICAL SPECIFICATION FOR
MILL REJECT SYSTEM
COMPLIANCE CUM CONFIRMATION
CERTIFICATE**

SPEC. NO.: PE-TS-423-563-A601

VOLUME: III

SECTION:

REV. NO. 00

SHEET 1 OF 2

COMPLIANCE CUM CONFIRMATION CERTIFICATE

The bidder shall confirm compliance with following by signing / stamping this compliance certificate (every sheet) and furnish same with the offer.

- a) The scope of supply, technical details, construction features, design parameters etc. shall be as per technical specification & there are no exclusions, other than those mentioned under "exclusion and those resolved as per 'Schedule of Deviations', with regard to same.
- b) There are no other deviations w.r.t. specifications other than those furnished in the 'Schedule of Deviations'. Any other deviation, stated or implied, taken elsewhere in the offer stands withdrawn unless specifically brought out in the 'Schedule of Deviations'
- c) Bidder shall submit QP in the event of order based on the guidelines given in the specification & QP enclosed therein. QP will be subject to BHEL / CUSTOMER approval & customer hold points for inspection / testing shall be marked in the QP at the contract stage. Inspection / testing shall be witnessed as per same apart from review of various test certificates/ Inspection records etc. This is within the contracted price without any extra implications to BHEL after award of the contract.
- d) All drawings/ data-sheets / calculations etc. submitted along with the offer shall not be taken cognizance off.
- e) The offered materials shall be either equivalent or superior to those specified in the specification & shall meet the specified / intended duty requirements. In case the material specified in the specifications is not compatible for intended duty requirements then same shall be resolved by the bidder with BHEL during the pre-bid discussions, otherwise BHEL / Customer's decision shall be binding on the bidder whenever the deficiency is pointed out.

For components where materials are not specified, same shall be suitable for intended duty, all materials shall be subject to approval in the event of order.

- f) The commissioning spares shall be supplied on 'As Required Basis' & prices for same included in the base price itself.
- g) All sub vendors shall be subject to BHEL / CUSTOMER approval in the event of order.
- h) Guarantee for plant/equipment shall be as per relevant clause of GCC / SCC / Other Commercial Terms & Conditions
- i) In the event of order, all the material required for completing the job at site shall be supplied by the bidder within the ordered price even if the same are additional to approved billing break up, approved drawing or approved Bill of quantities within the scope of work as tender specification. This clause will apply in case during site



TITLE:

**1X800 MW NCTPS STAGE-III TPS
TECHNICAL SPECIFICATION FOR
MILL REJECT SYSTEM
COMPLIANCE CUM CONFIRMATION
CERTIFICATE**

SPEC. NO.: PE-TS-423-563-A601

VOLUME: III

SECTION:

REV. NO. 00

SHEET 2 OF 2

commissioning, additional requirements emerges due to customer and / or consultant's comments. No extra claims shall be put on this account

- j) 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.
- k) As built drawings shall be submitted as and when required during the project execution.
- l) The bidder has not tempered with this compliance cum confirmation certificate and if at any stage any tempering in the signed copy of this document is noticed then same shall be treated as breach of contract and suitable actions shall be taken against the bidder.
- m) Successful bidder shall furnish detailed erection manual for each of the equipment supplied under this contract at least 3 months before the scheduled erection of the concerned equipment / component or along with supply of concerned equipment / component whichever is earlier.
- n) Document approval by customer under Approval category or information category shall not absolve the vendor of their contractual obligations of completing the work as per specification requirement. Any deviation from specified requirement shall be reported by the vendor in writing and require written approval. Unless any change in specified requirement has been brought out by the vendor during detail engineering in writing while submitting the document to customer for approval, approved document (with implicit deviation) will not be cited as a reason for not following the specification requirement.
- o) In case vendor submits revised drawing after approval of the corresponding drawing, any delay in approval of revised drawing shall be to vendor's account and shall not be used as a reason for extension in contract completion.



TITLE

TECHNICAL SPECIFICATION FOR
MILL REJECT HANDLING SYSTEM
1X800 MW NORTH CHENNAI TPP STAGE III

SPECIFICATION NO. PE-TS-423-160-A001

SECTION-III C

REV 00

DATE

SHEET 1 OF 1

PRE-BID CLARIFICATION SCHEDULE

S. No.	Section/Clause /Page No.	Statement of the referred clause	Clarification Required

The bidder hereby certifies that above mentioned are the only clarifications required on the technical specification for the subject package.

SIGNATURE: _____

NAME: _____

DESIGNATION: _____

COMPANY: _____

DATE: _____

COMPANY SEAL

**1X800 MW NORTH CHENNAI TPP STAGE III****MILL REJECT SYSTEM****UTILITY REQUIREMENT**

SPECIFICATION NO. PE-TS-423-160-A001

SECTION : IIID

DATE

SHEET 1 OF 1

UTILITY REQUIREMENT

S. No.	Description	Quantity	Pressure Requirement	Scope	Tapping
1	DMCW	25 m3/hr	Max inlet pressure (MRS compressor inlet) = 5 Kg/cm2 (g) at 0.00 m EL	BHEL	Tapping with isolation valve, both at inlet and outlet at a distance of 5m from MRS Compressor house.
2	Instrument Air	0.6 m3/min per bay	5-7 Kg/cm2 (g)	BHEL	One 25 NB Tapping at elevation of 3-6 m in each mill bay is required. Location of tapping shall be first col. of mill bay near D row.
3	Service Water	3-4 m3/hr per bay	2.5-3 Kg/cm ² (g)	BHEL	One 40 NB Tapping at elevation of 3-6 m in each mill bay is required. Location of tapping shall be first col. of mill bay near D row.

SIGNATURE: _____

NAME: _____

DESIGNATION: _____

COMPANY: _____

DATE: _____

COMPANY SEAL

Section-III E		
1X800 MW NCTPS STAGE III-MILL REJECT (PNEUMATIC TYPE)		
PERCENTAGE BREAK-UP OF PRICE SHEET		
MAIN SUPPLY		
S.No.	Details of Works or Equipment/System	Price percentage of total ex-works Main Supply price
1.0	Break - up of Main Supply Prices (To be used during contract execution for payment)	
1.1	Lumpsum price of transporter vessel with dome/ butterfly/ vertical swing type valve, insert plates and accessories.	10-15%
1.2	Lumpsum price of pyrite hopper with level probes, RTDs, rupture disc, metallic expansion bellow.	10-15%
1.3	Lumpsum price of pneumatic panel/ air control module/ solenoid box with accessories.	1-5%
1.4	Lumpsum price of storage bunkers, pressure relief valves, bag filters with pressure switch, terminal boxes, level transmitters, chain pulley blocks, bunker discharge gate with accessories.	30-35%
1.5	Lumpsum price of air compressors with drive, etc.	10-15%
1.6	Lumpsum price of air receivers with accessories.	1-5%
1.7	Lumpsum price of pipes for mill reject conveying.	5-10%
1.8	Lumpsum price of pipes for compressed air (instrument air and conveying air) & cooling water services, etc.	1-5%
1.9	Lumpsum price of air & water line valves.	1-5%
1.10	Lumpsum price of pneumatically operated knife gate valves for different application.	1-5%
1.11	Lumpsum price of Alloy CI bends/ fittings/ laterals.	5-10%
1.12	Lumpsum price of field instruments, cable glands & lugs, cable trays/ conduits (branch) as per specification requirement.	1-5%
1.13	Lumpsum price of portable sump pump along with all its control.	0.1-1%
1.14	Total price of erection & commissioning spares and special tools & tackles.	0.1-1%
	Cumulative percentages from 1.1 to 1.14 should be equal to 100%.	100%

1X800MW NORTH CHENNAI TPS STAGE -III - Mill Reject Handling System						
GUARANTEED POWER CONSUMPTION FORMAT						
Mode: Pneumatic Conveying						
Sl.No.	Description / Item	Working	Standby	Power Consumption (KW) (at motor input terminal)	Duty Factor	Total Power Consumption (KW)
1	2	3	4	5	6	7 = 3 x 5 x 6
1	Conveying Air Compressor	1	1		0.50	
Total KW						
Notes						
1	Power consumption (KW) of air compressors shall be measured at motor input terminals when operating at the rated capacity and pressure and performed on test rig at the vendor's works and actual motor shall be used for this purpose.					
2	<u>The base auxiliary power is 33 KW.</u> Quoted power by bidder at column no. (7) shall be evaluated with respect to base auxiliary power. For bid evaluation purpose, excess power quoted by bidder over base auxiliary power, shall be loaded with Rs. 588401 per KW.					
3	Power quoted by bidder shall be termed as 'Guaranteed Power consumption' (GPC) and bidder shall be liable to demonstrate compliance to GPC value during PG test/ Demonstration test at site. If the actual power consumption exceeds the guaranteed power consumption, liquidated damages shall be payable by the Contractor at the rate of Rs. 588401 per KW excess power consumed, over the guaranteed power consumption indicated by bidder in his bid. Such liquidated damages may be recovered by the BHEL by deduction from the contract price or by enforcing the contract performance guarantee or in any other manner deemed fit by the BHEL. For this purpose, the drives of standby equipment shall not be considered.					