TAMILNADU GENERATION AND DISTRIBUTION CORP. LTD. (TANGEDCO)

2X660 MW ENNORE SEZ COAL BASED STPP AT ASH DYKE OF NCTPS, CHENNAI

TECHNICAL SPECIFICATION
FOR
MILL REJECT SYSTEM (PNEUMATIC TYPE)

SPECIFICATION NO.: PE-TS-412-160-A001

BHARAT HEAVY ELECTRICALS LIMITED

POWER SECTOR

PROJECT ENGINEERING MANAGEMENT

NOIDA, INDIA

CONTENTS

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)

SUB-SECTION – IA

SPECIFIC TECHNICAL REQUIREMENTS (MECHANICAL)

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.

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, water spray nozzles & supporting structures.
   - 3 nos. of RF type level switch with probes per pyrite hopper
   - 2 no. of RTDs 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.

c) 4 nos. mill reject bunkers, i.e., two nos. mill reject bunkers per unit along with structure, liner 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, pressure relieve valve, chain pulley block with traveling trolley and monorail arrangement etc.

d) 2 nos. oil free screw type air compressors with drive motor, local control panel, instruments, portable vibration analyser, tachometer and all other accessories.

e) 1 no. air receiver per mill bay complete with drain traps, safety relief valve, instruments and all accessories.

f) 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) for pumping out water drains from local pit to nearest plant drain, control panel, instruments and all other accessories.

g) 1 lot of piping, fittings, valves & instruments for conveying air, instrument air, cooling water for transporter vessel inlet valve top plate (if applicable), cooling water quenching in the pyrite hopper, cooling water for air compressor etc.

h) 1 lot of Local Control Panel/pneumatic panels/JBs (1 no. for each pyrite hopper) properly mounted on rack along with required Stainless steel impulse/pneumatic tubing.

i) 1 lot of insulation & cladding, if required, to maintain surface temperature of pyrite hopper within 60° C

j) All structures including pipe cum cable rack required for supporting of various pipes in bidder's scope. Bidder may take support from existing mill bunker bay structures wherever possible.

k) All insert plates, embedment plates, anti-vibration pads below conveying vessel if applicable foundation bolts/ anchor bolts etc. required for bidder's equipment.

l) Charge of all lubricants and fluids as per GTR

m) Electrical and C&I scope as per enclosure elsewhere in the specification.

n) One (1) set of Mandatory Spares as per the list attached in specification.

o) One (1) set of erection & commissioning spares as required for the complete system.

p) One (1) set of Maintenance tools and tackles as per the list attached in specification.

q) All counter- flanges with nuts, bolts and gaskets at all the terminal points.

r) Relevant scope of supply as per GTR, GCC & SCC.

s) Any other instrument, item required for making the installation complete in all respect within battery limits and for satisfactory operation of the system, unless specifically EXCLUDED from scope under Clause No. 2.0 below.

1.2 SCOPE OF SERVICES

Scope of services shall include but not necessarily limited to 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, trail 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.

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 tappings	As mentioned in Utility Requirement – Section III D.

5.0 PERFORMANCE / DEMONSTRATION GUARANTEES

(Refer Annexures)

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 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 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 Annexures)

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

11.0 DRAWINGS/DOCUMENTS REQUIRED WITH THE BID (Refer Section-III)

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

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

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

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:

- *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 Annexures)

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

16.0 OTHER REQUIREMENTS

i) Site Visit before submission of offer

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

ii) Technical Requirements

- Operation philosophy and control philosophy shall be submitted by the vendor during detail engineering stage for BHEL / CUSTOMER /CONSULTANT approval and approved document shall be adhered and the system shall be provided accordingly for which no commercial implication shall be entertained by BHEL.

- All possible efforts shall be made by the bidder to get the approval of drawings and documents from BHEL / customer / consultant at the earliest and the documents prepared / generated by them or their sub-vendors shall be checked by their competent authority before submission to BHEL.

- Mill Reject System design shall also consider the presence of occasional burning coal particles along with the rejects, which would increase the reject temperature.

- Revision made by the bidder in any drawings and documents shall be highlighted by indicating the no. of revisions in a triangle without fail so that the minimum time is required by BHEL to review the drawings and documents.

- Civil works will be provided by BHEL / customer. Hence, bidder has to furnish the civil inputs in time. **Bidder has to carry out the rectification in the civil works in the event of any changes in the civil input data furnished by them or delay in submission of input data by them.** Bidder to furnish the civil foundation drawing along with the loading data for approval during detailed engineering stage showing / indicating the followings :-

  a) Scope of work by BHEL / customer and bidder shall be indicated with different legend or in the form of note.
  b) Civil loads shall be furnished showing detailed calculation.
  c) Details of pockets as required for anchor bolts.

- Bidder to depute competent designer (s) at BHEL's/ CUSTOMER /CONSULTANT office during detailed engineering stage to discuss drawings and other technical documents as and when required by BHEL. However, minimum 7 days notice shall be served for the same.

- All the drawings which are required to be furnished to BHEL during detailed engineering stage shall include technical parameters, details of paints, BOQ / BOM etc in tabular form indicating all components including bought out items and their quantity, material of construction indicating its applicable code / standard, weight, make etc.

- All drawings and documents including general arrangement drawing, data sheet, calculation etc. shall be furnished to BHEL during detailed engineering stage and shall include / indicate the following details for clarity w.r.t. inspection, construction, erection and maintenance etc.:-

  a) All drawings and documents shall bear BHEL's title block and drawing / document number.

  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.

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

ANNEXURE A
EQUIPMENT DESIGN/SELECTION CRITERIA

	Mill Data	
	No. of mills (working & standby) at 100% BMCR with worst coal firing	7 mills (6 working + 1 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	0.8 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	
	RTD	Two (2) nos. each per hopper in redundant mode for interlock and alarm purpose
	RF type level switch	Three (3) nos. (2 nos. for High level in redundant mode & 1 no. High – High level) for interlock, permissive and alarm
	Water Spray quenching system with solenoid operated spray nozzle	One (1) no. per hopper
	Rupture disc	One (1) no. per hopper
	Flexible joint	One (1) no. per hopper
	Oversize reject chute	One (1) no. per hopper
	Bypass Chute	One (1) no. per hopper
	Material of construction	
	Pyrite hopper body	MS as per IS 2062 Gr A, 10 mm THK
	Grid	Flat and bars, of MS:2062 with opening suitable to allow 50mm (max) particle
	Supports, Platform	MS as per IS 2062 Gr A
	Provision of inspection/poking doors in pyrite hopper	Yes
	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 valve with 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 • 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	52 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 complete bunker.
	Discharge gate (Manual)	Twin Sector gates Cast Iron IS 210/ MS to IS 2062 with TISCRAL/SAIL HARD Liner
	Pressure Relief Valve	One (1) no. per bunker
	Level Transmitter	Two (2) nos. 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/TISCRAL liner.
	Clear access/headroom underneath MRS bunker for a road tanker/truck	4.5 m
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
	Hand operated Chain Pulley Block with geared trolley over bag filter	• No. of CPB – 1 no. • Service condition – Class II outdoor • Capacity of Chain Pulley Block shall be selected considering a minimum margin of 25% over the maximum weight of the heaviest equipment/component to be handled but in no case the capacity shall be as per IS 3832.
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 Main Plant Air 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 2 units. • 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 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 customer specification

		(Vol – III).
	Instrumentation	As per manufacturer's standard practice with redundancy requirement as per attached C & I specification.
	• One no. Pressure Transmitter at common discharge header of Air Compressors for Auto standby logic and remote monitoring • At compressor water inlet: One temperature switch and one no. pressure switch. • At compressor water outlet: One no. Pressure switch and one no. temperature gauge. • One no. pressure gauge on each return water line from air compressors to return water header. • One Number Flow Gauge on each return water line from Air Compressors to return water Header. • One number pressure gauge and temperature gauge at common inlet water header of air compressors. • One no. pressure gauge at common discharge header of compressors. • One no. Flow meter at common discharge header of compressors	
	Conveying air compressor system shall be designed to supply the air to operate each dense phase pneumatic conveying system of both units simultaneously.	
8.	**Air receiver with isolation valves, instruments & accessories**	
	Quantity	One (1) no. per bay
	Design Code	ASME Section-VIII or IS: 2825 Class III 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	MS: IS 2062 Gr A/B; 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, DM water and Instrument air pipeline: as per low pressure piping specification. Conveying air pipelines : MS ERW pipes as per IS-1239(≤150NB) (heavy grade)/3589(>150NB)
	Pressure Transmitter	One (1) no. each at service water tapping and at instrument air tapping.
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

Material of Construction

a.	Compressor chamber	:	Cast iron coated with corrosion resistant material
b.	Rotor	:	Forged carbon steel coated with corrosion resistant material; 2nd 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

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/Contactor : Mfgr:- Works:-			Manufacturing Quality Plan Item :-Local Panels QAP No. LOI Nos:- Contractor :- M/s BHEL			Project:- Package :- Mill Rejects System Client :- Consultant :-						
Sl. No.	Components / Operations	Characteristics Checked	Category	Type/Method of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Records		Agency for Checking			Remarks
1	2	3	4	5	6	7	8	9		10			11
								TYPE	D	M	C	N	
1	**Materials**												
	CRCA Sheet	Visual	Major	Visual	100%	Appr. Drg / IS: 513	Appr. Drg / IS: 513	IR	-	P	-	-	
		Chem. & Physical.	Major	Chem.& Physical.	100%	Do	Do	TC	√	V	V	V	
		Thickness	Major	Measurement	100%	App. Drawing	App. Drawing	IR/TC	√	V	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	V	
3	**Painting**												
	Pre Treatment 7 tank process	Physical	Major	DFT / Shade / Finish	100%	Appr. Painting Schedule	Appr. Painting Schedule	IR/TC	√	V	V	V	
4	**Final Inspection**												
		Visual	Major	Visual	100%	Appr. Drawing / Data Sheet	Appr. Drawing / Data Sheet	IR/TC	√	P	**W**	V	
		Dimension	Major	Measurement	100%	Appr. Drawing / Data Sheet	Appr. Drawing / Data Sheet	IR/TC	√	P	**W**	V	
		Check for Pneumatic Circuit	Major	Visual	100%	Appr. Drawing / Data Sheet	Appr. Drawing / Data Sheet	IR/TC	√	P	**W**	V	
		Check for Wiring / Mountings / Terminations	Major	Visual / Continuity	100%	Appr. Drawing / Data Sheet	Appr. Drawing / Data Sheet	IR/TC	√	P	**W**	V	
		Functional Check for Solenoid Valve	Major	Functional	100%	Appr. Drawing / Data Sheet	Appr. Drawing / Data Sheet	IR/TC	√	P	**W**	V	
5	**QA Documents**	Review	Major	verification	100%	-	-	-					
Manufacturer / Sub Vendor		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				For Client Use:-		**Document. No.:**				
SIGNATURES			**P->Perform, V-> Verification, W-> Witness**				Name & Signature of Approving Authority with Seal						

	S/Contactor :	Manufacturing Quality Plan	Project:-
		Item :- Transport vessel	Package :- Mill Rejects System
	Mfgr:-	QAP No.	Client :
	Works:-	LOI Nos:-	
		Contractor :- M/s BHEL	Consultant :-

Sl. No.	Components / Operations	Characteristics Checked	Category	Type/Method of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Records		Agency for Checking			Remarks
1	2	3	4	5	6	7	8	9		10			11
								TYPE	D	M	C	N	
1	**Raw Materials**												
1.1	Dome & dome Valve Body	Dimensions	Major	Measurement	100%	App. Drg. / Data Sheet / Standard	App. Drg. / Data Sheet / Standard	-	-	P	-	-	
		Surface Defects		Visual	100%			-	-	P	-	-	
		Physical Check		TS & Hardness	1/Heat			TC	√	P/V	V	V	
		Chemical Check		Chemical Comp.	1/Heat			TC	√	P/V	V	V	
1.2	Plates for Vessel	Dimensions	Major	Measurement	100%	App. Drg. / Data Sheet / IS Standard	App. Drg. / Data Sheet / IS Standard	-	-	P	-	-	
		Surface Defects		Visual	100%			-	-	P	-	-	
		Physical Check		TS & Elongation	1/Heat			TC	√	P/V	V	V	
		Chemical Check		Chemical Comp.	1/Heat			TC	√	P/V	V	V	
1.3	Insert Seal	Surface Defects	Major	Visual	100%	Mfr's Drg. / Std	Mfr's Drg. / Std	-	-	P	-	-	
		Hardness		Measurement	1/Lot			IR	√	P/V	V	V	
1.4	Shaft	Physical Check	Major	TS & Elongation	1/Heat	App. Drg./ IS Std.	App. Drg./ IS Std.	TC	√	P/V	V	V	
		Chemical Check		Chemical Comp.	1/Heat								
2	**In - Process Insp.**												
2.1	Welders & Welding	WPS / PQR / WPQ	Major	Procedure / Qualification	100%	ASME sec - IX	ASME sec - IX	WPS / PQR	√	P/V	V	V	Welders to be approved by BHEL / CLIENT
		Welding Defects	Major	DPT on Root run	100%	ASTM E-165	ASTM E-165	IR	√	P/V	V	V	
			Major	DPT on Final run	10%	ASTM E-165	ASTM E-165	IR	√	P/V	V	V	
2.3	Machining of Dome & dome Valve	Visual & Dimension	Minor	Visual, Measurement	100%	Mfr's Drg / Standard	Mfr's Drg / Standard	-	-	P	-	-	
2.4	Hydotest of Vessel	Soundness / Leakage	Major	Visual, Hydro Pressure Test	100%	App. Drg. / Data sheet	App. Drg. / Data sheet	IR	√	P/V	**W**	**W**	
3	**Final Inspection**												
3.1	Final Assly	Completeness & Dimension	Major	Visual / Measurement	100%	App. Drg. / Data sheet	App. Drg. / Data sheet	IR	√	P/V	**W**	**W**	At Painted Condition
3.2	Run Test / Performance	Operation of Dome Valve	Minor	Visual, 5 times Cycle operation	100%	Mfr's Standard	Mfr's Standard	IR	√	P/V	**W**	**W**	
3.3	Painting	Finish / DFT	Major	Visual, Measurement	100%	App. Painting Schedule	App. Painting Schedule	IR	√	P/V	**W**	**W**	
4	**QA Documentation**												
4.1	TC & IR	Completeness	Major	Verification & approval	100%	App. Quality Plan	App. Quality Plan		–	P/V	V	V	

Manufacturer / Sub Vendor	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	For Client Use:-
SIGNATURES		**P->Perform, V-> Verification, W-> Witness**	Name & Signature of Approving Authority with Seal

Document No.

	S/Contactor : Mfgr:- Works:-	Manufacturing Quality Plan Item :- Pyrite Hopper QAP No. LOI Nos Contractor :- M/s BHEL	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
								TYPE	D	M	C	N	
1	**Raw Materials**												
1.1	Plates for Body	Dimensions	Major	Measurement	100%	App. Drg. / Data Sheet	App. Drg. / Data	-	-	P	-	-	
		Surface Defects		Visual	100%	/ IS Standard	Sheet / IS	-	-	P	-	-	
		Physical Check		TS & Elongation	1/Heat		Standard	MTC	√	P/V	V	V	
		Chemical Check		Chemical Comp.	1/Heat			MTC	√	P/V	V	V	
1.2	Spray Nozzle	Surface Defects	Major	Visual	100%	Mfr's Drg. / IS Standard	Mfr's Drg. / IS Standard	-	-	P	-	-	
		Chemical Check		Chemical Comp.	1/Lot			MTC	√	P/V	V	V	
		Dimensions		Measurement	100%			IR	√	P	V	V	
2	**In - Process Insp.**												
2.1	Welders & Welding	WPS / PQR / WPQ	Major	Procedure / Qualification	100%	ASME sec - IX	ASME sec - IX	WPS / PQR	√	P/V	V	V	Welders to be approved by BHEL
		Welding Defects		DPT on Root run	100%	ASTM E-165	ASTM E-165	IR	√	P/V	V	V	
				DPT on Final run	10%	ASTM E-165	ASTM E-165	IR	√	P/V	**W**	**W**	
2.2	Fabrication	Fit up, Marking, Cutting, Grinding	Minor	Visual, Measurement	100%	Mfr's Standard	Mfr's Standard	-	-	P	-	-	
3	**Final Inspection**												
3.1	Final Assly	Completeness & Dimension	Major	Visual	100%	App. Drg. / Data sheet	App. Drg. / Data sheet	IR	√	P/V	**W***	**W***	* -> Witness 10%
3.2	Painting	Finish / DFT	Major	Visual, Measurement	100%	App. Painting Schedule	App. Painting Schedule	IR	-	P/V	**W**	-	Painting shall be Heat Resistance
4	**QA Documentation**												
4.1	TC & IR	Completeness	Major	Verification & approval	100%	App. Quality Plan	App. Quality Plan		–	P/V	V	V	

Manufacturer / Sub Vendor	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	For Client Use:-	**Document No.:-**
SIGNATURES		**P->Perform, V-> Verification, W-> Witness**	Name & Signature of Approving Authority with Seal	

	S/Contactor :-. Mfgr:-	Manufacturing Quality Plan Item :- Terminal Box QAP No. :- LOI Nos:- Contractor :- M/s BHEL	Project:- Package :- Mill Rejects System Client :- Consultant :- .

Sl. No.	Components / Operations	Characteristics Checked	Category	Type/Method of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Records		Agency for Checking			Remarks
1	2	3	4	5	6	7	8	9		10			11
								TYPE	D	M	C	K	
1	**Raw Materials**												
1.1	Plates for Body	Dimensions	Major	Measurement	100%	App. Drg. / Data Sheet / IS Standard	App. Drg. / Data Sheet / IS Standard	-	-	P	-	-	
		Surface Defects		Visual	100%			-	-	P	-	-	
		Physical Check		TS & Elongation	1/Heat			MTC	√	P/V	V	V	
		Chemical Check		Chemical Comp.	1/Heat			MTC	√	P/V	V	V	
2	**In - Process Insp.**												
2.1	Welders Qualification & Welding	WPS / PQR / WPQ	Major	Procedure / Qualification	100%	ASME sec - IX	ASME sec - IX	WPS / PQR	√	P/V	V	V	Welders to be approved by BHEL / NTPC
		Welding Defects	Major	DPT on Root run	100%	ASTM E-165	ASTM E-165	IR	√	P/V	V	V	
			Major	DPT on Final run	10%	ASTM E-165	ASTM E-165	IR	√	P/V	**W**	V	
2.2	Flange Machining and Drilling	Dimensions	Major	Measurement	100%	Mfr/Appr. Drg	Mfr/Appr. Drg	IR	–	P	-	-	
2.3	Connection -pipe to flange, pipe to body	Fit up	Major	Joint set up, PCD, Orientation	100%	Mfr/Appr. Drg	Mfr/Appr. Drg	IR	–	P	-	-	If Applicable
2.4	Fabrication	Fit up, Marking, Cutting, Grinding	Minor	Visual, Measurement	100%	Mfr's Standard	Mfr's Standard	-	-	P	-	-	
3	**Final Inspection**												
3.1	Final Assly	Completeness & Dimension	Major	Visual	100%	App. Drg. / Data sheet	App. Drg. / Data sheet	IR	√	P/V	**W**	**W**	
3.2	Painting	Finish / DFT	Major	Visual, Measurement	100%	App. Painting Schedule	App. Painting Schedule	IR	–	P/V	**W**	-	Painting before disp.
4	**QA Documentation**												
4.1	TC & IR	Completeness	Major	Verification & approval	100%	App. Quality Plan	App. Quality Plan		–	P/V	V	V	

Manufacturer / Sub Vendor	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	For Client Use:-
SIGNATURES		**P->Perform, V-> Verification, W-> Witness**	Name & Signature of Approving Authority with Seal

Document No.:-

	S/Contactor :-. Mfgr:- Works:-	Manufacturing Quality Plan Item :- Bunker Discharge Gate QAP No. :- LOI Nos:- Contractor :- M/s BHEL	Project:- Package :- Mill Rejects System Client :- Consultant :-

Sl. No.	Components / Operations	Characteristics Checked	Category	Type/Method of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Records		Agency for Checking			Remarks
1	2	3	4	5	6	7	8	9		10			11
								TYPE	D	M	C	K	
1	**Raw Materials**												
1.1	Plates for Body	Dimensions	Major	Measurement	100%	App. Drg. / Data	App. Drg. / Data	-	-	P	-	-	
		Surface Defects		Visual	100%	Sheet / IS Standard	Sheet / IS Standard	-	-	P	-	-	
		Physical Check		TS & Elongation	1/Heat			TC	√	P/V	V	V	
		Chemical Check		Chemical Comp.	1/Heat			TC	√	P/V	V	V	
1.2	Shaft	Physical Check	Major	TS & Elongation	1/Heat	do	do	TC	√	P/V	V	V	
		Chemical Check		Chemical Comp.	1/Heat			TC	√	P/V	V	V	
		UT If Dia > 50 mm		Internal defect	100%			IR	√	P/V	V	V	
1.3	Cylinder / Actuator	Visual / Specification	Major	Visual	100%	do	do	Mfr's TC	√	V	V	V	
2	**In - Process Insp.**												
2.1	Welders & Welding	WPS / PQR / WPQ	Major	Procedure / Qualification	100%	ASME sec - IX	ASME sec - IX	WPS / PQR	√	P/V	V	V	Welders to be approved by BHEL / CLIENT
		Welding Defects	Major	DPT on Root run	100%	ASTM E-165	ASTM E-165	IR	√	P/V	V	V	
			Major	DPT on Final run	10%	ASTM E-165	ASTM E-165	IR	√	P/V	**W**	V	
3	**Final Inspection**												
3.1	Final Assly	Completeness & Dimension	Major	Visual	100%	App. Drg. / Data sheet	App. Drg. / Data sheet	IR	√	P/V	**W**	**W**	
3.2	Operation with job / shop actuator	Opening & Closing of Gate	Major	Visual	100%	Proper Working	Smooth Operation	IR	√	P/V	**W**	**W**	
3.3	Painting	Finish / DFT	Major	Visual, Measurement	100%	App. Painting Schedule	App. Painting Schedule	IR	–	P/V	**W**	-	Painting before disp.
4	**QA Documentation**												
4.1	TC & IR	Completeness	Major	Verification & approval	100%	App. Quality Plan	App. Quality Plan		–	P/V	V	V	

Manufacturer / Sub Vendor	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:- Name & Signature of Approving Authority with Seal
SIGNATURES			**Document No.:-**

	S/Contactor :- Mfgr:- Works:-	Manufacturing Quality Plan Item :- Pressure Relief Valve QAP No. : LOI Nos:- Contractor :- M/s BHEL	Project:- Package :- Mill Rejects System Client :- . Consultant :-

Sl. No.	Components / Operations	Characteristics Checked	Category	Type/Method of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Records		Agency for Checking			Remarks
1	2	3	4	5	6	7	8	9		10			11
								TYPE	D	M	C	K	
1	**Raw Materials**												
1.1	Plates for Body	Dimensions	Major	Measurement	100%	App. Drg. / Data Sheet / IS Standard	App. Drg. / Data Sheet / IS Standard	-	-	P	-	-	
		Surface Defects		Visual	100%			-	-	P	-	-	
		Physical Check		TS & Elongation	1/Heat			MTC	√	P/V	V	V	
		Chemical Check		Chemical Comp.	1/Heat			MTC	√	P/V	V	V	
2	**In - Process Insp.**												
2.1	Welders & Welding	WPS / PQR / WPQ	Major	Procedure / Qualification	100%	ASME sec - IX	ASME sec - IX	WPS / PQR	√	P/V	V	V	Welders to be approved by BHEL / NTPC
		Welding Defects	Major	DPT on Root run	100%	ASTM E-165	ASTM E-165	IR	√	P/V	V	V	
			Major	DPT on Final run	10%	ASTM E-165	ASTM E-165	IR	√	P/V	**W**	V	
2.2	Fabrication	Fit up, Marking, Cutting, Grinding	Minor	Visual, Measurement	100%	Mfr's Standard	Mfr's Standard	-	-	P	-	-	
3	**Final Inspection**												
3.1	Final Assly	Completeness & Dimension	Major	Visual	100%	App. Drg. / Data sheet	App. Drg. / Data sheet	IR	√	P/V	**W**	**W**	
3.2	Painting	Finish / DFT	Major	Visual, Measurement	100%	App. Painting Schedule	App. Painting Schedule	IR	–	P/V	**W**	-	Painting before disp.
4	**QA Documentation**												
4.1	TC & IR	Completeness	Major	Verification & approval	100%	App. Quality Plan	App. Quality Plan		–	P/V	V	V	

Manufacturer / Sub Vendor	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.:-**
SIGNATURES			Name & Signature of Approving Authority with Seal	

	S/Contactor :- Mfgr:- Works:-	Manufacturing Quality Plan Item :- Air Receiver QAP No. :- LOI Nos:- Contractor :- M/s BHEL	Project:- Package :- Mill Rejects System Client :- Consultant :-

Sl. No.	Components / Operations	Characteristics Checked	Category	Type/Method of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Records		Agency for Checking			Remarks
1	2	3	4	5	6	7	8	9		10			11
								TYPE	D	M	C	K	
1	**Raw Materials**												
1.1	Plates for Shell, Dished End & Flange	Dimensions	Major	Measurement	100%	App. Drg. / Data	App. Drg. / Data	-	-	P	-	-	
		Surface Defects		Visual	100%	Sheet / IS	Sheet / IS Standard	-	-	P	-	-	
		Physical Check		TS & Elongation	1/Heat	Standard		TC	√	P/V	V	V	
		Chemical Check		Chemical Comp.	1/Heat			TC	√	P/V	V	V	
1.2	Formed Dished End	Dimensions	Major	Measurement	100%	App. Drg. / Data	App. Drg. / Data	IR	√	P	-	-	
		Thickness/Thinning		Measurement	100%	Sheet	Sheet	IR	√	P	-	-	
		DPT of Knuckle		DP Test	100%	ASTM E-165	ASTM E-165	TC	√	P/V	V	V	
2	**In - Process Insp.**												
2.1	Welders & Welding	WPS / PQR / WPQ	Major	Procedure / Qualification	100%	ASME sec - IX	ASME sec - IX	WPS / PQR	√	P/V	V	V	Welders to be approved by BHEL / CLIENT
		Welding Defects	Major	DPT on Root run	100%	ASTM E-165	ASTM E-165	IR	√	P/V	V	V	
		do	Major	DPT on Final run	10%	ASTM E-165	ASTM E-165	IR	√	P/V	**W**	**W**	
		do	Critical	Radiography Test on all C/S & L/S including T & X	100%	IS 2825 Class-II / ASME Sec VIII	IS 2825 Class II / ASME Sec VIII	RT Film / Report	√	P/V	V	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 Assly	Completeness & Dimension	Major	Visual / Measurement	100%	App. Drg. / Data sheet	App. Drg. / Data sheet	IR	√	P/V	**W**	**W**	
3.2	Hydotest of Vessel	Soundness / Leakage	Major	Visual, Hydro Pressure Test	100%	App. Drg. / Data sheet	App. Drg. / Data sheet	IR	√	P/V	**W**	**W**	
3.3	Painting	Finish / DFT	Major	Visual, Measurement	100%	App. Painting Schedule	App. Painting Schedule	IR		P/V	**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	

Manufacturer / Sub Vendor	Contractor	**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**	For Client Use:-	**Document No.:-**
SIGNATURES			Name & Signature of Approving Authority with Seal	

	S/Contactor :- Manufacturer :-			Manufacturing Quality Plan Item :- Rupture Disc QAP No. :- LOI Nos:- Contractor :- M/s BHEL			Project:- Package :- Mill Rejects System Client :- Consultant :-					
Sl. No.	Components / Operations	Characteristics	Classification	Type of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Records		Agency for Checking			Remarks
1	2	3	4	5	6	7	8	9		10			11
								TYPE	D	M	C	K	
1 ->	**Materials** Rupture Disc Material	Physical & Chemical Properties	Major	Chemical Analysis, YTS & UTS	1 per Heat	ASTM A240 Type - 304 / Appved Data Sheet / Drg.	ASTM A240 Type - 304 / Appved Data Sheet	MTC	√	V	V	V	
2 -> ->	**Final Inspection** Dimension Burst Test of Rupture Disc	Measurement Functional	Major Major	Mesurement Burst Test @ 200 Degree Centigrade	100% 1 per lot offered	App. Drawing Approved drawing / Datasheet	App. Drawing Min 0.4 bar (g) @ 200 degree C Max 0.6 bar (g) @ 200 degree C / App. Data Sheet	IR IR / Burst Test Certificate	√ √	P P	**W** **W**	**W** **W**	

Manufacturer / Sub Vendor	Contractor	**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	For Client Use:-	**Document No.:-**
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/Contactor :- Manufacturer :-	Manufacturing Quality Plan Item:- CHAIN PULLY BLOCK QAP No. :- LOI Nos:- Contractor :- M/s BHEL	Project:- Package :- Mill Rejects System Client :- Consultant :-

Sl. No.	Components / Operations	Characteristics	Classification	Type of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Records		Agency for Checking			Remarks
1	2	3	4	5	6	7	8	9		10			11
								TYPE	D	M	C	K	
1	**Materials**												
->	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**												
->	Hook	Proof Load Test	Major	Load Test	100%	IS:8610 /Appr. Drg / Appr. Data sheet	IS:8610 /Appr. Drg / Appr. Data sheet	MTC / IR	√	P	V	V	
		DPT after Load Test	Major	DPT	100%	ASTM E-165	ASTM E-165 / No Defects	IR	√	P	V	V	
3	**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	Major	Measurement	100%			IR	√	P	**W**	V	
		Visual (After Load Test)	Major	Visual	100%	IS 3832	IS 3832	IR	√	P	**W**	V	

Manufacturer / Sub Vendor	Contractor	**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	For Client Use:-
SIGNATURES		**P->Perform, V-> Verification, W-> Witness**	Name & Signature of Approving Authority with Seal

Document No.:-

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

	S/Contactor :- Manufacturer :-	Manufacturing Quality Plan Item :- Bag Filter (Without Enclosure) QAP No. :- LOI Nos:- Contractor :- M/s BHEL	Project:- Package :- Mill Rejects System Client :- Consultant :-

Sl. No.	Components / Operations	Characteristics	Classification	Type of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Records		Agency for Checking			Remarks
1	2	3	4	5	6	7	8	9		10			11
								TYPE	D	M	C	K	
1	**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.	MTC	√	V	V	V	
1.2	Bag Cages (Inserts)	Chemical & Physical	Major	Chemical & Mechanical	1 per Lot	App. Drawing / data sheet / IS:7887 Gr.8 / IS:1079 Gr. 0	App. Drawing / data sheet / IS:7887 Gr.8 / IS:1079 Gr. 0	MTC	√	V	V	V	
1.3	Solenoid Valves	Functional	Major	Operational	100%	Approved Drawing / Appr. Data Sheet	Approved Drawing / Appr. Data Sheet	MTC	√	P	V	V	
1.4	Sequence Controller	Functional	Major	Operational	100%	Approved Drawing / Appr. Data Sheet	Approved Drawing / Appr. Data Sheet	MTC	√	P	V	V	
1.5	Filter Bags (Make :- Charminar / Supreme)	Physical	Major	Visual / Measurement	100%	Approved Drawing / Appr. Data Sheet	Approved Drawing / Appr. Data Sheet	MTC	√	P	V	V	
2	**In Process**												
2.1	Manifold	Dimensional & Visual	Minor	Dimensional & Visual	100%	As per Mfr's Drg.	As per Mfr's Drg.	IR	√	P	V	V	** -> DPT & Hydro -Test of Manifold to be witnessed by vendor
2.2		Welding	Major	DPT on Final Weld	100%	ASTM E-165	No Defect	IR	√	P	V**	V	
2.3		Hydro Test for 30 Minutes	Major	Leakage	100%	Appr. Data sheet	No Leakage	IR	√	P	V**	V	

Document No.:-

Sl. No.	Components / Operations	Characteristics	Classification	Type of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Records		Agency for Checking			Remarks
1	2	3	4	5	6	7	8	9		10			11
								TYPE	D	M	C	K	
3	**Final Inspection**												
3.1	Assembly	Dimensional	Major	Measurement	100%	Appr. Drawing	Appr. Drawing	IR	√	P	**W**	V	**Pressure Drop across Filter Bags & Emission Level at Filter outlet shall be checked at Site**
	$-> Pneumatic Test at 1.1 times W/Pressure	Pne. test $of Manifold in Assly.	Major	Leakage by soap solution	100%	Appr. Data Sheet	No Leakage	IR	√	P	**W**	V	
		Functional Test of Pulsing System	Major	Pulse Sequence	100%	Appr. Data sheet / Testing Procedure	Appr. Data sheet / Testing Procedure	IR	√	P	**W**	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	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	For Client Use:-
SIGNATURES		**P->Perform, V-> Verification, W-> Witness**	Name & Signature of Approving Authority with Seal

Document No.:-

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.

		S/Contactor :- **Manufacturer :-**			**Manufacturing Quality Plan** **Item :- MS GI ERW Pipes (IS:1239/IS3589)** **QAP No. :-** **LOI Nos:-** **Contractor :- M/s BHEL**			**Project:-** **Package :- Mill Rejects System** **Client :-** **Consultant :-**					
Sl. No.	**Components / Operations**	**Characteristics**	**Classification**	**Type of Check**	**Quantum of Check**	**Reference Documents**	**Acceptance Norms**	**Format of Records**		**Agency for Checking**			**Remarks**
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**		**10**			**11**
								TYPE	**D**	**M**	**C**	**K**	
1	Final Inspection of Finished Pipes	Physical	Major	Visual	100%	IS:1239 / IS:3589 / Approved Data Sheet	IS:1239 / IS:3589 / Approved Data Sheet	IR	-	P	W*	V	* -> Random 5% of offered lot irrespective of size
		Dimensional	Major	Measurement	100%			IR	√	P	W*	W*	
		Mechanical Properties	Major	Tensile, elongation, Bend or Flattening	IS: 4711			IR / TC	√	P / V	V	V	
		Chemical	Major	Chemical Analysis	1 per heat			TC	√	P / V	V	V	
		Hydro Test	Major	Pressure Testing	100%			IR / TC	√	P	W *	W*	
2	Galvanising (For GI Pipes	Uniformity & mass of Zinc Coating, Adhesion test, Free bore test	Major	As per IS:4736	As per IS:4736	As per IS:4736 / Approved Data Sheet	As per IS:4736 / Approved Data Sheet	IR	√	P	W #	V	# one sample for each size
3	Identification	Verification of Batch No. / Mfg stamp / Heat No.	Major	Visual	100%	Mfgr Practise / IS 1239 / IS 3589	Mfgr Practise / IS 1239 / IS 3589	IR	√	P	W	V	
4	Review of QA Documents	----------	----------	----------	----------	As per QAP	As per QAP	----------	√	V	V	V	

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.

Manufacturer / Sub Vendor	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	For Client Use:-
SIGNATURES		**P->Perform, V-> Verification, W-> Witness**	Name & Signature of Approving Authority with Seal

Document No.:-

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

	S/Contactor :- Manufacturer :-	Manufacturing Quality Plan Item :- ACI Bends QAP No. :- LOI Nos:- Contractor :- M/s BHEL	Project:- Package :- Mill Rejects System Client :-. Consultant :- .

Sl. No.	Components / Operations	Characteristics	Classification	Type of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Records		Agency for Checking			Remarks
1	2	3	4	5	6	7	8	9		10			11
								TYPE	D	M	C	K	
1	**Raw Material**												
1.1	Scrap Receipt	Chemical	Major	Lab Analysis	Random Sample / Lot	Mfg's Std	Mfg's Std	Mfg's Log Sheet	–	P	–	–	
1.2	Ferro Alloys	Chemical	Major	Lab Analysis	Random Sample / Lot	Mfg's Std	Mfg's Std	Mfg's Log Sheet	–	P	–	–	
2	**Final Inspection**												
2.1	Product Analysis	Chemical Analysis	Major	Chemical	1 / heat	Mfg's Standard	Mfg's Standard	MTC	√	P	V**	V	** Chemical. Analysis to be Witnessed by Vendor
2.2	Leakage	Hydro Test	Major	Pressure Test	100%	Approved Drg / Data Sheet	No Leakage	IR	√	P	W*	W*	* 10% by Vendor / BHEL / CLIENT
2.3	Dimension	Dimension	Major	Measurement	100%	Approved Drg / Data Sheet	Approved Drg / Data Sheet	IR	√	P	W*	W*	
2.4	Hardness	Hardness	Major	Measurement	100%	Approved Drg / Data Sheet	Approved Drg / Data Sheet	IR/TC	√	P	W*	W*	

Manufacturer / Sub Vendor	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	For Client Use:-	Document No.:-
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/Contactor :- Manufacturer :-	Manufacturing Quality Plan Item :- Knife Gate Valve [Manual / Pneumatic] QAP No. : LOI Nos:- Contractor :- M/s BHEL	Project:- Package :- Mill Rejects System Client :- Consultant :-

Sl. No.	Components / Operations	Characteristics	Classification	Type of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Records		Agency for Checking			Remarks
1	2	3	4	5	6	7	8	9		10			11
								TYPE	D	M	C	K	
1	**Raw Material / Bought Out's**												
1.1	Body	Chemical & Mechanical	Major	Foundary TC	1 per Heat	Relevent IS / Appr. Drg / Data Sheet	Relevent IS / Appr. Drg / Data Sheet	TC	√	P/V	V	V	
1.2	Gate	do	Major	Lab Analysis	1 per lot	do	do	Mill / Lab TC	√	P/V	V	V	
1.3	Stem (For Manual Valve)	do	Major	Lab Analysis	1 per batch	do	do	do	√	P/V	V	V	
1.4	Pneumatic Cylinder (For Pneu. Valve)	Visual & Functional	Major	Mfr's TC Review	100%	Smooth Operation	Smooth Operation	Mfr's TC	√	P/V	V	V	
2	**In - Process Inspection**												
2.1	Body, Gate	Dimensional	Major	Measurement	100%	Mfr's Drawing	In-Process Insp. Record	-		P	V	V	**# -> Test Pressure as per Data Sheet**
2.2	Body Shell Test	Leak Tightness	Major	Hydro Static Test #	100%	Approved Drg / Data Sheet	No Leakage	IR	√	P	V	V	
3	**Final Inspection**												
3.1	Assembled Valve	Dimension	Major	Measurement	100%	Approved Drg / Data Sheet	Approved Drg / Data Sheet	IR	√	P	**W**	**W**	**BHEL / Vendor/CLIENT to Witness 10 % of Quantity.**
3.2	do	Function	Major	Operation	100%	Smooth Opertaion	Smooth Opertaion	IR	√	P	**W**	**W**	
3.3	do	Seat Leakage	Major	Hydro Static Test #	100%	Approved Drg / Data Sheet	Approved Drg / Data Sheet	IR	√	P	**W**	**W**	

Manufacturer / Sub Vendor	Contractor	**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.:-**
SIGNATURES			Name & Signature of Approving Authority with Seal	

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

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

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

Manufacturer / Sub Vendor	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	For Client Use:- / **Document No.:-**
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/Contactor :- Manufacturer :-	Manufacturing Quality Plan Item :-EXPANSION BELLOW QAP No. :- LOI Nos:- - Contractor :- M/s BHEL	Project:- Package :- Mill Rejects System Client :- Consultant :-)

Sl. No.	Components / Operations	Characteristics	Classification	Type of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Records		Agency for Checking			Remarks
1	2	3	4	5	6	7	8	9		10			11
								TYPE	D	M	C	K	
1	**Raw Material**												
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	Fianges/ 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 Of Weld of L-Seam	major	DPT **(Before & After Forming)	100%	ASTM E- 165	No Cracks/ Linear Indication	IR		P	V	V	
3	**Final Inspection**												
3.1	Assembly	DP Test of Fillet Weld of Bellows to Pipe & Pipe to Fiange	Major	visual	100%	ASTM E-165	No Crack / Linear Inication	IR	√	P	**W**	V	
3.2	Testing	Dimensions	Major	Measurement	100%	Approved Drg	Approved Drg	IR	√	P	**W**	**W**	
		pressure	Critical	Hydraulic	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:-	For Client Use:-
		Records identified by √ shall be essentially included in QA documentation. TC- Test Certificate, IR - Insp. Report	**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

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			BHEL Ref. :					
			Sub-System :		Date :			Contract No.:					
					Page No.: 11 of 1			Contractor : BHEL SUB-CONTRACTOR-					

Sl. No.	Components & Operations	Characteristic/Item	Class	Type/method of check	Extent of Check	Reference Document	Acceptance	Format of Record		Agency			Remarks
										P	W	V	
1	2	3	4	5	6	7	8	9	D	10			11
	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	Refer Note Below
2		Visual and dimensional Check	Major	Visual and measurement	100%	Mfgr. TC	Mfgr. TC IS 1852	Mfgr. TC	√	3	2,1		
3		Identification / Marking	Major	Co-relation establish	100%	AS per manufacturing practice	AS per manufacturing practice IS 2062	Mfgr. TC	√	3	2	1	

		LEGEND :		BHEL Doc. No.	Rev. 0
		1 - BHEL / CUSTOMER 2 - VENDOR 3 - Manufacturer	P - Agency Performing the Test W - Agency Witnessing the Test V - Agency Verifying the Test		
MANUFACTURER/ SUBCONTRACTOR	**CONTRACTOR**	CR - Critical Characteristics MA - Major Characteristics MI - Minor Characteristics			
SIGNATURE				REVIEWED BY	NAME & SIGNATURE OF APPROVING AUTHORITY

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.

Annexure-C
Site Information

1.0 GENERAL BACKGROUND AND SALIENT FEATURES

1.1 Introduction

Tamilnadu Generation and Distribution Corporation owns the proposed green-field 1320 MW (2 units of 660 MW each) Coal Based Thermal Power Station at Katupalli. This is an expansion of North Chennai Thermal Power Station (NCTPS) and located on some portion of the ashdyke of NCTPS.

1.2 Location

The proposed site for main power plant is located near Ennore port (approx 5 kms).

The nearest Railway station is at Athipattu Pudunagar (approx 5 kms)

All weather road from Pattamandri on the Thiruvottiyur-Ponneri district highway is the nearest road access.

The nearest airport is at Chennai at a distance of 60 km.

1.3 Type of Plant

The proposed 2x660 MW Super-Critical Power Project consists of coal fired steam generator connected to a reheat type steam turbine generator along with all the required auxiliaries. Circulating cooling water system is envisaged for condenser cooling.

The description and salient technical data of the Steam Generator, Steam Turbine Generator, Auxiliary systems, Electrical, Control & Instrumentation, Civil etc. are explained elsewhere in the specification:

1.4 PROJECT INFORMATION

Project Title : **2 x 660 MW Ennore SEZ Coal Based Supercritical Thermal Power Project at Ash Dyke of NCTPS**

Owner : **TAMIL N ADU GENERATION AND DI STRIBUTION CORPORATION (TANGEDCO)**

LOCATION

The site is located near Vayalur Village, Ennore

Latitude	:	$13^0$17' N to $13^0$18' N
Longitude	:	$80^0$18' E to $80^0$19' E
Distance from Chennai City	:	35 km
Nearest Airport is at Chennai at a Distance of	:	60 km
Nearest Seaport is	:	Ennore
Nearest Railway Station is	:	Athipattu Pudunagar (approx 5 kms)

Meteorological Condition

Climate : Tropical ,very dry and hot summer, dry and cold winter and good rain-fall in monsoon accompanied with strong wind.

Climatological data :

Ambient temp. (^{0}C)

Annual Maximum Mean Temp	41.5(^{0}C)
Annual Minimum Mean Temp	24(^{0}C)
Design Ambient temperature	35(^{0}C)

Relative Humidity

Maximum	100%
Minimum	36%
Design	75%

Annual Rainfall

Maximum	2540 mm
Average	1600 mm
Minimum	1175 mm

Prevailing Wind Direction

Nov to Jan – From NW & NE

Feb to Mar – From East & SE

Apr to May – From South & SE

June – From SW

July to Aug – From NW

Sept to Oct – From SE & SW

Wind Speed 11.8 kmph (avg)

50 kmph (max)

Seismic Zone III as per IS:1893-2002

1.5 Access to Site

Site is well connected to all weather road from Pattamandri on the Thiruvottiyur – Ponneri district highway. Site is located adjacent to the Chennai – Howrah broad gauge line and thus well connected by rail also.

1.6 Plant Rating, Capacity, Availability, PLF

Each of the two units shall have a Turbine maximum continuous rating (TMCR) of 660 MW at generator terminals based on the following site conditions.

- Ambient air temperature
- Condenser cooling water inlet temperature of 33°C and 9°C temperature rise across the condenser.
- Generator power factor of 0.85.
- Fuel specification as given elsewhere.
- Design temperature for electrical equipment is 50°C.

The VWO capacity of the steam turbine shall not be less than 105% of TMCR flow at rated parameters. Boiler maximum Continuous Rating (BMCR) will be established to match the steam flow at VWO conditions, but BMCR flow shall not less than 108% of TMCR flow.

The capacity of the unit is selected so as to deliver the rated output even after ageing that will occur between overhauls, as a result of deposition of salts in turbine blades, wear and tear etc.

The plant load factor (PLF) being considered is 85%.

1.7 Power Evacuation

Power will be evacuated from the proposed thermal power station at 400 KV voltage level through 400 KV transmission lines . The power evacuation lines would be double circuit 400 KV lines which will act as Line in & Line out circuit.

1.8 Site Selection

The following factors which influence the project site selection have been found very favourable to establish and operate the project.

a. Availability of fuel.
b. Existing power plant
c. Availability of adequate cooling water.
d. Availability of adequate land for locating the power plant with approach roads.
e. Suitability of land from topographical and geological aspects
f. Proximity of National Highways, Ports & Transport of fuel & heavy equipment.
g. Facility for interconnection with transmission and distribution system for evacuation of power.
h. Environmental aspects.

Total land required for the project is 500 acres which is under the possession of TANGEDCO.

1.9 Fuel

1.9.1 Source of Fuel

Domestic coal requirement for the power plant will be sourced from Kalinga block of Talcher coal fields, Mahanadi and IB valley coal fields in the state of Orissa. Coal will be transported by sea. The port of dispatch and port of receipt for domestic coal would be Paradip port and Ennore port respectively. Imported coal shall be sourced from foreign countries through sea to Ennore port.

Coal can be transported from coal mines to Ennore port by sea and unloaded at proposed coal berth-III. Further the coal can be transported to the proposed power plant through pipe conveyor which shall have a system capacity of 2 x 2000TPH.

The steam generator shall be designed for the following conditions :

- **Best Coal** – 100% Imported Coal
- **Design Coal** – 70% Imported & 30% Domestic Coal
- **Worst Coal** – 50% Imported & 50% Domestic Coal

The analysis of fuel is given below :

1.9.2 Coal Analysis:

Coal Quality Parameters

SL.NO	DESCRIPTION	DOMESTIC COAL	IMPORTED COAL
1.	HIGHER HEATING	2800 (GCV as	6250 (GCV Air

	VALUE -As Fired basis given Kcal/kg	received basis)	dried basis) 5642 (as received basis)
2.	TOTAL MOISTURE %	During rainy season 20% (inherent + surface)	16.5%
3.	HGI Abrasiveness expected YGP Shale and sand stone content Feed coal size	45 to 55 Average 52 50 to 70 mg/kg 20% max. upto 50 mm.	51

DOMESTIC COAL

Sr. No.	Particulars	Units	Parameters
A.	**Proximate Analysis**		
1.	Moisture	%	16.00
2.	Volatile Matter	%	19.00
3.	Ash	%	45.00
4.	Fixed carbon	%	20.00
	Total	%	100
B.	**ULTIMATE ANALYSIS, % (As received)**		
1.	Carbon	%	27.70
2.	Hydrogen	%	2.60
3.	Nitrogen	%	0.52
4.	Oxygen	%	7.26
5.	Sulphur	%	0.50
6.	Ash	%	45.00
7.	Moisture	%	16.00
8.	Carbonates	%	0.38
9.	Phosphorous	%	0.04
10.	Others	%	-
	Total	%	100.00
C.	**Ash f usion temperature**	deg C	
1.	Initial deformation, IT	deg C	1100
2.	Spherical, ST	deg C	1200
3.	Hemispherical, HT	deg C	1300
4.	Fluid, FT	deg C	-
D.	**Ash Analysis, %**		
1.	Sio2	**%**	59.54
2.	Al 2 O3	**%**	29.00
3.	Fe2O3	**%**	6.42
4.	CaO	**%**	1.50
5.	Na2O	**%**	0.08

Sr. No.	Particulars	Units	Parameters
6.	K2O	%	-
7.	TiO2	%	1.60
8.	SO3	%	0.25
9.	P2O5	%	0.51
10.	MgO	%	0.50
11.	Others	%	0.60
12.	Total		100.00
E	**Resistivity of fly ash**	Ohm - cm	1.73x 10^12

IMPORTED COAL

Sr. No.	Particulars	Units	Parameters
A.	**Proximate Analysis (As received)**		
1.	Moisture	%	16.50
2.	Volatile Matter	%	36.45
3.	Ash	%	6.62
4.	Fixed carbon	%	40.43
5	Total	%	100.00
B.	**ULTIMATE ANALYSIS, % (As received)**		
1.	Carbon	%	60.12
2.	Hydrogen	%	4.38
3.	Nitrogen	%	1.48
4.	Oxygen	%	10.37
5.	Sulphur	%	0.53
6.	Ash	%	6.62
7.	Moisture	%	16.5
8.	Carbonates	%	-
9.	Phosphorous	%	-
10.	Others	%	-
	Total	%	100.00
C.	**Ash f usion temperature**	deg C	
1.	Initial deformation, IT	deg C	1230
2.	Spherical, ST	deg C	1270
3.	Hemispherical, HT	deg C	1320
4.	Fluid, FT	deg C	-
D.	**Ash Analysis, %**		
1.	Sio2	%	36.00
2.	Al 2 O3	%	13.90
3.	Fe2O3	%	14.80
4.	CaO	%	12.70
5.	Na2O	%	0.70
6.	K2O	%	1.70
7.	TiO2	%	0.80

Sr. No.	Particulars	Units	Parameters
8.	SO3	%	10.60
9.	P2O5	%	0.20
10.	MgO	%	8.60
11.	Others	%	-
12.	Total	%	100.00

The plant should be suitable to accept imported coal sourced from any country. The limiting parameters of imported coal are furnished below :

S. No.	Particulars	Unit	Parameter
1	Total Moisture (ARB)	%	Up to 23 (Max)
2	Ash (ADB)	%	Up to 20 (Max)
3	Gross Calorific Value (ADB)	Kcal / Kg	5800 - 6500
4	Sulphur (ADB)	%	Up to 1 (Max)
5	Fixed Carbon (ADB)	%	30-50
6	Volatile Matter (ADB)	%	25-45
7	HGI		45-60
8	IDT (Under Reducing Atmosphere)	Deg C	1100-1250
9	Size	mm	< 50

Note: ADB stands for “As dried Basis” and ARB for “As Received Basis”

1.9.3 Specification of LDO

Specific gravity @ 15° C	0.8348
Gross calorific value, Kcal/kg	10400
Pour point “°C” max.	12
Flash point “°C” min.	66
Sulphur % “T” max.	0.5
K. Viscosity in Centistokes @ 50° C max.	7.5
Ash by wt. %	0.01
Water & sediment Vol. Max. %	0.25

1.9.4 Specification of HFO

Flash point “°C” min.	66
K. Viscosity in Centistokes @ 50° C max.	370

Ash by wt. %	0.1
Water content by volume % max	1
Sediment by weight % max	0.25
Total Sulphur by weight % max	4.5
Gross calorific value, Kcal/kg	10800

1.9.5 Fuel Linkage

TANGEDCO has approached Ministry of Coal through Ministry of Power for the long term linkage of Coal from the coal sources of Talcher or Mahanadi in Orissa.

The coal requirement has been worked as under:-

Coal required at MCR per hr. (Blended) 872 tonnes

Per day	20928 tonnes.
Annual	6.5 MTPA for 85% PLF

1.9.6 Fuel Transportation

The coal shall be received at Ennore port. The coal will be transported by pipe conveyor from coal berth 3 in Ennore Port and then through 2 x 2000 TPH pipe conveyor to the bunker directly or to stockyard.

1.10 Source Of Water

1.10.1 Source

The raw water intake shall be from the existing cooling water forebay of NCTPS PHASE-II.

1.10.2 Chemical analysis of Sea Water:

As given in Annexure-1, Volume III, Chapter- 3.

1.10.3 Requirement

The requirement of water for the plant will be for meeting the requirement of make up for the re-circulating cooling water system, dust suppression system in coal handling plants, ash disposal system and the RO/ D.M. water plant which will be supplying the power cycle make up requirements, etc. In addition the water requirements will be for drinking and service purposes. Water requirement is estimated as approx. 15523 m^3/hr.

1.11 Source of Equipment

The proposed plant will be supplied, erected and commissioned on Single EPC basis.

1.12 Power Evacuation Plan

Power will be evacuated from the proposed thermal power station at 400 KV voltage level through 400 KV transmission lines . The power evacuation lines would be double circuit 400 KV lines.

1.13 400 KV GIS Switchyard

The 400 KV Switchyard is proposed to have one and a half bus arrangement and will comprise following bays/circuits :

- 2 – Generator transformer bays
- 1– Start up transformer bay
- 4 – Line Bays
- 2 – Bus VT's
- 2 – Bus Reactor Bays
- 2 – Spare bay (Equipped)
- 1 – Equipped bay for future GT
- 2 – Equipped bays for future lines

The switchyard will be complete with galvanized steel structures, lightning surge arrestors, OPGW Equipment, CTs, PTs of suitable VA burden and accuracy class as required for measurement protection and communication, insulators, bus-bars clamps & hard wares etc. The switchyard will be controlled by computerized control and data acquisition (SCADA) system.

1.14 Average Yearly Generation

The average yearly generation is calculated considering the following.

- The expected plant load factor is 85 %. With this PLF the average yearly generation will be around 11914 Million units.

1.15 INFORMATION FOR ENVIRONMENTAL APPRAISAL

1.0 GENERAL IN FORMATION ABOUT THE PROJECT

1.1	Name / Title of the Project	:	2 x 660 MW Ennore SEZ Coal Based Supercritical Thermal Power Project at Ash Dyke of NCTPS
1.2	Name of Owner	:	Tamilnadu Generation and Distribution Corporation (TANGEDCO)

1.3	Location of the Project	:	Near Vayalur Village, Ennore, Tamil Nadu
1.4	Site where proposed plant is to be located	:	Ash dyke of NCTPS
1.5	Capacity of the project under consideration	:	2x 660MW
1.5.1	Govt. land / Private land / others	:	TANGEDCO land
1.5.2	Topographical feature, demographic profile & physiography	:	Site has differential levels and require filling to maintain the desried grade level of +10.00 meter above MSL
1.5.3	Nature of soil	:	Clayey soil
1.5.4	Distance from the nearest town / city / major human settlements	:	Chennai -35 km
1.5.5	Population to be displaced	:	Nil
1.5.6	Distance from water source	:	Approx. 5 km (from Cooling Water Forebay of NCTPS Stage II)
1.5.7	Area of forest land, if involved	:	Nil
1.5.8	Distance of forest from the site	:	N.A
1.6	Is this an extension? If so indicate capacity of existing plant	:	No
1.7	What is the ultimate capacity envisaged	:	2x660 MW
2.0	**GENERAL ENVIRONMENTAL INFORMATION**		
2.1	Area of the land proposed to be acquired	:	Refer Plot Plan Land already acquired
	i. Area required for plant	:	500 Acres
	ii. Ash disposal	:	100 % dry fly ash disposal and

			100% wet bottom ash disposal is envisaged to existing ash pond.
	iii. Plant facilities	:	The area is adequate for locating all the required systems for 2x660 MW.
2.2	Area proposed to be built-up or developed	:	Power station will be built-up in the proposed site as indicated in the plot plan.
2.3	Specify site characteristics River basin/ estuarine / coastal / others	:	Site is close to Buckingham Canal
2.4	Is the site situated in the forest area? Give following details	:	No
2.4.1	Area	:	N.A
2.4.2	Type of forests	:	N.A
2.5	Is site situated near to the forests? Give the distance from the site.	:	N.A.
2.6	Give a description of the flora within 25 km of your plant site under the following heads	:	
	a. Crops	:	Refer details in the specification elsewhere.
	b. Forest	:	
	c. Grass land	:	
	d. Endangered species	:	
	e. Others (Specify)	:	
2.6.2	Give details of the following features, if they exist, within a radius of 25 km of the proposed site?	:	
	i. Fisheries	:	
	ii. Sanctuary / natural park biosphere reserve	:	
	iii. Lakes / ponds / reservoir	:	
	iv. Stream / river	:	Buckingham canal is close to the site
	v. Estuary / sea	:	Bay of Bengal is 5 km from site

vi.	Hills / mountains	:	
vii.	Historic / cultural / tourist / archaeological scenic sites / defence installations	:	
2.7	Human settlement	:	
2.7.1	Total number of persons proposed to be employed	:	
	i. During construction	:	2500
			450(0.75person/MW) TANGEDCO
	ii. During operation	:	direct employees

Annexure -D

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	
		FILTERATION 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.	HORZIONTAL/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		

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

1.0. 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:-

1.1. MANDATORY SPARES

a) 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.

Whenever the quantity is mentioned in "sets" the bidder has to give the item details and prices of each item.

b) The Employer reserves the right to buy any or all the mandatory spares parts.

c) The prices of mandatory spares indicated by the Bidder in the Bid Proposal sheets shall be used for bid evaluation purposes.

d) 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.

e) Wherever quantity is specified both as a percentage and a value, the Bidder has to supply the higher quantity until and unless specified otherwise.

1.2. RECOMMENDED SPARES

a) 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.

b) 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.

1.3. 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.

1.4. 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.

1.5 The Contractor shall indicate the service expectancy period for the spares parts (both mandatory and recommended) under normal operating conditions before replacement is necessary.

1.6 All spares supplied under this contract shall be strictly inter changeable with the parts for which they are intended for replacements. The spares shall be treated and packed for long storage under the climatic conditions prevailing at the site e.g. small items shall be packed in sealed transparent plastic with desecrator packs as necessary.

1.7 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.

1.8 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.

1.9 Each spares part shall be clearly marked or labeled 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.

1.10 All cases, containers or other packages are to be opened for such examination as may be considered necessary by the Employer.

1.11 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.

1.12 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.

1.13 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.

1.14 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.

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.

ANNEXURE-E

2X660 MW ENNORE SEZ STPP

MILL REJECT HANDLING SYSTEM

MANDATORY SPARES

S. No.	Description	Qty for 2 units
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.
	GLAND PACKING	4 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	2 SETS
6.3	LOW PRESSURE COMPRESSOR ELEMENT	1 SET
6.4	HIGH PRESSURE COMPRESSOR ELEMENT	1 SET
6.5	INTER COOLER TUBE BUNCH	1 SET
6.6	AFTER COOLER TUBE BUNCH	1 SET
6.7	AUTOMATIC PURGE DRAIN VALVE FOR INTER COOLER AND AFTER COOLER(AUTO DRAIN TRAP)	1 SET
6.8	AIR OUTLET CHECK VALVE	2 SETS
6.9	RUBBER AIR OUTLET COMPENSATOR	1 SET
6.10	LUBE OIL FILTER	2 SETS
6.11	LUBE OIL PRESSURE REGULATING VALVE	1 SET
6.12	DIFFERENTIAL OIL SEALS FOR LUBE OIL SYSTEM	2 SETS
6.13	COOLING WATER INLET AND OUTLET CONNECTION RUBBER BELLOWS	2 SETS
6.14	GEAR BOX COMPONENT	
6.14.1	DIFFERENT OIL SEALS	2 SETS
6.14.2	SET OF BEARINGS	1 SET
6.14.3	BREATHING SYSTEM	2 SETS
6.15	COMPONENTS OF L.P ELEMENTS	
6.15.1	GEAR PINION	1 SET
6.16	COMPONENT OF HP ELEMENT	
6.16.1	GEAR SETS	1 SET
6.16.2	DIFFERENT SAFETY VALVES	1 SET
6.16.3	FLEXIBLE RUBBER STUD COUPLINGS FOR COUPLING COMPRESSOR TO THE MOTOR	1 SET
7	**415 V Motors**	
7.1	Terminal plates	10 Nos. each for small motors upto 30 kW & 4 Nos. each for more than 30 kW
7.2	Heaters	2 sets
7.3	Greasing arrangements	4 sets each type of motor
7.4	Motor of each type and rating	10% of the installed quantity or minimum 1 number whichever be higher
7.5	Bearings (DE and NDE) for each type and rating of motor	4 sets
8	**CONTROL AND INSTRUMENTATION SPARES**	**REFER C & I SPECIFICATION**

NOTES:

a) Unless stated otherwise, a 'set' means item or sub-items required for each type/ size, range of assembly/ sub- assembly required for complete replacement in one comprerssor/equipment
It is further intended that the assembly/ sub-assembly which have different orientation (like left hand or right hand, top or bottom), different direction of rotation or mirror image positioning or any other reasons which result in marinating two different sets of spares to be used for subject assembly/
sub assembly, these shall be considered as different type of assembly/ sub assembly.

b) Wherever quantity has been specified as percentage(%), the quantity of mandatory spares to be provided by the vendor shall be the specified percentage (%) of total population required to meet the specification requirements. In case the quantity of mandatory spares so calculated happens to be in fraction, the same shall be rounded off to next higher whole number.

c) 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 breakup of these shall be furnished by the vendor during detail engineering.

d) In case spares indicated in the list are not applcable to the particular design offered by the bidder, the bidder should offer spares applicable to the offered design with quantities generally in line with the approach followed in the above list.

e) Wherever bidder has indicated an item as not applicable in offer, the same will have to be supplied free of cost, in case it is found applicable during detail engineering.

ANNEXURE-F
MAINTENANCE TOOLS & TACKLES

.

Sl.No.	Description	Qty.	Unit
1	Spur gearded 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.

PERFORMANCE GAUARNTEE & LIQUIDATED DAMAGES

ANNEXURE -G

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 –

- 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 compulsory correction

The contractor shall make every effort to practicable to correct the deficiencies. In case the Contractor fails to meet the guarantees, the equipment / system shall be replaced with the one that shall meet the guaranteed values without any time and cost implication to the Owner. The following items are under compulsory correction.

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

13.0 QUALITY PLAN FOR MANUFACTURE OF EQUIPMENT:

13.1 The Quality plan for manufacture is a document, which presents in a tabular form. The Quality Control checks to be exercised by the Contractor during the various stages of manufacture and despatch 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.

13.2 After issuance of Letter of Intent (LOI), the contractor shall submit to the Owner, the detailed quality plans to be followed during manufacture of all major equipments. 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.

13.3 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 equipments 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.

14.0 OWNER'S REPRESENTATIVE AT SITE:

14.1 SE/ Projects, "2 x 660 MW Ennore SEZ Supercritical Thermal Power Project at Ash Dyke of NCTPS" 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.

15.0 CONSIGNEE:

All materials shall be consigned to:
SE/ Projects
Tamil Nadu Generation and Distribution Corporation
Ennore SEZ Supercritical TPP

16.0 PAINTS, CONSUMABLES:

16.1 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.

16.2 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.

17.0 THIRD PARTY INSPECTION:

a) 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.

b) 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.

18.0 OPERATION AND MAINTENANCE MANUALS:

18.1 For all the equipments supplied by the Contractor, he shall submit to the Owner ten 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.

18.2 ERECTION MANUALS:

18.2.1 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.

19.0 SUBMISSION AND APPROVAL OF DRAWINGS:

19.1 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.

20.0 TEST REPORTS:

20.1 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.

21.0 FIELD QUALITY PLAN:

21.1 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.

22.0 COMMISSIONING AND HANDING OVER:

22.1 INITIAL TRIAL:

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.

22.2 INITIAL OPERATION:

After successful initial trials of all the individual equipment, all equipments 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.

22.3 TRIAL OPERATION:

22.3.1 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 / equipments 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 equipments 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.

22.3.2 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. 22.3.1 mentioned above.

22.4 After the trial operation is carried out successfully, to declare it as such, a joint protocol should be signed between TANGEDCO and the Contractor.

22.5 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.

23.0 PERFORMANCE GUARANTEE TEST:

23.1 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.

23.3 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.

23.4 All test instrumentation as required for the Performance Guarantee Test shall be arranged by the Contractor 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.

23.5 Any special equipment, tools and tackles required for the successful completion of the performance tests shall be provided by the Contractor free of cost.

23.6 The performance guarantee figures of the equipment shall be proved by the Contractor during the Performance Guarantee Test.

23.7 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.

23.8 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 equipments, accuracy class and test certificates to be submitted and got approved by the owner before the commencement of trail operation.

PG test to be witnessed by the consultant and the owner.

23.9 The above shall be read in conjunction with Volume – I, Section 1, General Technical Specification on Performance Guarantee Test.

24.0 PERFORMANCE GUARANTEES, PENALTIES & CAPABILITY TESTS:

24.1 The Contractor shall meet the Performance Guarantees as have been indicated in the Specifications and Schedule thereof.

24.2 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.

24.3 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.

24.4 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.

24.4.1 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. "

25.0 PENALTY FOR POOR PERFORMANCE:

25.1 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.

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

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

S. No.	Variation Factor	Loading for evaluation of shortfall in performance	Penalty for shortfall in performance
1	2	3	4
1	HEAT RATE:- Increase in Station heat rate in kCal / kWh under rated steam conditions at 100% TMCR	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

S. No.	Variation Factor	Loading for evaluation of shortfall in performance	Penalty for shortfall in performance
1	2	3	4
	after subtracting excitation power with following conditions: 1.Cycle make-up : 0% makeup 2.Cooling water inlet temperature of 33 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)		

S. No.	Variation Factor	Loading for evaluation of shortfall in performance	Penalty for shortfall in performance
1	2	3	4
2	Total auxiliary power consumption of all auxiliaries (*) at 1320 MW at after subtracting excitation power with following conditions: 1.Cycle make-up : 0% makeup 2.Cooling water inlet temperature of 33 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 % lowest quoted Auxiliary Power Consumption as base)	Rs.4,70,72,094 for every 0.01 % increase or part thereof from guaranteed value
3	Capitalization of losses of Transformers Iron losses Copper losses Cooler pump/fan losses (applicable for each transformer separately	Rs.3,49,880 /kW Rs.2,89,701 /kW Rs.2,79,904 / kW (considering lowest quoted values as base)	Rs.3,49,880 /kW Rs.2,89,701 /kW Rs.2,79,904 / kW Increase per kW or part thereof from guaranteed value

S. No.	Variation Factor	Loading for evaluation of shortfall in performance	Penalty for shortfall in performance
1	2	3	4
4	Deficiency in capacity of TG from 660 MW at Generator terminals with following conditions: 1.Cycle make-up : 0% makeup 2.Cooling water inlet temperature of 33 deg.C 3.TDBFP's in operation 4. Generator power factor of 0.85	--	Rs 10,55,668 for every kW or part thereof by which output determined by the tests fall short of guaranteed figure of 660 MW
5	Steam Generator Efficiency with following conditions: i) 100% TMCR ii) Firing design coal iii) On Gross Calorific value	--	Rs 9,33,52,000/- for every 0.1% (zero point one percent) shortfall in efficiency

S. No.	Variation Factor	Loading for evaluation of shortfall in performance	Penalty for shortfall in performance
1	2	3	4
	(GCV) basis iv) Rated excess air v) At 32 deg C DBT and 65% RH ambient air conditions.		

Note: All above loadings & penalties as mentioned in Col. 3 & 4 shall be calculated on pro-rata 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.

26.0 FINAL ACCEPTANCE:

26.1 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.

26.2 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.

26.3 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.

****

Annexure-H

GENERAL TECHNICAL REQUIREMENTS

1.00.00 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.

2.00.00 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.

3.00.00 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.

4.00.00 COMPLETENESS OF FACILITIES

4.01.00 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.

4.02.00 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.

5.00.00 CODES & STANDARDS

5.01.00 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.

5.02.00 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)

5.03.00 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, alongwith 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 else where in the specification together with the complete word to word translation of the standard that is normally not published in English.

5.04.00 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.

5.05.00 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.

5.06.00 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.

5.07.00 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.

6.00.00 EQUIPMENT FUNCTIONAL GUARANTEE

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

6.02.00 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.

6.03.00 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.

7.00.00 DESIGN OF FACILITIES/ MAINTENANCE & AVAILABILITY CONSIDERATIONS

7.01.00 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.

7.02.00 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.

8.00.00 DOCUMENTS, DATA AND DRAWINGS TO BE FURNISHED BY BIDDER

8.01.00 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/drgs. in accordance with the schedule of information as specified in Technical Specification and data sheets.

8.02.00 The number of copies/prints/CD-ROMs/manuals to be furnished for various types of documents is given in Annexure-I attached with Chapter 3.

8.03.00 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:

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/ 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 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.

i. Layouts, general arrangements, elevations and cross-sections drawings for all the equipment and facilities of the plant.

ii. Flow diagrams, Process & Instrumentation Diagrams alongwith 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 system wherever applicable & input and output data alongwith 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, 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, 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 alongwith the date vide which the submissions are made.

8.03.01 **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. 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.

Erection Manuals

The erection manuals shall be submitted atleast 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 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

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 maloperation 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.

8.03.02 **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

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.

8.03.03 **Project Completion Report**

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

8.03.04 **Drawings**

(a.) 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.

(b.) Final copies of the approved drawings shall be submitted on CD-ROM along with the requisite number of hard copies as per Annexure-I.

(c.) The completed plant documentation with equipment drawings, data sheets, P&ID, BOQ, schematics, logic diagrams, test reports and quality plan, etc. shall be furnished to Owner.

(d.) All documents/text information shall be in latest version of MS Office.

(e.) 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.

(f.) 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, notings, markings and writings on the drawing shall be in English. All the dimensions should be in metric units.

(g.) 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”.

(h.) Similarly, all the drawings/ documents submitted by the Bidder during detailed engineering stage shall be stamped “FOR APPROVAL” or “FOR INFORMATION” prior to submission.

(i.) 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.

(j.) 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.

(k.) 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.

(l.) 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.

(m.) 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.

(n.) 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.

(o.) 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.

(p.) 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.

(q.) 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.

8.04.00 **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 alongwith 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 monthwise.

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.

8.05.00 **Engineering Progress and Exception Report**

8.05.01 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.

8.05.02 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.

8.06.00 **Co-Ordination Meetings**

8.06.01 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.

8.06.02 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.

8.06.03 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.

8.06.04 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.

8.06.05 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.

8.07.00 **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.

8.08.00 **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.

8.09.00 **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.

8.10.00 **Lubricants, Servo Fluids and Chemicals**

8.10.01 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.

8.10.02 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.

8.11.00 **Lubrication**

8.11.01 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.

8.12.00 **Material of Construction**

8.12.01 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.

8.13.00 **Rating Plates, Name Plates & Labels**

8.13.01 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.

8.13.02 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.

8.13.03 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.

8.13.04 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.

8.13.05 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.

8.13.06 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.

8.13.07 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.

8.13.08 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.

8.13.09 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

8.14.00 **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 alongwith 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.

8.15.00 **Welding**

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

8.16.00 **Colour Code for all Equipment/ Pipings/ Pipe Services**

8.16.01 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.

8.17.00 **Protection and Preservative Shop Coating**

8.17.01 **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 nonmetallic 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 overground environment as the case may be.

8.17.02 **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 atleast 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 colors shall be as per manufacturer's standards, to be selected and specified by the Owner at a later date.

8.17.03 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.

8.17.04 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.

8.17.05 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.

8.17.06 Painting for Civil structures shall be done as per relevant part of technical specification.

9.00.00 QUALITY ASSURANCE PROGRAMME

9.01.00 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.

9.02.00 **General Requirements - Quality Assurance**

9.02.01 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.

9.02.02 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.

9.02.03 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.

9.02.04 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.

9.02.05 No material shall be despatched from the manufacturer's works before the same is accepted, subsequent to predespatch 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).

9.02.06 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.

9.02.07 The Bidder shall submit to the Owner Field Welding Schedule for field welding activities in the enclosed format No.: QS-01-QAI-P-02/F3. 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.

9.02.08 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.

9.02.09 All brazers, welders and welding operators employed on any part of the contract either in Bidder's/sub-Bidder's 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.

9.02.10 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.

9.02.11 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.

9.02.12 Unless otherwise proven and specifically agreed with the Owner, welding of dissimilar materials and high alloy materials shall be carried out at shop only.

9.02.13 No welding shall be carried out on cast iron components for repair.

9.02.14 All the heat treatment results shall be recorded on time temperature charts and verified with recommended regimes.

9.02.15 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.

9.02.16 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.

9.02.17 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. With in 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.

9.02.18 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.

9.02.19 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.

9.02.20 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.

9.02.21 For all spares and replacement items, the quality requirements as agreed for the main equipment supply shall be applicable.

9.02.22 Repair/rectification procedures to be adopted to make the job acceptable shall be subject to the approval of the Owner/ authorised representative.

9.02.23 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.

9.03.00 **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.

9.03.01 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.

9.03.02 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

9.03.03 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.

9.03.04 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 endeavor 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.

9.03.05 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.

9.04.00 **Project Manager's Supervision**

9.04.01 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.

9.04.02 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.

9.05.00 **Inspection, Testing And Inspection Certificates**

9.05.01 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.

9.05.02 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.

9.05.03 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.

9.05.04 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.

9.05.05 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.

9.05.06 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.

9.05.07 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.

9.05.08 To facilitate advance planning of inspection in addition to giving inspection notice as specified at clause no 9.05.03- 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.

9.05.09 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.

9.06.00 **Associated document for quality assurance programme:**

9.06.01 List of items requiring quality plan and sub supplier approval. (Annexure-III).

9.06.02 Status of items requiring Quality Plan and sub supplier approval. (Annexure-IV).

9.06.03 Field Welding Schedule (Annexure-V).

9.06.04 Manufacturing Quality Plan (Annexure-VI).

9.06.05 Field Quality Plan (Annexure-VII).

10.00.00 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 of 1st unit. The chart should contain :

(1.) Biodata 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.

10.02.00 **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 performacne 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 with holding the aforesaid permission.

10.03.00 **Guarantee Tests**

a) The final test as to prove the Functional 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 and completed as per schedule indicated in Vol I GCC

b) These tests shall be binding on both the parties of the Contract to determine compliance of the equipment with the functional guarantee.

c) 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.

d) Any special equipment, tools and tackles required for the successful completion of the Guarantee Tests shall be provided by the Bidder, free of cost.

e) The Guarantee tests and specific tests to be conducted on equipment have been brought out in detail elsewhere in the specification.

11.00.00 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 with held 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.

12.00.00 TRAINING OF OWNER'S PERSONNEL

12.01.00 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.

12.02.00 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.

12.03.00 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 reappropriate the training period between O&M and engineering depending upon the details of training module proposed by the Bidder.

12.04.00 Clause 12.02.00 & 12.03.00 shall be applicable for domestic bidders. For foreign bidders refer Vol I GCC.

12.05.00 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.

12.06.00 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.

12.07.00 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.

13.00.00 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.

14.00.00 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 intermittantly operating control valves, the noise level shall be within the limit of 85 dBA.

15.00.00 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 labeled 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.

16.00.00 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.

17.00.00 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.

17.01.00 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.

17.02.00 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.

17.03.00 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.

18.00.00 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.

19.00.00 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.

20.00.00 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

21.00.00 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.

22.00.00 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 developmental 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:

The environmental appraisal minutes are indicated below.

"Expert Appraisal Committee/MoEF has considered the project on 25th June 2012 and recommended issue of EC subject to TANGEDCO furnishing the cumulative impact on air, water and soil considering the Industries located 15km radius from the Ennore SEZ Project Site. The same is being furnished. Copy of Minutes of EAC is enclosed. Final Environmental Clearance yet to be received. 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/$Nm^{3.}$.
c) Bag filters have been proposed for the coal crushers to collect suspended particulate emission.
d) Dust suppression system has been proposed for the coal yard.
e) Equipment for continuous monitoring of Ambient Air Quality has been proposed.
f) On line / automatic continuous stack monitor has been proposed.
g) Port holes in the chimney and sampling facilities for the stack for the proposed Boiler, as per the Central Pollution Control Board guide lines.
h) 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 equipments / machines shall be erected over the Anti vibration foundations to reduce noise, vibration etc.,
i) The unit shall have separate energy meter for the operation of the Electro Static Precipitator, the Air pollution control equipment for the proposed Boiler.

j) Alternate power source will come into effect in case of power failure for the operation of Air Pollution Control measures

k) laboratory for analysis of gaseous / particulate emissions

l) 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.

m) 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.

n) Closed conveyors for coal transport and Bag filters in all the transfer points to control dust emission have been proposed

o) Dust suppression system / water sprinklers to keep the stock pile sufficiently wet all the time to avoid carryover of dust.

p) 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.

q) Burners have been designed for low NOx.

r) 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.

s) 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.

t) The unit shall have on line/automatic continuous stack monitors with computer recording arrangement for monitoring SPM, Sox and Nox in the boiler emission.

u) Sewage Treatment Plant & Effluent Treatment Plant has been proposed.

v) Natural draft cooling tower has been included in the specification.

w) 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.