



**MAHARASHTRA STATE POWER GENERATION CO.LTD.
(MAHAGENCO)**

1X660 MW BHUSAWAL TPS UNIT-6

**TECHNICAL SPECIFICATION
FOR
ELEVATORS**

SPECIFICATION NO.: PE-TS-415-502-A001



**BHARAT HEAVY ELECTRICALS LIMITED
(A Govt. of India Undertaking)
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NOIDA, U.P
INDIA**



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SPECIFICATION NO.: PE-TS-415-502-A001

SECTION:

SUB SECTION:

REV: 01

DATE: SEP'22

Page: 1 of 1

INDEX

SECTIONS	TITLE	Page No.
I	SPECIFIC TECHNICAL REQUIREMENT	
	SPECIFIC TECHNICAL REQUIREMENT (MECHANICAL)	1
	INTENT OF SPECIFICATIONS/ SCOPE OF ENQUIRY	2
	SCOPE OF SUPPLY & SERVICES	4
	GENERAL TECHNICAL REQUIREMENT	44
	FUNCTIONAL / PERFORMANCE / DEMONSTRATION GUARANTEE (AS APPLICABLE)	161
	QUALITY ASSURANCE	163
IA	ANNEXURE-I- LIST OF MAKES	168
	ANNEXURE-II- MANDATORY SPARE LIST	170
	ANNEXURE-III- LIST OF TOOLS & TACKLES	172
	ANNEXURE-IV- DRAWING / DOCUMENT SUBMISSION SCHEDULE	173
	ANNEXURE-V- MAIN DRAWING LIST WITH SCHEDULE OF SUBMISSION	174
	ANNEXURE-VI- CIVIL INPUT	183
IB	SPECIFIC TECHNICAL REQUIREMENT (ELECTRICAL)	185
IC	DATA SHEET-A	220
II	STANDARD TECHNICAL SPECIFICATION REQUIREMENT	
	STANDARD TECHNICAL SPECIFICATION REQUIREMENT (MECHANICAL)	228
IIA	ANNEXURE-VII- FORMAT FOR OPERATION AND MAINTENANCE MANUAL	234
	ANNEXURE-VIII- SITE STORAGE AND PRESERVATION	237
III	DOCUMENTS TO BE SUBMITTED BY THE BIDDER	
IIIA	LIST OF DOCUMENTS TO BE SUBMITTED WITH BID	252
IIIB	COMPLIANCE CUM CONFIRMATION CERTIFICATE	254
IIIC	ELECTRICAL LOAD LIST	257
IIID	PRE BID CLARIFICATION SCHEDULE	259



1X660 MW BHUSAWAL TPS UNIT-6
TECHNICAL SPECIFICATION
FOR
ELEVATORS

SPECIFICATION NO.: PE-TS-415-502-A001

SECTION: I

SUB SECTION: IA

REV: 01

DATE: SEP'22

Page: 1 of 1

SECTION – I

SPECIFIC TECHNICAL REQUIREMENTS

IA – Specific Technical Requirement (Mechanical)



1X660 MW BHUSAWAL TPS UNIT-6
TECHNICAL SPECIFICATION
FOR
ELEVATORS

SPECIFICATION NO.: PE-TS-415-502-A001

SECTION: I

SUB SECTION: IA

REV: 01

DATE: SEP'22

Page 1 of 14

SCOPE OF ENQUIRY / INTENT OF SPECIFICATION

- 1.1 This specification includes, but not limited to, design (i.e. preparation and submission of drawing /documents including "As Built" drawings and O&M manuals), engineering, material selection, manufacture, fabrication, assembly, inspection, testing at vendor's & sub-vendor's works, painting, maintenance tools & tackles (as applicable), fill of lubricants & consumables, mandatory spares (if applicable) along with spares for erection, startup and commissioning as required, forwarding, proper packing, shipment and delivery at site, unloading, handling, transportation & storage at site, in-site transportation, assembly, minor civil works, erection & commissioning, carrying out trial run at site, preparation of drawings in 3D (if applicable) and carrying out acceptance /performance guarantee/Functional/Demonstration tests at site (As applicable), training of customer/client O&M staff (if applicable) & final handing over to end customer in flawless condition for elevator package complete with all accessories for the total scope defined as per BHEL NIT & tender technical specification, amendment & agreements till placement of order for **1X660 MW BHUSAWAL TPS UNIT-6 in Maharashtra State** and necessary accessories including supply of mandatory spares, erection and commissioning spares, special maintenance tools and tackles etc.
- 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 of the **Elevators** and its accessories.
- 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 term 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 Section-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.



1X660 MW BHUSAWAL TPS UNIT-6
TECHNICAL SPECIFICATION
FOR
ELEVATORS

SPECIFICATION NO.: PE-TS-415-502-A001

SECTION: I

SUB SECTION: IA

REV: 01

DATE: SEP'22

Page 2 of 14

- 1.8 Deviations, if any, should be very clearly brought out clause by clause in the Deviation schedule enclosed with NIT; 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 Unless specified otherwise, all through the specification, the word contractor shall have same meaning as successful bidder /vendor and Customer/ Purchaser/Employer will mean BHEL and /or customer including their consultant as interpreted by BHEL in the relevant context.
- 1.11 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.
- 1.12 Site Visit before submission of offer.

Bidders shall make Site visit in order to familiarize themselves with existing condition of site before submitting the bid in order to make their offer complete. During detail engineering also, the successful bidder shall be responsible for the correctness of details wrt existing facility at site. Customer approval on any drawing having details of existing facility shall not be cited by the successful bidder a valid reason for any shortcoming in the work by them. BHEL shall also not entertain any cost implication for any lack of input data with regard to site during detail engineering.

- 1.13 Compliance cum confirmation certificate is to be accepted by bidder without any modification.

- 1.14 Other requirements

Successful bidder shall furnish detailed erection manual for each of the equipment supplied under this contract at least 3 months before the scheduled erection of the concerned equipment / component or along with supply of concerned equipment / component whichever is earlier.

Document approval by customer under Approval category or information category shall not absolve the vendor of their contractual obligations of completing the work as per specification requirement. Any deviation from specified requirement shall be reported by the vendor in writing and require written approval. Unless any change in specified requirement has been brought out by the vendor during detail engineering in writing while submitting the document to customer for approval, approved document (with implicit deviation) will not be cited as a reason for not following the specification requirement.

In case vendor submits revised drawing after approval of the corresponding drawing, any delay in approval of revised drawing shall be to vendor's account and shall not be used as a reason for extension in contract completion.



1X660 MW BHUSAWAL TPS UNIT-6
TECHNICAL SPECIFICATION
FOR
ELEVATORS

SPECIFICATION NO.: PE-TS-415-502-A001

SECTION: I

SUB SECTION: IA

REV: 01

DATE: SEP'22

Page 3 of 14

1.0 Introduction

Passenger elevator shall be provided for access to various operating floors / platforms in FGD Control building for 1X660 MW BHUSAWAL TPS UNIT-6 to facilitate movement of operating and maintenance personnel.

2.0 Scope of equipment supply and services

2.0.1 Design, Engineering, Manufacture, Inspection & Testing at manufacturer's works or at their sub-vendor's works, painting at manufacturer's or at their sub-vendor's works, duly packed for transportation to site, delivery to site, storage and handling at site, mandatory spares, Erection & Commissioning, carrying out trial run and Acceptance / functional tests at site & final painting of Passenger Elevators for 1X660 MW BHUSAWAL TPS UNIT-6 as listed below: -

Sl. No	Building	No of Lifts	Cap.	No of landings	Total Rise	Type	Rated Speed	Type of floor
1.	FGD Control Room Building	1 No.	680 Kg	-0.5M, 3.2M, 8.2M & 11.9M (Four (04) including Ground)	11.9M	Passenger Elevator Conventional Type.	1 m/s	MS chequered flooring base & framework with shock absorber

2.0.2 Elevator shall include but shall not be limited to the following: -

- 1) Elevator car with SS 304, 1.5 mm (min) thick sheet of hair line finish.
- 2) Guide rails for car and counterweights.
- 3) Counterweight.
- 4) DCEM brakes.
- 5) Spring buffer for car and counterweight.
- 6) Driving arrangement including motor, gear box, sheaves etc.
- 7) All electrical equipment including power cable, control cable, controller panel, safety devices including push buttons, limit switches, safety switches, indicators etc.
- 8) Isolating switch / MCBs.
- 9) Car doors, car ceiling and hoist way doors of SS 304, 1.5 MM (min) thick sheet of hair line finish.



1X660 MW BHUSAWAL TPS UNIT-6
TECHNICAL SPECIFICATION
FOR
ELEVATORS

SPECIFICATION NO.: PE-TS-415-502-A001

SECTION: I

SUB SECTION: IA

REV: 01

DATE: SEP'22

Page 4 of 14

- 10) Car operating panel, digital control, car position indicator at all floors, luminous hall buttons, auto door operating mechanism, alarm bell, car light & car fan.
- 11) Intercom connection through EPABX.
- 12) Ropes for hoisting.
- 13) Circuit breaker, switch fuse unit etc. in machine room for terminating the power supply cable (power supply cable provided by purchaser up to machine room level), other power/control and trailing cabling and equipment earthing.
- 14) Ladder in pits.
- 15) Emergency light with rechargeable battery.
- 16) All fixing materials require fixing rails, brackets, equipment including nuts and bolts.
- 17) Fascia plates (750 mm minimum) & sill angels.
- 18) Full length infra-red Curtain safety feature in door along with pressure limiter as an extra mechanical safety.
- 19) Any other equipment required to meet the requirement of local statutory and regulatory body and prevailing lift etc.
- 20) Car lighting, LED along with fittings for illumination level of 100 lux.
- 21) Elevator shaft, pit cable conduit fixtures, switches 3 pin or as required by bidder during erection / maintenance purpose at every 3 m.
- 22) Mirror for the car rear panel.
- 23) Floor announcement cum music system to be provided.
- 24) Maintenance tools and tackles along with un-priced list with the offer.
- 25) Three (03) sided SS- mirror finish hand railing at suitable height.
- 26) Minor civil work including grouting as well as foundation bolt grouting as required during installation of elevator.
- 27) Bidder shall include scaffoldings required in their scope of supply for erection.



1X660 MW BHUSAWAL TPS UNIT-6
TECHNICAL SPECIFICATION
FOR
ELEVATORS

SPECIFICATION NO.: PE-TS-415-502-A001

SECTION: I

SUB SECTION: IA

REV: 01

DATE: SEP'22

Page 5 of 14

- 28) Automatic rescue device with battery drive - Modern advanced electronic drive system of rescuing passenger trapped in an elevator shall be provided.
- 29) Emergency safety devices - The lift shall be provided with safety device attached to the lift car frame and sustaining the lift car up at governor tripping speed with full rated load in car.
- 30) All steel embedment for fixing landing doors / indicators etc. to the elevator well shaft and fascia plate shall be supplied by the bidder.
- 31) Guide rails complete with supporting brackets for the car and counter weights.
- 32) Elevator drive machines complete with electric motor, reduction gear unit, suspension ropes, buffers for the cars and the counter weights and other drives and control mechanism. All foundation anchor bolts, sleeves, anchoring steels and any item required to complete the job satisfactorily shall be provided by the bidder. The bidder shall also provide for the grouting of anchor bolts, sleeves, anchoring steel etc. and other anchorages.
- 33) Any other steel works as well as all other accessories / components not specified in the technical specification but necessary for making the elevator complete.
- 34) All minor building works including the supply of steel items, associated with installations of equipments in the machine room hoist way, hoist way door, frames and elevator pit, shall form part of bidder's scope of supply & service, BHEL / customer will provide the elevator well complete with foundation and brick walls around the lift well together with overhead machine room. The machine room will be provided with RCC floor slab with necessary pockets for anchor bolts and slots.
- 35) Dummy landing/s, as required in case travel between two consecutive landings is more than 11 m, shall be considered by bidder in his offer.
- 36) Any other requirement stipulated by state statutory body and prevailing local lift act requirement shall also to be included by bidder in their scope.
- 37) Bidder shall use latest IS 14665 (all parts) for outline dimensions of elevator & shaft, installation, operation, maintenance & inspection and testing and for elevator components design.
- 38) Mandatory Spares:

A complete unused and new set of Mandatory Spare parts shall be supplied. The items supplied shall be of the best quality and specially protected against rusting in tropical climate. The minimum requirement of mandatory spare parts is listed in Annexure –II section-IA of this specification.



1X660 MW BHUSAWAL TPS UNIT-6
TECHNICAL SPECIFICATION
FOR
ELEVATORS

SPECIFICATION NO.: PE-TS-415-502-A001

SECTION: I

SUB SECTION: IA

REV: 01

DATE: SEP'22

Page 6 of 14

- 39) Split Air conditioner (reputed make) of min 2 Ton capacity in the machine room which includes fans, air filter and accessories to prevent dust ingress in the machine room. However, successful bidder shall furnish the heat load calculation and capacity of air conditioner after considering all actual heat loads of elevator machine room during detail engineering stage for selection of final capacity of air conditioner.
- 40) 1/2 Kg CO₂/suitable type Fire extinguisher in bidder scope. Fixing arrangement shall be provided in Car accordingly.

NOTES:

- 1) Flooring for elevators shall be as per scope of supply ref cl. No. 2.0.1, Section IA of Technical Specification with MS steel frame suspended on the car frame with spring isolation element as indicated in the Data sheet.
- 2) Functional Guarantee test shall be carried out at site for over speed test and over load test, travel and hoist speed checks as per latest IS :14665. Bidder shall refer the requirement mentioned elsewhere in this specification.
- 3) Car, landing door and car ceiling shall be of SS-304 sheet with thickness (min) 1.5 mm.
- 4) Min dimensions as specified in applicable IS 14665 (all five parts) shall be considered / provided for lift shaft / pit / car / M/c Room. Safety requirement shall be as per latest IS 14665 (Relevant part). Bidder to refer the civil input drawings attached in the specification for different buildings.
- 5) Elevators pit for FGD Control Building shall be bare pit (i.e. pit without any RCC block / pedestal for buffer for CAR & CWT). Accordingly, MS structure & buffer required for elevator resting shall be provided by bidders.
- 6) All Equipment's / facilities needed for erection & commissioning shall be in bidder's scope.
- 7) Bidder to note that all LT Power cables (Fixed power and control cables etc), Trailing cable and instrument / signal cable for elevator shall be as per electrical specification. The circular trailing cables shall be either in accordance with IS 4289 Part-I (elastomer insulated) or IS 4289 Part II (PVC insulated). The flat type trailing cables if offered shall be in accordance with IEC 60227-6.
- 8) Make of various bought out items & QAP shall be subject to approval of BHEL / Customer during detail engineering stage without any commercial implication at contract stage.



1X660 MW BHUSAWAL TPS UNIT-6
TECHNICAL SPECIFICATION
FOR
ELEVATORS

SPECIFICATION NO.: PE-TS-415-502-A001

SECTION: I

SUB SECTION: IA

REV: 01

DATE: SEP'22

Page 7 of 14

- 9) Bidder shall supply erection and commissioning spares as required during E&C stage without any commercial implication.
- 10) Car frame and structure (guide brackets, supports, MS Structure for buffer car & counterweight, etc) shall be painted with epoxy based paint for all elevators.
- 11) Protection class for Elevator traction machine (elevator motor) shall be IP 55 & Protection class for door motor shall be IP 54 and main control panel shall be min IP 54 and elevator control shall be VVVF type. Push buttons, Car operating Panel, Landing Operating Panel, and other equipment shall be IP-54.
- 12) Factor of safety for rope shall be 12 (min).
- 13) All Landing door shall be fire rated for at min 2 hours or as per latest IS / as per the state statutory requirement whichever is more stringent.
- 14) Motor shall be S4 duty with insulation class F & temp rise limited to class B.
- 15) Bidder shall submit the following documents (min) for BHEL/customer approval during detail engineering stage: -
 - a) General arrangement of Elevator
 - b) Technical data sheet of elevator
 - c) Technical data sheet of motor along with power, control and trailing cable details
 - d) Wiring schematic diagram
 - e) MQP for elevator along with test procedure of various components.
- 16) Bidder shall comply to the quality requirements as enclosed with specification. Quality plan shall be submitted by the successful bidder for approval during detail engineering.
- 17) Bidder shall confirm that supply, installation and commissioning of elevator shall be completed within project schedule as indicated elsewhere from placement of intent / letter of intent.
- 18) Bidder shall be responsible for obtaining all necessary approval from statutory and regulatory body and lift inspector. However, purchaser will furnish required information time to time basis, if required.
- 19) Elevator shall be provided with AC VVVF type drive control system.
- 20) The local statutory clearance approval / permit board shall be placed on lift cabin.



1X660 MW BHUSAWAL TPS UNIT-6
TECHNICAL SPECIFICATION
FOR
ELEVATORS

SPECIFICATION NO.: PE-TS-415-502-A001

SECTION: I

SUB SECTION: IA

REV: 01

DATE: SEP'22

Page 8 of 14

3.0 SCOPE OF SERVICES

Scope of services will broadly include the following: -

- 1) Complete erection, testing and commissioning including all testing and commissioning materials, consumables and other tools and tackles required for erection of complete elevator package.
- 2) Painting of all equipments / items within the battery limit.
- 3) Unloading, storage, handling and transportation at site for all items of elevator.
- 4) Minor civil and structural works shall be carried out by the bidder if required at site for which no additional commercial implication shall be entertained by BHEL.
- 5) Necessary consumables and instrumentation as required for inspection and testing at works as well as at site including pre-commissioning activities, if any, shall be arranged by the successful bidder at their own cost.
- 6) Functional testing of complete elevator package.
- 7) Preparation of civil input drawings including elevator pit, shaft, machine room etc.
- 8) Preparation of all necessary drawings / data sheets / documents / calculations as required for obtaining necessary local administration permits / approval from statutory authority and make arrangements for inspection and tests required thereby for necessary approval on behalf of the customer. Fees as required for obtaining approval from statutory bodies shall also be included in the scope of work of the bidder.
- 9) Any other service as required for making the installation complete in all respect and satisfactory erection and commissioning of the system.
- 10) Relevant requirements as per GCC, ECC & SCC.

4.0 Exclusion

- 1) Complete civil works for hoist way, machine room, pit complete with the side enclosure (brick / RCC), interconnecting platform (if any) and monorail beam.
- 2) Electric hoist with travelling trolley of 3T capacity to facilitate handling of equipment in the machine room.
- 3) Power supply cable (AC 415 V, 3 Ph, 50 Hz) up to machine room level & earthing at one point in machine room. Further cabling (all cables including power, control, earthing and instrumentation as per tender specification) shall be provided by the bidder.
- 4) Electrical exclusion as per separate scope sheet attached in the specification.



1X660 MW BHUSAWAL TPS UNIT-6
TECHNICAL SPECIFICATION
FOR
ELEVATORS

SPECIFICATION NO.: PE-TS-415-502-A001

SECTION: I

SUB SECTION: IA

REV: 01

DATE: SEP'22

Page 9 of 14

5.0 Operation

Elevator shall have provision to meet followings operational requirements: -

- a) Selective simplex / duplex collective (As applicable), automatic operation with or without attendant through illuminated push button station located inside the lift car.
- b) Door operating shall be automatic door operation and electronic door protection system for opening / closing of car and landing doors.
- c) Bidder shall provide car operating panel with luminous buttons, car position indication in car (both visual and audio) combined with direction arrows, overload warning indicator, battery operated alarm bell and emergency light and fan and hands free speaker telephone set with suitable battery, charger and controls.
- d) Bidder shall provide emergency indicator to indicate the location of elevator in case of elevator being stuck up between the floors through automatic flashers/ display (both audio and visual as out of service).
- e) Suitable arrangement shall be provided to intimate unit control room during emergency in the form of audio visual alarm.
- f) Two (2) push buttons, one for upward movement and the other for downward movement at each intermediate landing and one (1) push button at each terminal landing shall be provided in order to call the car. Digital hall position indicator at all floors, tell lights at all floors shall also be provided by the bidder.
- g) All fixtures shall be in stainless steel face plates.
- h) Push buttons shall be fixed in the car for holding the door open for any length of time required.
- i) All other safety / protection / operation interlocks as required by IS – 14665 (all parts) latest edition.

6.0 Electric Motor

The driving motors shall conform to IS 325 and suitable for variable voltage variable frequency (VVVF) application. All motors shall be squirrel cage induction type, suitable for operation at 415 V (+/- 10% variation), 3 Phase, 4 wire, 50 Hz (+5% to -5% variation) supply. Motors shall be provided with class F insulation & temp rise limited to class 130 (B).

7.0 Controls



1X660 MW BHUSAWAL TPS UNIT-6
TECHNICAL SPECIFICATION
FOR
ELEVATORS

SPECIFICATION NO.: PE-TS-415-502-A001

SECTION: I

SUB SECTION: IA

REV: 01

DATE: SEP'22

Page 10 of 14

The control shall be variable voltage and variable frequency type and shall provide smooth and constant acceleration and retardation under all conditions of operation. Suitable control panels shall be provided in the machine room. The lift will be automatically stopped by upper and lower terminal switches. The elevators will have an emergency stop switch, limit switches and other safety devices according to statutory rule.

8.0 Cables and wirings

- a) All the cables except trailing cables shall be as per IS 1554-1 or IS 7098-1. The PVC outer sheath of these cables shall be flame retardant, low smoke (FRLS) type.
- b) Trailing cable:
The circular trailing cables shall be either in accordance with IS 4289 Part-I (elastomer insulated) or IS 4289 Part II (PVC insulated). The flat type trailing cables if offered shall be in accordance with IEC 60227-6.

All wiring/ cabling between the equipments in the lift machine room and that between the machine room and equipments in the lift well and at the landings shall be wired in HDP conduits/ galvanized steel conduits to be supplied by the elevator supplier. Alternatively, armoured cables may be used. However, bidder shall refer detailed specification of cables / wirings elsewhere in the specification.

9.0 Earthing

The elevator structures and all equipment including metal conduits shall be effectively earthed with earth conductors provided in the machine room as per IS 3043.

10.0 DESIGN CRITERIA

The design criteria and equipment specification will be as follows:

- i) The rated speed will be 1.0 m/ sec (for all elevators). Proper allowance will be made for impact and wear and the factor of safety for rope shall not be less than twelve (12) or as per IS 14665 (all parts). The suspension wire rope will conform to IS-14665 or approved equivalent international standard.
- ii) The lift will be providing with automatic travelling device which will take care of overrun and under run of the car and rope stretch that the car floor is within 6.0 mm from the landing level at the floors while in operation.



1X660 MW BHUSAWAL TPS UNIT-6
TECHNICAL SPECIFICATION
FOR
ELEVATORS

SPECIFICATION NO.: PE-TS-415-502-A001

SECTION: I

SUB SECTION: IA

REV: 01

DATE: SEP'22

Page 11 of 14

- iii) The lift will be equipped with upper and lower terminal switches arranged to stop the car automatically within the limit of the top car clearance and bottom run-by, from the any normal operating speed.
- iv) The elevator car shall be provided with SS-304 sheet fabricated, hair line finish (including landing doors of the car), flooring as indicated at scope of supply ref cl. No. 2.0.1, Section IA of Technical Specification, concealed fan and indirect lighting, emergency lighting, intercom, car position and travel direction indicator.
- v) As the elevator is to provide service in a power station, it is necessary for the equipment to be specially coated (painted). This will include application of anticorrosive paint as applicable. The electrical equipment will have enclosures meeting degree of protection as covered under electrical specification.
- vi) The elevator as a whole will comply with relevant Indian Standard i.e. 14665 or approved international standard. The outline dimensions of electric lift shall meet the requirements of IS 14665 (latest edition).
- vii) The elevator shall be provided with AC VVVF type drive control system.
- viii) Doors are automatic, center opening with emergency key opening at all landings, horizontal sliding type for car as well as for hoist way. Trap door shall be provided by civil contractor as per IS-14665 (latest edition).

11.0 Other Technical Requirements

- 1) Characteristic curves of all motors shall be furnished by the bidder during detail engineering stage for approval showing torque, speed, current and voltage.
- 2) Electrical requirements shall be as per requirements enclosed elsewhere in the specification.
- 3) Complete elevator installation shall be in accordance with the requirements of concerned approving authority.
- 4) In case of any contradictory requirement amongst the various clauses within the specification and clarifications not having been sought by the bidders, the most stringent requirement as per interpretation of BHEL's engineer shall be final and binding on the bidder for which BHEL will not entertain any commercial implication.
- 5) Data sheets of various items shall be prepared by the bidder and shall be submitted to BHEL / customer / consultant for approval after placement of order and any changes required by BHEL / customer / consultant for the same shall be incorporated and adhered by the bidder without any commercial implications.



1X660 MW BHUSAWAL TPS UNIT-6
TECHNICAL SPECIFICATION
FOR
ELEVATORS

SPECIFICATION NO.: PE-TS-415-502-A001

SECTION: I

SUB SECTION: IA

REV: 01

DATE: SEP'22

Page 12 of 14

- 6) GA drawing indicating design data, material of construction etc. shall be prepared by the bidder during detail engineering stage based on specification / contractual requirement and there should be no commercial implication on account of finalization of the drawings and documents.
- 7) O & M manual shall be furnished to BHEL / customer / consultant for approval during detailed engineering stage.
- 8) Field quality plan / quality assurance plan / check list shall be prepared by the bidder for each item of elevator and shall be submitted to BHEL / customer / consultant for approval after placement of order and any changes required by BHEL / customer / consultant for the same shall be incorporated and adhered by the bidder without any commercial implications.
- 9) 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.
- 10) 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.
- 11) Bidder to note that all the drawings shall be prepared in Auto Cad version and required number of hardcopies and soft copies shall be furnished to BHEL during detailed engineering stage. Exact requirement of number of hard copies and soft copies of all drawings and documents as required by BHEL / customer / consultant shall be informed to the successful bidder during detail engineering stage and bidder to furnish the same for which no additional cost shall be entertained.
- 12) 21 days' time is required by BHEL to offer their comments on the drawings and documents being submitted by the bidder (during detailed engineering stage in the event of L.O.I being placed) from the date of receipt.
- 13) 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 and bidder shall be indicated with different legend or in the form of note.



1X660 MW BHUSAWAL TPS UNIT-6
TECHNICAL SPECIFICATION
FOR
ELEVATORS

SPECIFICATION NO.: PE-TS-415-502-A001

SECTION: I

SUB SECTION: IA

REV: 01

DATE: SEP'22

Page 13 of 14

- b) Recommended locations of earthing pads.
 - c) Civil loads along with detailed calculation of loading.
 - d) Details of pockets / cut outs as required for anchor bolts.
- 14) Bidder to depute competent designer (s) at BHEL's office during detailed engineering stage to discuss drawings and other technical documents as and when required by BHEL.
- 15) 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.
- 16) 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. However, BHEL's drawing / document numbering scheme shall be furnished to the successful bidder after the placement of L.O.I.
 - 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.
- 17) Bidder to assess the capability of their sub-vendors in terms of preparation of drawings, calculations, documents, quality assurance, supply of material etc. as per project schedule before placing the order on them. No deviations shall be entertained.
- 18) Bidder to furnish prices and unit price of each item of proposed system as per BHEL's price format only along with the final price bid.
- 19) Bidder shall check that specifications of all the items are available in the NIT specification. However, in the event of absence of specification for any item, bidder will approach BHEL to furnish the specification of missing items and new specification will be adhered by the bidder for which no commercial implication shall be entertained by BHEL.



1X660 MW BHUSAWAL TPS UNIT-6
TECHNICAL SPECIFICATION
FOR
ELEVATORS

SPECIFICATION NO.: PE-TS-415-502-A001

SECTION: I

SUB SECTION: IA


REV: 01

DATE: SEP'22

Page 14 of 14


- 20) Bar chart, list of drawings and documents including data sheet, manual calculation, quality plan, field quality plan, PG test / functional 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.
- 21) “Technical deviations” shall be clearly indicated in bidder’s offer in prescribed format only.
- 22) All drawings shall be prepared as per BHEL's title block and bear BHEL's drawing No. and customer / consultant’s drawing no; which will be forwarded to the successful bidder during detail engineering stage.

The following customer specifications shall be applicable for supply ref cl. No. 2.0.1, Section IA of Technical Specification also.

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: III-I
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 1 /B
REV: R0	MATERIAL HANDLING AND MISCELLANEOUS EQUIPMENTS	Page 53 of 328

VOLUME III-I
SECTION – 1/B
ELEVATORS


CONSULTANT : PROCON ENGINEERS

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: III-I
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 1 /B
REV: R0	MATERIAL HANDLING AND MISCELLANEOUS EQUIPMENTS	Page 55 of 328

CONTENTS

<u>CLAUSE NO.</u>	<u>DESCRIPTION</u>
1.0	INTRODUCTION
2.0	CODES AND STANDARDS
3.0	SCOPE OF WORK
4.0	OPERATION AND CONTROL PHILOSOPHY
5.0	PERFORMANCE REQUIREMENT
6.0	DESIGN AND CONSTRUCTION
DATA SHEET- A	GOODS CUM PASSENGER ELEVATORS FOR STEAM GENERATOR & MILL AREA
DATA SHEET- A	GOODS CUM PASSENGER ELEVATORS FOR POWER HOUSE BUILDING
DATA SHEET- A	PASSENGER ELEVATORS FOR SERVICE BUILDING
DATA SHEET- A	GOODS CUM PASSENGER ELEVATORS FOR CRUSHER HOUSE BUILDING
DATA SHEET- A	GOODS CUM PASSENGER ELEVATORS FOR STACK
ANNEXURE-I	DEGREE OF PROTECTION FOR VARIOUS EQUIPMENT

CONSULTANT : PROCON ENGINEERS

 MAHAGENCO <small>Maharashtra State Power Generation Co. Ltd.</small>	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: III-I
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 1 /B
REV: R0	MATERIAL HANDLING AND MISCELLANEOUS EQUIPMENTS	Page 57 of 328

1.0 INTRODUCTION

1.1 This section covers the Elevators which will be required for various power plant activities during erection and maintenance purposes and for running of 1 X660 MW Power plant.

2.0 CODES AND STANDARDS

2.1 The design, manufacture and testing of the elevators and components thereof shall, unless specifically stated otherwise, conform to the following specific codes and standards as applicable, including its latest amendments subsequent to the date of publication as mentioned below :

2.1.1 IS-14665 : Electric Traction Lifts.

2.1.2 IS-2365 : Specification for Steel Wire Suspension Ropes for Lifts and Hoists.

2.1.3 State Elevator and Escalator Act.

2.1.4 State Elevator and Escalator Rules.

2.1.5 Indian Electricity Act.

2.1.6 Indian Electricity Rules.


2.1.7 Any other acts/standards as applicable as mentioned in Volume II of this specification.

2.2 The installation of the elevators under this section shall be carried out in conformity with the local acts/rules with latest amendments which are in force, including the rules of fire lifts, as shall be required by the Bidder to obtain license for the elevator from concerned authorities.


2.3 Technical requirements of the elevators shall be as given in Attachments enclosed to this section.

2.4 Minimum acceptable degree of protections for various equipment are presented in Annexure-I.


CONSULTANT : PROCON ENGINEERS

 MAHAGENCO <small>Maharashtra State Power Generation Co. Ltd.</small>	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: III-I
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 1 /B
REV: R0	MATERIAL HANDLING AND MISCELLANEOUS EQUIPMENTS	Page 58 of 328
2.5	<p>In case of any contradiction between the above standards and attachments, the stipulation in the attachments shall prevail and shall be binding on the Contractor.</p> <p>Stipulations in this section shall prevail in case of any contradiction between this section and other relevant sections/ volumes.</p>	
3.0	<p><u>SCOPE OF WORK</u></p> <p>The scope of works under this section shall be as below. Items though not specifically mentioned but needed to make the installation of the elevators complete in all respects are also to be furnished by the Contractor.</p>	
3.1	<p><u>SCOPE OF SUPPLY</u></p>	
3.1.1	<p>The scope of supply of Elevators is as follows.</p>	
	<p>(a) Two (2) goods cum passenger elevator complete with all accessories shall be furnished for steam generator unit at the suitable location so that the same can be used for the movement of man and materials for the inspection and maintenance of the various steam generator parts. The lift shall be connected to the steam generator structural steel and as such part of the lift load shall be transferred to the steam generator columns. The Bidder shall ensure that the steam generator columns are designed to take the loads due to the lift shafts and connecting platforms at different elevations. The preferable location of elevators is indicated on the layout drawings.</p> <p>Both the elevators shall also have access to mill area, to feeder floor to bunker tripper area.</p>	
	<p>(b) One (1) goods cum passenger elevator complete with all accessories to be located in the B-C Bay. These shall be connected to the turbine house/B-C Bay structural steelwork and as such part of their loads may be transferred to the main T-G house/B-C Bay structural steelwork columns. The Bidder shall ensure that these columns are designed to take care of the loads due to elevator shafts and connecting platforms at different elevations. Elevator shall be located</p>	


CONSULTANT : PROCON ENGINEERS

 MAHAGENCO <small>Maharashtra State Power Generation Co. Ltd.</small>	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: III-I
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 1 /B
REV: R0	MATERIAL HANDLING AND MISCELLANEOUS EQUIPMENTS	Page 59 of 328
<p>between B-C Bay columns on relevant layout drawings (enclosed to this specification) to serve various floor elevations.</p> <p>(c) Two (2) passenger elevators of 884 kg capacity each complete with all accessories for Service Building</p> <p>(d) One (1) goods cum passenger elevator complete with all accessories shall be provided for crusher house.</p> <p>(e) One (1) Rack & Pinion type Stack elevator complete with all accessories shall be in the chimney at the suitable location.</p> <p>3.1.2 The above elevators shall be provided with the following accessories as applicable,</p> <p>(a) Elevator car complete with door, door hangers and tracks, push button station, operating panel, car position indicators, illumination fittings, fan fittings and other required accessories. Lighting point and plug point shall be provided over the elevator car roof for the purpose of maintenance work.</p> <p>(b) Mast, guide rails, guide rollers and structural steels, terminal buffers and guide rail lubrication device.</p> <p>(c) Complete drive machinery and accessories e.g. electric motor, gear box etc., electrical and control equipment including cables & isolating switch starting from Owner's power supply point including Power & lighting distribution boards.</p> <p>(d) Necessary brakes and limit switches, safety locks for car and landing door & all other protective devices including switch, fuse, starters etc. All rigid/flexible conduit, ferrules, lugs, glands, terminal blocks, cable clamps, general purpose flexible/Trailing cables automatic, levelling device and other miscellaneous items, as required.</p> <p>(e) Hoist-way doors and push button station with digital lights at each landing.</p>		


CONSULTANT : PROCON ENGINEERS

 MAHAGENCO <small>Maharashtra State Power Generation Co. Ltd.</small>	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: III-I
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 1 /B
REV: R0	MATERIAL HANDLING AND MISCELLANEOUS EQUIPMENTS	Page 60 of 328
<p>(f) Provision of Battery back up for emergency lighting inside the Elevator car and alarm, in case of power failure.</p> <p>(g) Facility of intercom in the Elevator car with necessary wiring for connection from car to a terminal box adjacent to bottom most landing and to the Plant Control room as well as Maintenance Engineer room.</p> <p>(h) Any other fittings and accessories required for safe and efficient operation of the equipment.</p> <p>(i) Supply of first fill of lubricants, painting etc.</p> <p>(j) All required foundation plates and/or base plates, anchor bolts lifting lugs, eye bolts etc. wherever necessary.</p> <p>(k) Firemen’s switch as per rules of fire lifts.</p> <p>(l) Earth leakage circuit breaker.</p> <p>3.1.3 Supply of one set of special tools and tackle for maintenance of the elevator.</p> <p>3.1.4 Supply of Mandatory Spares as required</p> <p>3.1.5 List of Recommended Spare Parts for five (5) years operation of the elevator along with various drawings, data, test reports and certificates, erection manual, operation and maintenance manual etc. as required by the applicable clauses of this Specification. Earth leakage circuit breaker shall be provided by the bidder on the lift installation as per requirements of inspector of lifts.</p> <p>3.2 <u>SCOPE OF SERVICES</u></p> <p>3.2.1 The complete service of unloading, in-plant transportation, handling, storage, erection, final check-up, testing and commissioning including arranging of all labour, supervision, erection tools, equipment and consumables and final paintings.</p>		


CONSULTANT : PROCON ENGINEERS

 MAHAGENCO <small>Maharashtra State Power Generation Co. Ltd.</small>	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: III-I
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 1 /B
REV: R0	MATERIAL HANDLING AND MISCELLANEOUS EQUIPMENTS	Page 61 of 328
3.2.2	For erection and complete commissioning of the elevator, all necessary insulated wiring in conduits or tubing together with necessary fittings, metal boxes, troughs and ducts, trailing cables, suitable earthing of machines and elevator etc. shall be supplied and installed by the Contractor in conformity with the Indian Electricity Rules or IS Codes as applicable.	
3.2.3	Conducting all necessary tests at manufacturer's works and also after completion of erection specified hereinafter to full satisfaction of Owner or the concerned local Government Inspectorate/Authority. All test gadgets, instruments; test weights etc. necessary for conducting test at site shall be arranged by the Contractor. All test certificate/load test certificate should be acceptable to the concerned local Government Inspectorate/Authority.	
3.2.4	Complete maintenance training to personnel for independent maintenance of elevator.	
4.0	<u>OPERATION AND CONTROL PHILOSOPHY</u>	
4.1	The elevators, while starting from any level, shall start at rated speed but during stopping, elevator shall slow down to lower speed when the car reaches around one meter of the selected landing floor and stop when reached the landing floor. The control system shall be microprocessor based with AC variable voltage and variable frequency drive.	
4.2	The elevators specified herein shall be operated in selective collective automatic mode of operation as defined in IS-14665. Operation and Control features of this elevator shall be as follows :	
4.2.1	One push button for each of the all landings shall be provided inside the car. Two push buttons, one "Up" button and one "down" button, shall be provided at each of the intermediate landings. The uppermost and lower most landings shall be provided with one push button.	
4.2.2	Calls initiated by the car or landing push buttons shall be registered and stored until answered, irrespective of the car being in motion or any landing door being open.	
4.3	The car shall answer calls in one direction of travel, that is all "UP" landing calls shall be answered when the car travels in the upward direction and	


CONSULTANT : PROCON ENGINEERS

 MAHAGENCO <small>Maharashtra State Power Generation Co. Ltd</small>	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: III-I
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 1 /B
REV: R0	MATERIAL HANDLING AND MISCELLANEOUS EQUIPMENTS	Page 62 of 328
<p>"DOWN" landing calls shall be answered when the car travels in the downward direction, except in the case of uppermost or lowermost calls which shall be answered as soon as they are reached irrespective of the direction of travel of the car.</p> <p>4.4 Besides the automatic mode of operations described above, the elevators shall have provision for attendant operation also, transfer of operation between automatic control and attendant operation being achieved by a key operated switch in the car.</p> <p>4.5 The operation of the elevators shall be through push button station located inside the lift car. Suitable interlock shall be provided so that the elevators shall not move unless the door are properly closed. The landing doors of any floor shall not open when the elevator is not on that floor. Push buttons shall be fixed in one car for holding the doors open for any length of time required.</p> <p>4.6 Both the elevators for steam generator unit shall have doors opening towards boiler and mill side respectively. Logics will be developed for opening the doors for common landing at boiler & mill side and identified single side opening (Boiler or Mill). Total number of push button for landings will be decided accordingly. The naming for these buttons would indicate 'Boiler' or 'MILL' along with floor number as the case may be i.e. if door is opening towards boiler or mill side. For common landing, push button would indicate only floor number.</p> <p>4.7 The elevators under this section shall be treated as "Fire Lifts". "Fire Switch" in a glass front box shall be provided adjacent to the lifts at the entrance level, the function of which is to enable the fire authority to take over the complete control of the lifts, when required. When the switch is on, landing call points shall become inoperative and the lift shall be on the car control only. When the switch is off, the lift shall return to normal working.</p> <p>4.8 <u>STACK ELEVATOR</u></p> <p>4.8.1 The elevators, while starting from any level, shall start at rated speed and shall slow down to lower speed on actuation of the landing limit switches.</p>		

CONSULTANT : PROCON ENGINEERS

 MAHAGENCO <small>Maharashtra State Power Generation Co. Ltd.</small>	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: III-I
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 1 /B
REV: R0	MATERIAL HANDLING AND MISCELLANEOUS EQUIPMENTS	Page 63 of 328
<p>4.8.2 The elevator shall be operated by a push button system consisting of buttons for “UP” and “DOWN” and a button for “next level”.</p> <p>4.8.3 Door shall be manually closed and opened but shall open only when the Cage reaches the landing.</p> <p>4.8.4 The elevator shall be operated in a Semi-automatic mode.</p> <p>4.9 The elevator after a predetermined speed shall actuate the over-speed brake Governor. The governor pawl due to the centrifugal action shall actuate the incorporated mechanism and stop the downward motion</p> <p>5.0 <u>PERFORMANCE REQUIREMENT</u></p> <p>Performance requirement for the elevators shall be guided by the Attachments/ Annexure enclosed with this Volume.</p> <p>6.0 <u>DESIGN AND CONSTRUCTION</u></p> <p>6.1 <u>LOAD AND SPEED</u></p> <p>6.1.1 The elevator shall lift a pay load against rated load or its nearest as per manufacturer's present standard in addition to the weight of the car and its accessories and shall travel at a rated speed as indicated in the applicable Annexure.</p> <p>6.1.2 All mechanical and electrical operating devices and trailing cable shall be designed for outdoor operation with dusty and high humidity condition and shall operate equally well in any ambient temp as per project data.</p> <p>6.1.3 Elevator shall be capable of operating from the bottom most landing to the top most landing with intermediate stops at all landings, as stipulated.</p> <p>6.2 <u>CAR/CAGE</u></p> <p>6.2.1 Size</p> <p>The dimensions of the lift car/cage and car/cage platform and door shall be as per IS-14665.</p>		

CONSULTANT : PROCON ENGINEERS

 MAHAGENCO <small>Maharashtra State Power Generation Co. Ltd</small>	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: III-I
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 1 /B
REV: R0	MATERIAL HANDLING AND MISCELLANEOUS EQUIPMENTS	Page 64 of 328

6.2.2 Car/Cage Frame

Lift car/cage shall be carried in a complete frame of steel which shall be sufficiently rigid to withstand the operation of the safety gear without permanent deformation to the car/cage frame.

At least four renewable guide shoes or guide shoes with renewable linings or set of roller guides shall be provided, two at the top and two at the bottom of the car/cage frame.

6.2.3 Car Enclosure

Car/cage shall be enclosed on all sides by means of car/cage body and door. The sides of the car/cage shall be lined with heavy gauge sheet steel panels properly braced and reinforced. The enclosure shall be flush on the inside and securely fastened to the platform. Car/cage inside enclosure shall be of stainless steel plate of grade SS:304 of bright finish.


Car/cage of the elevators specified herein shall be equipped with decorated Stainless Steel hand rails on three sides. Car/cage shall be equipped with fan with grills and suitable lighting complete with decorative fittings. The light shall be left burning during the whole time the lift is available for use.

Necessary provisions shall be made for adequate ventilation of the car/cage. Ventilation openings shall be provided in the enclosure walls as per requirement of IS-14665. To permit switching off the power supply to the lift without switching off the fan and light, a separate switch shall be provided for fan and light.

The enclosure of lift car shall withstand the maximum possible thrust applied normally at any point, excepting any vision panel, without permanent deformation. Glass shall not be used in the lift car except for the following purposes:

- (a) As covers for certificate.
- (b) For lighting fixtures.
- (c) For appliances used in connection with the operation of the car.

CONSULTANT : PROCON ENGINEERS

 MAHAGENCO <small>Maharashtra State Power Generation Co. Ltd.</small>	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: III-I
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 1 /B
REV: R0	MATERIAL HANDLING AND MISCELLANEOUS EQUIPMENTS	Page 65 of 328

(d) For vision panels and mirrors.

Suitable arrangement to secure isolating cushion between car/cage and the steel car/cage-frame shall be provided.

Telephone or paging facility shall be installed in the lift car/cage. The Bidder shall provide suitable cabinets in the car/cage to house hand sets. The Bidder shall also provide necessary wiring for telephone or paging connection from the car/cage to a terminal box adjacent to the lift well. The car/cage panels shall be given final painting. The type and colour of the final painting shall be subject to the approval of the Owner/Consultant.

6.2.4 Platform

Car Platform

It shall be constructed of structural steel shapes securely fastened together with one layer of wood flooring. Floor of the elevators shall be as specified in Datasheet. The platform construction shall be designed based on rated loads evenly distributed.

Since, the car levelling devices will be used; substantial aprons of sufficient depth shall be fitted to the car floor to ensure that no space is permitted between the threshold and the landing while the car is being levelled to a floor.

~~Cage Platform~~


~~Cage platform shall be constructed of Aluminium chequered plate and attached to the cage frame.~~

6.2.5 Roof

Car Roof

Car roof shall be covered with sheet metal. The construction of roof shall be strong enough to be capable of supporting at least two persons.

CONSULTANT : PROCON ENGINEERS

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: III-I
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 1 /B
REV: R0	MATERIAL HANDLING AND MISCELLANEOUS EQUIPMENTS	Page 66 of 328

A three pin plug socket with switch of industrial type having adequate capacity for a hand lamp shall be fitted on top of the lift car for use by persons working thereon during maintenance.

Cage Roof

Cage roof shall be strong enough to withstand the weight of the equipment and shall be provided with an escape hatch electrically interlocked with hoist control system. Cage roof shall be provided with Tubular steel handrail to protect the equipment.

6.3 DOORS

6.3.1 Type of door

6.3.1.1 Car

Type of car doors shall be as indicated in the Annexure and made of steel provided with necessary rubber buffers. Doors for fire lifts shall have fire resistance for minimum one hour. The final paints on car door shall be same as that of the car.

6.3.1.2 Cage


Cage door shall be made of MS Angle & Perforated sheet with mechanical and electrical interlocking to prevent cage door from being operated until the cage door and landing level enclosure doors are fully closed.

Cage door shall be bi-parting/sliding type and hoist-way door shall be swinging type.


6.3.2 Door Hangers and Tracks

Hangers and tracks for car/cage door and each hoist way door shall be furnished. Suitable material shall be used to minimise noise. Ball bearing, rollers or equal arrangement shall be provided to take upward thrust of the doors. Suitable devices shall be furnished for transmitting motion from one door panel to the other.

CONSULTANT : PROCON ENGINEERS

 MAHAGENCO <small>Maharashtra State Power Generation Co. Ltd</small>	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: III-I
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 1 /B
REV: R0	MATERIAL HANDLING AND MISCELLANEOUS EQUIPMENTS	Page 67 of 328
<p>All required materials for landing entrance e.g. extruded aluminium or equivalent sills, strut angles, headers etc. shall be provided.</p> <p>6.3.3 Door Operators</p> <p>The door operation shall have power opening and power closing. Necessary electric type door operators shall be furnished. The car door shall mechanically connect and shall move simultaneously during opening and closing. The necessary door cushioning devices shall be furnished.</p> <p>The car door shall open automatically when the car stops at a landing. Should the electric power fail, the door operator shall be so designed that doors can be manually opened from within the car. Necessary door locking devices shall be furnished. Necessary switches shall be furnished in the elevator machine room to control the operation of the door.</p> <p>Cage doors shall be manually operated.</p> <p>6.4 <u>CAR SELF-LEVELING DEVICE</u></p> <p>The elevator shall be equipped with automatic self-levelling devices, to bring the car to the floor landings. These self-levelling devices shall correct for over travel and rope stretch.</p> <p>6.5 <u>OPERATING PANEL</u></p> <p>6.5.1 Car</p> <p>In the car, an operating panel containing push buttons, numbered to elevations of the landings served, two-position key-operated switch, marked to indicate, "With Attendant" and "without Attendant" shall be furnished. Emergency stop switch; a buzzer; an emergency call button connected to a bell shall be provided by the Contractor at the bottom most landing of each elevator and also in the control room with an indication to serve as an emergency signal. A non-stop button; push button, or switches for lighting and fan; up push button, down push button, one door open push button and other push buttons, switches, emergency light, telephone hand set etc, as required shall be provided.</p>		

CONSULTANT : PROCON ENGINEERS

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: III-I
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 1 /B
REV: R0	MATERIAL HANDLING AND MISCELLANEOUS EQUIPMENTS	Page 68 of 328

The emergency call button mentioned above shall have two sets of potential free contact and shall be suitably wired upto the control panel in the machine room for indication or annunciation at unit Control Room.

When the key switch in the car operating panel is set at the attendant position, the attendant shall have full control of the operation of the elevator. Any hoistway calls which are then registered shall cause a buzzer to sound in the car operating panel and the appropriate indicator light to illuminate.

~~6.5.2 Cage~~

~~Operating panel shall be furnished in the cage containing push buttons, one button for emergency stop, one button for hooter, one for “up” direction and one for “down” direction, button for next landing and switch for light and fan. One auxiliary panel shall be furnished and mounted on the ground level enclosure. Panel shall be equipped with a main “ON-OFF” selector switch.~~


6.6 CAR POSITION INDICATOR IN CAR

For the elevators, signal indication above the entrance in the car shall be provided by the appropriate numeral (which shall be the elevation of the respective floor) being illuminated when the car is passing the corresponding floor. The indication shall remain illuminated when the car stops at a floor. Up and down direction, jewel lights shall also be provided.


6.7 PUSH BUTTON STATION AND CALL-REGISTERED LIGHTS FOR CAR

6.7.1 The elevators shall be equipped with a push button station consisting of a single up or down push button at terminal landings and up and down push buttons at each intermediate landing including call registered lights (up or down call registered lights at each terminal landing and both up and down call-registered lights at all intermediate landings). These shall illuminate when the corresponding button is pressed to indicate that the call is registered and shall remain illuminated until the call is answered. An illuminated car position indicator shall be provided above the entrance of all the landings.


CONSULTANT : PROCON ENGINEERS

 MAHAGENCO <small>Maharashtra State Power Generation Co. Ltd.</small>	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: III-I
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 1 /B
REV: R0	MATERIAL HANDLING AND MISCELLANEOUS EQUIPMENTS	Page 69 of 328
6.8	The word "Fire Lift" shall be conspicuously displayed in radium paint on the lift landing doors of the elevators designated as fire lifts.	
6.9	<p><u>SAFETY SHOE DEVICE ON CAR DOOR</u></p> <p>Safety shoe device shall be furnished on car doors. Safety shoe shall extend the full height on the closing edges of the car doors. The arrangement shall be such that should the safety shoe touch a person or an object while the door is closing, the car door shall return to the open position. The doors shall remain open until the expiration of a pre-determined interval and then close automatically.</p>	
6.10	<u>EMERGENCY EXIT</u>	
6.10.1	<p>Car</p> <p>Elevator car shall be provided with an emergency exit of adequate dimensions. The location of the emergency exit shall be at the top of the car.</p>	
6.10.2	<p>Cage</p> <p>Cage roof shall be provided with an escape hatch electrically interlocked with hoist control system.</p>	
6.11	<u>BUFFERS</u>	
6.11.1	<p>Car</p> <p>The terminal buffers shall be furnished for stopping the car and the counter-weight at the extreme ends of travel. All structural steel members required to install the buffer shall be supplied under this section.</p>	
6.11.2	Cage	
	<p>Sufficient number of buffers of spring-loaded type shall be fitted below the cage. The buffers shall be capable of stopping the Cab without permanent damage or deformation to themselves or any other part of the equipment.</p>	


CONSULTANT : PROCON ENGINEERS

 MAHAGENCO <small>Maharashtra State Power Generation Co. Ltd.</small>	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: III-I
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 1 /B
REV: R0	MATERIAL HANDLING AND MISCELLANEOUS EQUIPMENTS	Page 70 of 328
6.12	<u>LOAD PLATE FOR CAR/CAGE</u>	
	A load plate giving the rated payload of the elevator shall be fitted in the car/cage in a conspicuous position. The rated load shall be given in kilograms and in number of passengers.	
6.13	<u>COUNTER-WEIGHTS AND COUNTER-WEIGHT FRAMES</u>	
	Counter-weight sections shall be mounted on structural metal frames so designed to retain the weights securely in its place. Counter-weight frames shall be guided on each guide rail by upper and lower guiding members attached to the frame.	
	A substantial metal counter-weight guard of required length shall be provided at the bottom.	
6.14	<u>GUIDES FOR CAR AND COUNTER-WEIGHT</u>	
	Car and counter-weight guides shall be of rigid steel and shall be continuous throughout the entire length and shall be provided with adequate steel bracings and stiffeners. The necessary lubrication device for guide rail shall be provided.	
6.15	<u>LIMIT SWITCHES</u>	
6.15.1	Car	
	Normal terminal limit switches to slowdown and stop the car automatically, shall be provided at terminal landings and final limit switches shall be furnished to automatically cut-off the power and apply the brake, should the car travel beyond the terminal landings.	
6.15.2	Cage	
	Double limit switches shall be provided to ensure cage stops at top and bottom position. An ultimate 3-position over-travel limit switch which will cut off power and control supply in the event of over travel shall be provided. It should also be possible to manually turn the switch to off position.	


CONSULTANT : PROCON ENGINEERS

 MAHAGENCO <small>Maharashtra State Power Generation Co. Ltd.</small>	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: III-I
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 1 /B
REV: R0	MATERIAL HANDLING AND MISCELLANEOUS EQUIPMENTS	Page 71 of 328
6.16	<u>CONTROLLER & TRACTION MACHINE</u>	
6.16.1	The design ambient temperature shall be taken as 50° C. The insulation of motor shall be class "F" and temperature rise shall be limited to Class "B".	
6.16.2	Complete details of controller and traction machine shall be furnished by the Bidder.	
6.16.3	The elevators being offered with Microprocessor based AC variable voltage and variable frequency type control, motor and generator shall be mounted on independent shafts coupled with proper coupling.	
6.16.4	Number of starts per hour for which motor shall be capable, shall be selected by the Bidder for the given applications and in accordance with applicable code/standard.	
6.16.5	Necessary brakes shall be provided in the traction machine.	
6.16.6	Protective relays shall be furnished on the controller to protect against phase reversal, low voltage and phase failure. Overload and other protective relays shall also be furnished for traction motor. Single phasing preventor shall also be provided to protect motor while running at no-load.	
6.17	<u>LIGHTING</u>	
6.17.1	Car	
	Lighting shall be provided in machine room, lift well and lift cabin.	
	Two (2) 40 W LED LIGHTING Fluorescent tubes with fittings shall be provided at each of the machine room and the lift cabin whereas incandescent G.L.S. lamp shall be provided in the lift well. Emergency lighting shall be provided in all the places including Cabin. All necessary wires, conduits, junction boxes shall be supplied. In the lift cabin, indirect illumination type fitting shall be provided.	


CONSULTANT : PROCON ENGINEERS

 MAHAGENCO <small>Maharashtra State Power Generation Co. Ltd</small>	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: III-I
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 1 /B
REV: R0	MATERIAL HANDLING AND MISCELLANEOUS EQUIPMENTS	Page 72 of 328
<p>6.17.2 <u>Cage</u></p> <p>Cage shall be equipped with a 220 volts A.C. 20W fluorescent lamp fixtures as interior light. Emergency lighting shall be provided in the mast structure, landings, cage etc. and other places, as required. Other lighting arrangement shall be provided as per consultation.</p> <p>6.18 <u>GROUNDING</u></p> <p>Grounding of all enclosure of live parts shall be done as per applicable Electricity Rules with latest amendment. All structures of the lift shall also be grounded.</p> <p>6.19 <u>OTHER ELECTRICAL ITEMS</u></p> <p>6.19.1 <u>Car</u></p> <p>Special care and precaution shall be taken regarding the handing of lift trailing cable loops between the points of suspension. A 1/4" sling rope should be used for tying up. Conductor and insulation of these trailing cables shall be flexible with suitable reinforcement provided.</p> <p>All control cables shall have crimped type lugs and wire numbering ferrules at either ends.</p> <p>6.19.2 <u>Cage</u></p> <p>Trailing cables shall be specifically designed for the specific service and shall conform to IS: 4289.</p> <p>A Cable trolley is to be provided to wind and rewind the cable and to keep the cable in tension and suitable cable guides are to be provided to prevent damage to cable.</p> <p>6.20 <u>SAFETY GEARS FOR CAR</u></p> <p>The elevator shall be provided with one or more safety devices capable of stopping and sustaining the lift car with full rated load in the car at governor tripping speed.</p>		


CONSULTANT : PROCON ENGINEERS

 MAHAGENCO <small>Maharashtra State Power Generation Co. Ltd</small>	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: III-I
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 1 /B
REV: R0	MATERIAL HANDLING AND MISCELLANEOUS EQUIPMENTS	Page 73 of 328
<p>When the safety gear is applied, decrease in the tension of the governor rope or motion of the car in the descending direction shall not release the safety gear.</p> <p>6.21 <u>SAFETY DEVICE FOR CAGE</u></p> <p>An over speed governor in constant mesh with the rack by means of a pinion shall be provided to protect the cage against over speed during the cab downward motion. Safety hooks shall be provided for positive engagement of rack and pinion.</p> <p>Hooter shall be provided as an emergency alarm and should have a provision to be actuated from the inside of the cage.</p> <p>6.22 <u>OVER SPEED GOVERNOR</u></p> <p>The elevator shall be equipped with over speed governor device which operates to apply the safety gear in the event of the speed of the car in the descending direction exceeding a predetermined limit.</p> <p>6.23 <u>BRAKES</u></p> <p>6.23.1 Car</p> <p>The machine shall be provided with direct current spring set, solenoid released, double shoe brakes of sufficient capacity to stop the car at any position with the design load. These brakes shall be designed in such a way to apply automatically in the event of power supply failure. The details of equipment offered shall be indicated in the offer.</p> <p>6.23.2 Cage</p> <p>The drive unit shall incorporate an electromagnetic disc type brake and an external manual brake release to be provided in the Cage. The brake should be such that during power failure the brakes should be applied automatically to prevent any further movement of the cage and to be released only when power is restored.</p>		

CONSULTANT : PROCON ENGINEERS

 MAHAGENCO <small>Maharashtra State Power Generation Co. Ltd</small>	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: III-I
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 1 /B
REV: R0	MATERIAL HANDLING AND MISCELLANEOUS EQUIPMENTS	Page 74 of 328
6.24	<u>ROPE</u>	
	<p>Suitable traction steel hoist ropes of the sizes and number to ensure proper wearing qualities shall be supplied. As a minimum, the number of ropes shall comply with the factor of safety requirements of Indian Standard for lift/elevator. The full details of ropes, the maker's name, trade name, breaking strength, designed factor of safety of all ropes shall be submitted with the bid.</p>	
6.25	<u>BRINGING OF STRANDED LIFT</u>	
	<p>During prolonged power failure, arrangement shall be provided, so that, after cutting out supply point manually through hand wheel, the lift stranded between two floors may be brought to the nearer floor.</p> <p>Alternative offer for bringing the stranded lift to the nearer floor by automatic winding arrangements may be given and price quoted separately.</p>	
6.26	<u>LIFTING ATTACHMENTS</u>	
	<p>All equipment/component shall be equipped with suitable lifting attachments, e.g. lifting lugs, eye bolts etc. to facilitate erection and maintenance.</p>	
6.27	<u>LANDING & GROUND ENCLOSURE FOR CAGE</u>	
	<p>A three-sided enclosure with one access door shall be provided for the bottom most landing. At each platform landing above the bottom most landing, a one sided enclosure with access door shall be provided.</p> <p>The space underneath the bottom most landing enclosure shall be enclosed. A staircase shall be provided for access to the cage.</p>	
6.28	<u>DRIVE UNIT FOR CAGE</u>	
	<p>Drive unit shall consist of two (2) AC squirrel cage induction motors, reduction gear, drive pinion, over-speed governor and brakes. The drive</p>	

CONSULTANT : PROCON ENGINEERS

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: III-I
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 1 /B
REV: R0	MATERIAL HANDLING AND MISCELLANEOUS EQUIPMENTS	Page 75 of 328

~~unit shall be mounted on the cage itself. Drive shall be rated for intermittent duty with starting (S4) as per IS 8151(Latest Edition).~~

~~6.29 MAST~~

~~Mast shall be provided in Sections of approximately 1.5 m length welded together to form a frame work to which rack is bolted. Mast shall be securely anchored to the structure at suitable distances. Mast shall be made of MS – ERW tubes as per IS 1239 & prestressed components as IS 2062 Gr A.~~

6.30 POWER AND CONTROL CABINETS

6.30.1 The lift shall be raised/lowered using momentary contact push button.


6.30.2 A reversing Combination motor starter shall be provided with a three phase thermal overload relay for motor protection. The control circuit in the elevator shall have miniature circuit breakers for isolation.

6.30.3 Control Cabinets shall be sheet steel enclosed, dust, weather and vermin-proof. Degree of protection of the control cabinet shall be IP-52 as per IS: 2147.


6.31 ELECTRIC MOTORS

Motor in general shall be in line with specification of motor in general electrical specification and shall be designed for operation at the required speed; 415 volts, 3 phase, 50 Hz and shall be suitable for full voltage starting, S4 duty class with CDF of 25% and maximum number of 180 starts per hour. Motor and driven equipment shall be direct coupled or belted as required, and mounted on a common base plate with coupling or belt guard.


CONSULTANT : PROCON ENGINEERS

 MAHAGENCO <small>Maharashtra State Power Generation Co. Ltd.</small>	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: III-I
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 1 /B
REV: R0	MATERIAL HANDLING AND MISCELLANEOUS EQUIPMENTS	Page 81 of 328
<p><u>GOODS CUM PASSENGER ELEVATORS FOR POWER HOUSE BUILDING</u></p> <p><u>DATASHEET- A</u></p>		
SR. NO.	ITEM	
1.0	Type of service	Goods -cum- passenger type.
2.0	Rated load on elevator	2000 Kg (minimum)
3.0	Rated speed of lift	1 m/s
4.0	Total travel	From Ground Floor to Machine/Deaerator Floor.
5.0	Minimum number of floors to be served	To be decided by Bidder and shall be subjected to Owner's approval.
6.0	Method of control	ACVVVF control with automatic level adjustment.
7.0	Position of machine room	Directly above the lift shaft.
8.0	Car enclosure construction, design and finish of car	SS-304, bright finish, 1.5 mm thick sheet of hairline finish.
9.0	Size of platform and car entrance	As per IS-14665
10.0	Car and landing door	Centre opening, automatic horizontal sliding type.
11.0	Flooring	MS chequered flooring base & framework with shock absorber.
12.0	Operation	Automatic simplex collective with and without attendant with provision for locking control in "Auto" or "Attendant" position. Provide Key type lock switch.

CONSULTANT : PROCON ENGINEERS

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: III-I
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 1 /B
REV: R0	MATERIAL HANDLING AND MISCELLANEOUS EQUIPMENTS	Page 82 of 328
SR. NO.	ITEM	
13.0	Signal	Car position indicator in car and at all floors, telltale lights at all floors, battery operated alarm bell and emergency light with suitable battery, battery charger and controls. Provide Remote alarm and Public address system.
14.0	Method of operation of car and landing doors	Power operated with automatic door opening and closing device.
15.0	Lighting & fan	One cabin fan, two recessed fluorescent lamp fittings.
16.0	Power Supply	
	(a) Power	415 Volts, 3 phase, 50 c/s, 3 wire system
	(b) Lighting & fan inside the car	240 volts, 1 phase, 50 c/s, 4 wire system
17.0	Other requirements	(a) Plant Telephone Communication system shall extend up to the elevator car through EPABX in M/C room.
		(b) Suitable arrangement shall provide to intimate unit control room during emergency in the form of audio-visual alarm.
		(c) Automatic rescue device.
		(d) If floor-to-floor distance between 2 floors is more than 10m, dummy landing should provide in between these 2 floors. Dummy landing should have the connectivity with the staircase.
		(e) Hall Lantern & gong with scrolling indicator.
		(f) Scrolling indicator in car.


CONSULTANT : PROCON ENGINEERS

 MAHAGENCO <small>Maharashtra State Power Generation Co. Ltd.</small>	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: III-I
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 1 /B
REV: R0	MATERIAL HANDLING AND MISCELLANEOUS EQUIPMENTS	Page 83 of 328


SR. NO.	ITEM	
		(g) CFL lighting inside car
		(h) Overload sensing device & warning indicator.
		(i) Announcement of floor level.

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CONSULTANT : PROCON ENGINEERS

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: III-I
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 1 /B
REV: R0	MATERIAL HANDLING AND MISCELLANEOUS EQUIPMENTS	Page 85 of 328
<p><u>PASSENGER ELEVATORS FOR SERVICE BUILDING</u></p> <p><u>DATASHEET- A</u></p>		
SR. NO.	ITEM	
1.0	Type of service	Passenger type.
2.0	Rated load on elevator	884 Kg
3.0	Rated speed of lift	1 m/s
4.0	Total travel	From Ground Floor to Fourth Floor of Service Building
5.0	Minimum number of floors to be served	At all floors and shall be subjected to Owner's approval.
6.0	Method of control	ACVVVF control with automatic level adjustment.
7.0	Position of machine room	Directly above the lift shaft.
8.0	Car enclosure construction, design and finish of car	SS-304, bright finish, 1.5 mm thick sheet of hairline finish.
9.0	Size of platform and car entrance	As per IS-14665
10.0	Car and landing door	Centre opening, automatic horizontal sliding type.
11.0	Flooring	MS chequered flooring base & framework with shock absorber.
12.0	Operation	Automatic simplex collective with and without attendant with provision for locking control in "Auto" or "Attendant" position. Provide Key type lock switch.

CONSULTANT : PROCON ENGINEERS

 MAHAGENCO <small>Maharashtra State Power Generation Co. Ltd.</small>	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: III-I
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 1 /B
REV: R0	MATERIAL HANDLING AND MISCELLANEOUS EQUIPMENTS	Page 86 of 328
SR. NO.	ITEM	
13.0	Signal	Car position indicator in car and at all floors, telltale lights at all floors, battery operated alarm bell and emergency light with suitable battery, battery charger and controls. Provide Remote alarm and Public address system.
14.0	Method of operation of car and landing doors	Power operated with automatic door opening and closing device.
15.0	Lighting & fan	One cabin fan, two recessed fluorescent lamp fittings.
16.0	Power Supply	
	(c) Power	415 Volts, 3 phase, 50 c/s, 3 wire system
	(d) Lighting & fan inside the car	240 volts, 1 phase, 50 c/s, 4 wire system
17.0	Other requirements	(a) Plant Telephone Communication system shall extend up to the elevator car through EPABX in M/C room.
		(b) Suitable arrangement shall be provided to intimate unit control room during emergency in the form of audio-visual alarm.
		(c) Automatic rescue device.
		(d) Hall Lantern & gong with scrolling indicator.
		(e) Scrolling indicator in car.
		(f) CFL lighting inside car
		(g) Overload sensing device & warning indicator.
		(h) Announcement of floor level.


CONSULTANT : PROCON ENGINEERS

 MAHAGENCO <small>Maharashtra State Power Generation Co. Ltd.</small>	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: III-I
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 1 /B
REV: R0	MATERIAL HANDLING AND MISCELLANEOUS EQUIPMENTS	Page 88 of 328

NOTE:

1. The design, manufacture, inspection and testing of Elevator shall comply with all currently applicable statutes, regulations and safety codes in the locality where the equipment is to be installed.
2. Elevator shall be complete with all accessories like hoist, mast and guide rails, machinery buffers etc.
3. The design of the Elevator shall be such that the elevator operation is safe at all times.

CONSULTANT : PROCON ENGINEERS


 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: III-I
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 1 /B
REV: R0	MATERIAL HANDLING AND MISCELLANEOUS EQUIPMENTS	Page 91 of 328

ANNEXURE-I

DEGREE OF PROTECTION FOR VARIOUS EQUIPMENT


SR. NO.	EQUIPMENT	DEGREE OF PROTECTION
1.0	A.C. Motor	IP 55
2.0	Controller	IP 54
3.0	Hall Buttons Fixture	IP 54
4.0	Hall Position Indicator	IP 54
5.0	Car Operating Panel	IP 54
6.0	Car Position Indicator	IP 54
7.0	Safety Operating Switch (car)	IP 54
8.0	Junction/Inspection Box	IP 54
9.0	Lighting Fixture (for shaft & M/C room)	
(a)	Tube Light	IP 21
(b)	Bulk Head	IP 21
10.0	Brake	IP 21
11.0	Indoor Equipment (car light & fan junction box)	IP 54

CONSULTANT : PROCON ENGINEERS

 MAHAGENCO <small>Maharashtra State Power Generation Co. Ltd.</small>	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 4
REV: R0	MASTER SPECIFICATIONS	Page 61 of 555

VOLUME II
SECTION – 4
GENERAL TECHNICAL REQUIREMENTS


CONSULTANT : PROCON ENGINEERS

 MAHAGENCO <small>Maharashtra State Power Generation Co. Ltd.</small>	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 4
REV: R0	MASTER SPECIFICATIONS	Page 63 of 555


CONTENTS

<u>CLAUSE NO.</u>	<u>DESCRIPTION</u>
1.0	CODES AND STANDARDS
2.0	RESPONSIBILITY FOR DESIGN
3.0	NAME PLATES (RATING PLATES)
4.0	SAFETY AND SECURITY
5.0	GUARDS
6.0	LOCATION AND LAYOUT REQUIREMENTS
7.0	OPERATION, MAINTENANCE AND AVAILABILITY CONSIDERATIONS
8.0	MATERIALS
9.0	LUBRICATION
10.0	LUBRICANTS & CONTROL FLUIDS
11.0	OPERATION AND MAINTENANCE
12.0	PLANT LIFE AND MODE OF OPERATION
13.0	PACKAGING & MARKING
14.0	PROTECTION
15.0	PAINTING
16.0	COLOUR CO-ORDINATION AND FINISH
17.0	ENVIRONMENT PROTECTION AND NOISE LEVEL REQUIREMENT
18.0	INSPECTION AND TESTING
19.0	TRAINING OF OWNER'S PERSONNEL

CONSULTANT : PROCON ENGINEERS

 MAHAGENCO <small>Maharashtra State Power Generation Co. Ltd.</small>	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 4
REV: R0	MASTER SPECIFICATIONS	Page 64 of 555
<u>CLAUSE NO.</u>	<u>DESCRIPTION</u>	
ANNEXURE–A	LIST OF STANDARDS FOR REFERENCE	
ANNEXURE–B	CRITERIA FOR LAYOUT	
ANNEXURE–C	BUILDING/ EQUIPMENT LAYOUT REQUIREMENTS	
ANNEXURE–D	SPECIFIC LAYOUT CONSIDERATIONS	


CONSULTANT : PROCON ENGINEERS

 MAHAGENCO <small>Maharashtra State Power Generation Co. Ltd.</small>	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 4
REV: R0	MASTER SPECIFICATIONS	Page 65 of 555


1.0 CODES AND STANDARDS

- 1.1 Except where otherwise specified, the Plant shall comply with the appropriate Indian Standard or an agreed internationally accepted Standard Specification as listed in the Annexure to this Section and mentioned in detailed Specifications, each incorporating the latest revisions at the time of tendering. Where no internationally accepted standard is applicable, the Bidder shall give all particulars and details as necessary; to enable the Owner to identify all of the Plant in the same detail as would be possible, had there been a Standard Specification.
- 1.2 Where the Bidder proposes alternative codes or standards, he shall include in his tender one copy (in English) of each Standard Specification to which materials offered shall comply. In such case, the adopted alternative standard shall be equivalent or superior to the standards mentioned in the specification.
- 1.3 Wherever specified or required, the Plant shall conform to various statutory regulations such as Indian Boiler Regulations, Indian Electricity Rules, Indian Explosives Act, Factories Act etc. Wherever required, approval for the plant supplied under the specification from statutory authorities shall be the responsibility of the Bidder.
- 1.4 In the event of any conflict between the codes and standards referred above and the requirements of this specification, the requirements, which are more stringent, shall govern.
- 1.5 In case of any change of code, standards and regulations between the date of purchase order and the date the Contractor proceeds with manufacturing, the Owner shall have the option to incorporate the changed requirements. It shall be the responsibility of the Contractor to advise Owner of the resulting effect.
- 1.6 Successful Bidder shall furnish two (2) sets of latest of national/international codes and standards to owner.


CONSULTANT : PROCON ENGINEERS

 MAHAGENCO <small>Maharashtra State Power Generation Co. Ltd.</small>	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 4
REV: R0	MASTER SPECIFICATIONS	Page 66 of 555
<p>2.0 <u>RESPONSIBILITY FOR DESIGN</u></p> <p>2.1 The Bidder shall assume full responsibility for the design of the whole and every part of the Plant, whether or not the design work was undertaken specifically in relation to the Contract and whether or not the Contractor was directly involved in the design work.</p> <p>2.2 Notwithstanding the Owner's wish to receive the benefits of new, advanced and improved technologies, a prime requirement is that all the systems and components proposed shall have been already adequately developed and shall have demonstrated good reliability under similar or more arduous conditions elsewhere, at least for continuous two (2) years in two different power stations.</p> <p>2.3 The successful bidder shall have to carry out surge analysis and other transient condition studies as may be necessary and as required by the Owner as per proven engineering practice.</p> <p>2.4 The Bid shall include a detailed discussion on the development status of and the reasons for any changes made in proposed systems or components for the Plant, as compared with similar items previously supplied in other installations cited by the bidder as reference plants.</p> <p>2.5 The Bidder may also make alternate offers, provided such offers are superior in his opinion in which case adequate technical information, operating feed back etc are to be enclosed with the offer, to enable the Owner to assess the superiority and reliability of the alternatives offered. In case of each alternative offer, its implications on the performance, guaranteed efficiency, auxiliary power consumptions etc shall be clearly brought out to the Owner to make an overall assessment. In any case, the base offer shall necessarily be in line with the specifications i.e. Base offer shall be as per the technical specifications and the same will be considered for techno-commercial evaluation.</p> <p>3.0 <u>NAME PLATES (RATING PLATES)</u></p> <p>3.1 Instruction plates, nameplates or labels shall be permanently attached to each main and auxiliary item of Plant in a conspicuous position. These plates shall</p>		


CONSULTANT : PROCON ENGINEERS

 MAHAGENCO <small>Maharashtra State Power Generation Co. Ltd.</small>	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 4
REV: R0	MASTER SPECIFICATIONS	Page 67 of 555
<p>be engraved with the identifying name, type and manufacturers serial number, together with the loading conditions under which the item of Plant has been designed to operate.</p> <p>3.2 Items such as valves etc which are subject to hand operation, shall be provided with nameplates so constructed as to remain clearly legible throughout the life of the plant giving due consideration to the difficult climatic conditions to be encountered. Nameplates shall be securely mounted where they will not be obscured in service by insulation, cladding, actuators or other equipment. Direction of flow is also to be engraved.</p> <p>3.3 All trade nameplates and labels shall be in English language. All measurements shall be in M.K.S. Units.</p> <p>3.4 The size and location of nameplates shall be subject to Approval of the Engineer.</p> <p>4.0 <u>SAFETY AND SECURITY</u></p> <p>4.1 The design shall incorporate every reasonable precaution and provision for the safety of all personnel and for the safety and security of all persons and property. The design shall comply with all appropriate statutory regulations relating to safety. All structures and equipment shall be designed and constructed to withstand every foreseeable static and dynamic loading condition, including loading under earthquake conditions, with an adequate margin of safety.</p> <p>4.2 Ready and safe access with clear head room shall be provided to all parts of the plant for operation, inspection, cleaning and maintenance.</p> <p>4.3 Escape routes and clear ways shall be provided to allow speedy evacuation of the plant in the event of fire or explosion and the plant layout shall allow for ease of access to all parts of the Works by rescue and fire fighting teams. The plant layout shall be designed to localize and minimise the effects of any fire or explosion. The recommendations of NFPA, OSHA and TAC etc as necessary shall be followed in all respects.</p> <p>4.4 The use of corrosive, explosive, toxic or otherwise hazardous materials shall be kept to a minimum during construction and the design of the plant shall</p>		


CONSULTANT : PROCON ENGINEERS

 MAHAGENCO <small>Maharashtra State Power Generation Co. Ltd.</small>	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 4
REV: R0	MASTER SPECIFICATIONS	Page 68 of 555
<p>minimise the requirement for such materials during operation and maintenance. Where such materials must be used, all necessary precautions shall be taken in the design, manufacture and layout of equipment to minimise the resulting hazard and all equipment necessary for the protection and first-aid treatment of personnel in the event of accidents shall be provided. Particular attention is drawn to avoid the use of materials containing asbestos in any form.</p> <p>5.0 <u>GUARDS</u></p> <p>5.1 Effective guards and fences must be provided to prevent injury to operators through accident or malpractice.</p> <p>5.2 Mesh guards which allow visual inspection of equipment with the guard in place are generally preferable. The guards shall be constructed of mesh attached to a rigid framework of mild steel rod, tube, or angle and the whole galvanised to prevent loss of strength by rusting or corrosion. The guards shall be designed to facilitate removal and replacement during maintenance.</p> <p>5.3 All drive belts, couplings, gears, sharp metallic edges and chains must be safely guarded. Any lubricating nipple requiring attention during normal running must be positioned where they can be reached without moving the guards.</p> <p>5.4 Guards for couplings and rotating shafts shall be in accordance with BS 5304-1975 or similar approved standard. All rotating shafts and parts of shafts must be covered.</p> <p>5.5 Suitable fencing shall be provided to enclose all openings or doorways used for the hoisting and lowering of machinery etc. This fencing must be securely fixed but quickly detachable when required. A secure hand hold must be provided on each side of the opening or doorway.</p> <p>6.0 <u>LOCATION AND LAYOUT REQUIREMENTS</u></p> <p>The majority of plant and equipment shall all be of indoor installation. Layout should facilitate access for operation-maintenance and inspection of any one or more equipment / components at a time without disturbing the operation or installation of rest of the plant. Further, Bidder should comply with the criteria</p>		


CONSULTANT : PROCON ENGINEERS

 MAHAGENCO <small>Maharashtra State Power Generation Co. Ltd.</small>	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 4
REV: R0	MASTER SPECIFICATIONS	Page 69 of 555
<p>given under the various equipment and system specifications as well as those stipulated in Annexure-B attached to this section.</p> <p>Enclosed General Layout and other tender layout drawings show the location of major installations and auxiliary buildings. The Bidder shall try to retain these locations as far as practicable. The layout of equipment within the powerhouse as shown in the tender drawings is indicative. The Bidder may, subject to Owner's approval alter the same to suit the space requirement of the equipment offered.</p> <p>Bidder may give as an alternative his own preferred layout clearly indicating the advantages and other implications, if any. Such alternative will not be considered for evaluating the bid, but may be considered with the successful Bidder if Owner / Engineer find the proposal more attractive in terms of techno-economic consideration.</p> <p>6.1 While developing the layout of buildings the following criteria shall be given effect:</p> <p>6.1.1 The minimum width of clear access corridors around equipment shall be one (1) meter.</p> <p>6.1.2 Each building shall have an identified vacant space for equipment unloading and maintenance and preferably a separate bay altogether in buildings housing heavy equipment. Provision for handling equipment by monorail hoist and/or overhead crane shall be made as specified.</p> <p>6.1.3 The plinth level with respect to the existing grade level shall be as indicated elsewhere in this specification. Finished Grade Level (FGL) above Mean Sea Level (MSL) for the plant area, CHP area and for PWS area inside plant to be developed. Mean sea level for the plant is 210 m.</p> <p>6.1.4 The minimum clear height available between two consecutive floor slabs shall not be less than five (5) meters. A clear head room of two (2) meters shall be maintained between the floor and any overhead piping/cables or other obstruction. Adequate provision for natural ventilation and illumination shall be made as per good engineering practices.</p>		


CONSULTANT : PROCON ENGINEERS

 MAHAGENCO <small>Maharashtra State Power Generation Co. Ltd.</small>	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 4
REV: R0	MASTER SPECIFICATIONS	Page 70 of 555
6.1.5	<p>There shall be at least two (2) main access doors, one on either side of each building, of which one shall be minimum three (3) meters wide with rolling shutters for equipment entry. For multistoried buildings, at least two (2) regular staircases diagonally opposite to each other shall be provided connecting all the floors and roof. These minimum requirements shall be augmented as required depending on the floor area, statutory requirements and TAC recommendations.</p>	
6.1.6	<p>All buildings shall have provision for toilet and associated effluent discharge system together with facility for drinking water. The criteria for ventilation, fire protection and illumination of building spaces specified elsewhere in this specification shall be complied with.</p>	
6.1.7	<p>All rail/road crossings for pipe/cable racks shall be done with minimum Seven (7) meters headroom from top of rail/road to bottom of rack. Similarly, top cover over underground pipes/cables shall be minimum one (1) meter.</p>	
6.1.8	<p>Cubicle for operating personnel shall be located at safe place near the equipment.</p>	
6.1.9	<p>Cable racks / pipe racks shall have hand railings in walkways on both sides at appropriate heights.</p>	
6.1.10	<p>Concept of various mechanical and electrical equipment location and building dimensions (including column-row spacing) as shown in Plot Plan/Floor Plan drawing are to be adhered as far as possible. Any departure from this suggestive layout is primarily not recommended.</p>	
6.2	<p>The following requirements for equipment layout shall be complied with:</p>	
6.2.1	<p>The regular basement floor is not acceptable in Boiler & Mill Bunker bay building. Further, local pits/trenches shall be avoided as far as possible.</p>	
6.2.2	<p>Mills shall be located by the side of Boiler. The width of Mill/Bunker building shall be 12.5 M and the length of the same shall be 10.5 M per Mill. A clear walkway of 1200 mm (min) shall be ensured between the mills/ its foundation/ mill reject vessel edge and inner face of mill bay column. Raw coal bunker shall be circular in shape unless otherwise approved.</p>	


CONSULTANT : PROCON ENGINEERS

 MAHAGENCO <small>Maharashtra State Power Generation Co. Ltd.</small>	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 4
REV: R0	MASTER SPECIFICATIONS	Page 71 of 555
6.2.3	<p>Interconnecting walkways (minimum 2 m width) between main plant building and boiler (on either side of boiler) at Ground, Mezzanine, Operating, PRDS and Deaerator floor levels shall be provided. Also inter-connecting platform between Boiler and Coal Tripper floor level and roof of Mill maintenance floor level, Feeder floor level, Bunker Building at Mill bay shall be provided. Number of interconnecting platforms between Boiler and Coal Bunker building for each level / floor specified above shall be two (2) on each side of Boiler i.e. four (4)/floor.</p>	
6.2.4	<p>Two of the landing levels of the Goods Elevator shall preferably coincide with the feeder and tripper floor elevations. In case of difference in levels, electric hoists to shift goods from elevator floors to feeder/ tripper floors shall be provided.</p>	
6.2.5	<p>Fuel Oil (F.O.) piping shall be routed over trestles. The headroom for F.O. trestle in Boiler/ESP/ID fan/Chimney area shall be 8.0 M till the road behind chimney and 7.0 M in CD bay area. The headroom for F.O. trestle in outlying area shall be 3.0 M except at rail/road crossing where the headroom shall be 8.0 M.</p>	
6.2.6	<p>Clear walkways along A-row & B-row of TG building shall be provided as indicated below:</p> <ul style="list-style-type: none"> (a) 1.5 m at all levels of AB Bay. (b) 3.5 m along B-row at operating floor level for interconnection with service Building & in front of control room. 	
6.2.7	<p>The layout of the steam turbine unit shall permit sufficient lay down area for all the parts/components to enable carrying out maintenance and overhauling operations.</p>	
6.2.8	<p>Steam turbine and generator (except stator) and other equipments located in the turbine hall shall be accessible by the EOT cranes for their handling during erection and maintenance. For all other equipment/components, suitable handling arrangement for erection and maintenance shall be provided.</p>	


CONSULTANT : PROCON ENGINEERS

 MAHAGENCO <small>Maharashtra State Power Generation Co. Ltd.</small>	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 4
REV: R0	MASTER SPECIFICATIONS	Page 72 of 555
6.2.9	In TG bay at crane rail level, walkway with handrails is envisaged for entire column sectional depth for full length of the building. In addition, it shall be ensured that on A-row and B-row columns, through walkway (without hindrance) of minimum 600 mm clear width is available from the face of the column to the handrail of the platform.	
6.2.10	Layout of facilities and equipment shall allow removal of Generator Stator, Generator transformers, Station & Unit transformers without disturbing equipments, piping, cabling, duct routed in the area.	
6.2.11	Adequate space and handling arrangement shall be provided for handling/removal of pumps, heaters, heat-exchanger, fans, mills during maintenance.	
6.2.12	Valves shall be located in accessible positions and operating/maintenance platforms shall be provided along with approach ladders & handrails for the same.	
6.2.13	While developing the layout, all fresh air ventilation louvers shall be considered 1000 mm from floor level and directed downwards at an angle. Ventilation fans on AB bay roof shall be kept staggered and shall not be near the centerline of turbo generator set.	
6.2.14	Each equipment room shall be provided with alternate exits in case of fire/accidents as per requirements of factory Act and Statuary bodies/Insurance companies.	
6.2.15	All other safety requirements as per the factories Act, Rules/regulations made under Electricity Act, 2003 and applicable codes/standards shall be observed while developing the layout.	
7.0	<u>OPERATION, MAINTENANCE & AVAILABILITY CONSIDERATIONS</u>	
7.1	Equipment/works offered shall be designed for high availability, high reliability, low maintenance and ease of operation & maintenance. The Bidder shall specifically state the design features incorporated to achieve high degree of reliability, availability, operability and ease of maintenance. He shall also furnish details of availability records in plants stated in his experience list.	


CONSULTANT : PROCON ENGINEERS

 MAHAGENCO <small>Maharashtra State Power Generation Co. Ltd.</small>	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 4
REV: R0	MASTER SPECIFICATIONS	Page 73 of 555
7.2	<p>Ample space for ease of operation and maintenance including equipment removal, tube bundle / cartridge / rotor pulling etc shall be provided. All valves, gates, dampers and other devices shall be located and oriented in such a way that they are accessible from operating floor levels. Where this cannot be adhered to, platforms and walkways with access ladders shall be provided to facilitate operation and maintenance.</p>	
7.3	<p>Motorised lifting devices, i.e. hoists, chain pulleys, jacks, etc. shall be provided for handling and carrying out maintenance of any equipment and/or part. Suitable beams, hooks etc. for this purpose shall be provided in the Buildings.</p>	
7.4	<p>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, accessories covered under this specification.</p>	
7.5	<p>All similar parts of the equipment shall be made to gauge and shall be interchangeable with and shall be made of same material and workmanship as the corresponding parts of the equipment. Where ever feasible, common components shall be employed in different pieces of equipment in order to optimize the spares inventory and utilization.</p>	
8.0	<u>MATERIALS</u>	
8.1	<p>In selecting materials of construction of equipment, the Contractor shall pay particular attention to the atmospheric conditions existing at the Site and the nature of material/ fluid handled. Wherever deviations are taken in respect of materials specified, the reasons shall be spelt out clearly in the proposal.</p> <p>All materials shall be new, and shall be of the quality most suited to the proposed application.</p>	
8.2	<p>In as far as is possible; materials shall be in accordance with Indian or international standard specifications and shall be used in accordance with Indian or International codes of practice. Where such standards or codes of practice are not available, sufficient information shall be provided to allow the Engineer to assess the suitability of the material for the particular application.</p>	


CONSULTANT : PROCON ENGINEERS

 MAHAGENCO <small>Maharashtra State Power Generation Co. Ltd.</small>	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 4
REV: R0	MASTER SPECIFICATIONS	Page 74 of 555
<p>All materials used shall have performed lengthy satisfactory service in similar or more arduous conditions to those proposed by the Contractor.</p> <p>8.3 All parts which could deteriorate or corrode under the influence of the atmospheric, meteorological or soil conditions at the Site, or under the influence of the working conditions shall be suitably and effectively protected so that such deterioration or corrosion is a minimum over the life of the plant.</p> <p>9.0 <u>LUBRICATION</u></p> <p>9.1 Provision shall be made for suitable efficient lubrication where necessary to ensure smooth operation free from undue wear.</p> <p>9.2 Non ferrous capillary tubing shall be used throughout.</p> <p>9.3 Gear boxes and oil baths shall be provided with filling and drain plugs, both of adequate size. An approved means of oil indication including level switches and temperature indication shall be provided.</p> <p>9.4 All high speed gears shall be oil bath lubricated. Low speed gears shall be lubricated by means of soft grease. Removable and accessible drip pans shall be provided to collect lubricant which may drop from operating parts.</p> <p>9.5 All lubrication points shall be conveniently situated for maintenance purposes. It must be possible to carry out lubrication from a gangway or landing and without the removal of guarding or having to insert the hand into it. Where accessibility to a bearing for oiling purposes would be difficult a method of remote lubrication shall be fitted.</p> <p>9.6 The Contractor shall supply grease gun equipment suitable to service each type of nipple fitted.</p> <p>10.0 <u>LUBRICANTS AND CONTROL FLUIDS</u></p> <p>10.1 The Contractor shall provide a detailed and comprehensive specification for all lubricating oils, greases and control fluids required for the entire plant. A sufficient supply of these shall be provided by the Contractor for initial commissioning, first fill and till COD of unit.</p>		


CONSULTANT : PROCON ENGINEERS

 MAHAGENCO <small>Maharashtra State Power Generation Co. Ltd.</small>	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 4
REV: R0	MASTER SPECIFICATIONS	Page 75 of 555
10.2	<p>The Contractor shall supply a detailed schedule giving the lubricant testing, cleaning and replacement procedures. All equipment and facilities necessary for the testing, cleaning and changing of lubricants and control fluids shall be provided. The Contractor shall endeavor to reduce the varieties and grades of required lubricants and control fluids to a minimum, matching them where possible to those already in use in the generating station in order to simplify procurement and minimise storage requirements. All lubricants and control fluids shall be of internationally recognized standards and shall be easily obtainable from a large number of Indian suppliers. Bidder shall also indicate the equivalent Indian Standard for the above for easy procurement in future.</p>	
10.3	<p>No lubricant or control fluid shall have toxic or other harmful effects on personnel or on the environment.</p>	
11.0	<u>OPERATION AND MAINTENANCE</u>	
11.1	<p>The plant shall be designed and constructed so that operation and maintenance manpower requirements are minimized.</p> <p>The design and layout shall facilitate inspection, cleaning, maintenance and repair. The importance of continuity of operation is second only to that of safety.</p>	
11.2	<p>Spare parts for equipment shall be interchangeable with the original components and, so far as possible, be of common design and manufacture.</p>	
11.3	<p>All similar standard components/parts of similar standard equipment provided shall be interchangeable with one another. Further, identical equipments shall be provided for similar duties so that the same are interchangeable with one another in totality and component wise.</p>	
11.4	<p>All heavy parts (500 Kg and above) must be provided with a convenient arrangement for slinging and handling during erection and overhaul. Any item of plant normally stripped or lifted during periods of maintenance and weighing one tonne or above, shall be clearly marked with its weight.</p>	

CONSULTANT : PROCON ENGINEERS

 MAHAGENCO <small>Maharashtra State Power Generation Co. Ltd.</small>	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II												
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 4												
REV: R0	MASTER SPECIFICATIONS	Page 76 of 555												
11.5	<p>On completion of commissioning, a complete set of tools for the maintenance of the entire plant shall be provided by the Contractor. This shall include all necessary spanners, special wrenches, extraction equipment and any special tools reasonably required by the Engineer. Tools used during erection and commissioning shall not be accepted except with the specific approval of the Engineer.</p>													
11.6	<p>All equipment and major valves should be provided with adequate maintenance approach and facility.</p>													
12.0	<p><u>PLANT LIFE AND MODE OF OPERATION</u></p> <p>The complete plant including all the equipment and systems individually and collectively shall be designed for continuous operation for an economic service life of thirty (30) years under the prevailing site conditions and for the type of duty intended.</p> <p>The critical components of the major equipments like Steam Generator, Turbine-Generator and Auxiliary equipment, the life of which is limited by time and temperature dependent mechanisms such as thermal stress, creep and low cycle fatigue, are to be designed considering expected (hot, warm and cold) start-up, shut-down and cyclic load variations.</p> <p>The unit would be operated on base load with cyclic load variation. The load variation is expected to be as per schedule depending on power demand. The units shall also be suitable for two shift operation, if required.</p> <p>The expected start-ups should be considered as minimum (Based on HPT metal temperature)</p> <table border="0"> <tr> <td>(a)</td> <td>Cold start-up (>50 hrs. shutdown)</td> <td>:</td> <td>20 per year</td> </tr> <tr> <td>(b)</td> <td>Warm start-up (between 10 to 50 hrs. of shutdown)</td> <td>:</td> <td>40 per year</td> </tr> <tr> <td>(c)</td> <td>Hot start-up (Less than 10 hrs. shutdown)</td> <td>:</td> <td>180 per year</td> </tr> </table> <p>The allowable stresses shall be so selected so that life expectancy to minimum 2,00,000 hours of operation can be achieved. The Bidder shall</p>		(a)	Cold start-up (>50 hrs. shutdown)	:	20 per year	(b)	Warm start-up (between 10 to 50 hrs. of shutdown)	:	40 per year	(c)	Hot start-up (Less than 10 hrs. shutdown)	:	180 per year
(a)	Cold start-up (>50 hrs. shutdown)	:	20 per year											
(b)	Warm start-up (between 10 to 50 hrs. of shutdown)	:	40 per year											
(c)	Hot start-up (Less than 10 hrs. shutdown)	:	180 per year											

CONSULTANT : PROCON ENGINEERS

 MAHAGENCO <small>Maharashtra State Power Generation Co. Ltd.</small>	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 4
REV: R0	MASTER SPECIFICATIONS	Page 77 of 555

discuss this aspect in his technical proposal.

13.0 PACKAGING & MARKING

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


As per the information available, the dimensions of OD consignment for transportation of the equipment by rail (if any equipment to be handled through rail transportation) are as below:

- (a) Width of the Package (from centre-line of rails-1.6 metres on both sides) : 3.2 Meters
- (b) Height of the package from rail top : 4.47 Meters

The above indicates the dimensions, which can be normally transported on the wagons without infringement of the "moving gauge". This is however not indicative of the consignment which can be carried out with infringement of "moving gauge" duly authorised and approved by the Indian Railways. There may be difference between the "moving gauge" and the "fixed structure gauge" and consignments infringing the "moving gauge" can be moved after investigation regarding possible infringement with the fixed structures. As the critical fixed structures in each route are different, consignments infringing moving dimensions have to be individually investigated to select a route and also determine the restrictions under which such movement is to be carried out. Such routes selected or other mode of transport envisaged is to be clearly brought out in the proposal wherever transport of over dimensional equipment is involved.

Bidder shall consider unloading of material delivered through rail transportation, at near by railway station/ site unloading siding. The subsequent transportation up to project work place shall be considered by

CONSULTANT : PROCON ENGINEERS

 MAHAGENCO <small>Maharashtra State Power Generation Co. Ltd.</small>	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 4
REV: R0	MASTER SPECIFICATIONS	Page 78 of 555

road only. All unloading and handling equipment both at railway station siding and at project site shall be arranged by the Bidder. Necessary arrangement to be organized with the railway authority for such purpose shall also be under the scope of services of the Bidder. Bidder may consider entire material delivered up to site through rail transportation only.

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

For imported equipment and material, suitable port facilities may be used in which case material may be transported from the port by tractor-trailer. Bidder may consider this aspect.

Specification of Packaging and Marking has been described in detail in Volume I: General Condition of Contract of the Specification.


14.0 PROTECTION

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

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

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

CONSULTANT : PROCON ENGINEERS

 MAHAGENCO <small>Maharashtra State Power Generation Co. Ltd.</small>	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 4
REV: R0	MASTER SPECIFICATIONS	Page 79 of 555

openings shall be closed with forged steel plugs. The closures shall be taped to seal the interior of the equipment. Open ends of piping, tubing and conduit shall be sealed and taped.

Returnable containers and special shipping devices shall be returned by the manufacturer's field representative at the Contractor's expense.

15.0 PAINING

15.1 GENERAL

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


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

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


All primers shall be well marked into the surface, particularly in areas where pitting is evident, and the first priming coat shall be applied as soon as possible after cleaning, within four hours maximum. The paint shall be applied by brush, roller or airless spray, according to the manufacturer's instructions. Spray painting shall be carried out by operators trained and thoroughly experienced in the use of the equipment. If the drying interval between successive coats, which should not exceed one week, has been so long as to endanger the adhesion of the following coat, the paint already applied shall be lightly rubbed down with fine abrasive paper before putting on the next coat.

Paint spraying on large surfaces shall not normally be done indoors, except with the approval of the Engineer. Spray guns shall not be used outdoors in


CONSULTANT : PROCON ENGINEERS

 MAHAGENCO <small>Maharashtra State Power Generation Co. Ltd.</small>	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 4
REV: R0	MASTER SPECIFICATIONS	Page 80 of 555
<p>windy weather or near unprotected surfaces of a contrasting colour and under no circumstances shall spray guns be used where spray may be carried into or onto exposed electrical equipment.</p> <p>Paint containers shall not be opened until required and the paint shall be mechanically mixed thoroughly before use, and agitated occasionally during use.</p> <p>Electrical equipment shall be shop finished with one or more coats of primer and two coats of high-grade oil resistant enamel. The interior of all panels' cabinets and enclosures shall be finished with gloss white enamel.</p> <p>The Contractor shall furnish sufficient touch-up paint for one complete finish coat on all exterior factory surfaces of each item of equipment. The touch-up paint shall be of the same type and colour as the factory applied paint and shall be carefully packed to avoid damage during shipment. Complete painting instructions shall be furnished.</p> <p>The Contractor shall select shop primer for steel and iron surfaces, which will have a continuous operating temperature below 35°C, in accordance to the relevant standard. Special high temperature primer shall be used on surface exposed to operating temperature above 35°C.</p> <p>The Owner/Engineer shall submit the colour scheme during execution of contract for approval.</p> <p>15.2 <u>PREPARATION</u></p> <p>Oil and grease shall be removed from the surface by washing with a suitable detergent, rinsing with clean water, and drying.</p> <p>Surfaces to be shot blasted shall be cleaned to Swedish Standard SA 2.5 or equivalent, and all dust remaining after cleaning shall be removed.</p> <p>The priming coat shall be applied without delay.</p> <p>15.3 <u>DAMAGED PAINTWORK</u></p> <p>Any damaged paintwork shall be made good as follows:</p>		

CONSULTANT : PROCON ENGINEERS

 MAHAGENCO <small>Maharashtra State Power Generation Co. Ltd.</small>	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 4
REV: R0	MASTER SPECIFICATIONS	Page 81 of 555
15.3.1	The damaged area, together with an area extending 25 mm around its boundary, shall be cleaned down to bare metal.	
15.3.2	A priming coat shall be immediately applied, followed by a full paint finish equal to that originally applied and extending 50 mm around the perimeter of the original damage.	
15.3.3	The repainted surface shall present a smooth surface. This shall be obtained by carefully chamfering the paint edges before and after priming	
15.4	<u>PAINTING SYSTEMS</u>	
	The requirements for the Dry Film Thickness (DFT) of paint and the materials to be used shall be as stated below, unless otherwise specified elsewhere in this specification.	
15.4.1	Surfaces subject to Weathering	
	All surfaces shall have a minimum of four coats of paint made up as follows:	
	(a) Primer coat	: 35 micron DFT
	(b) Tie coat	: 35 micron DFT
	(c) Finishing coat (Two Nos.)	: 35 micron DFT per coat
	(d) The total minimum DFT	: 140 micron
15.4.2	Surfaces Inside Buildings	
	All surfaces shall have a minimum of three coats of paint made up as follows:	
	(a) Primer coat	: 35 micron DFT
	(b) Tie coat	: 35 micron DFT
	(c) Finishing coat (Two Nos.)	: 25 micron DFT per coat
	(d) The total minimum DFT	: 120 micron

CONSULTANT : PROCON ENGINEERS

 MAHAGENCO <small>Maharashtra State Power Generation Co. Ltd.</small>	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 4
REV: R0	MASTER SPECIFICATIONS	Page 82 of 555

The Contractor shall select the type and colour of primer & finish coat after approval by the Owner.

For detail painting on building & structural steel elements, please refer **Volume VI / A & B** of this specification.

16.0 COLOUR CO-ORDINATION & FINISH

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

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

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

16.4 Final colours and finishes shall be to the Approval of the Engineer.


17.0 ENVIRONMENT PROTECTION AND NOISE LEVEL REQUIREMENT

17.1 ENVIRONMENT PROTECTION


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

In case the Ministry of Environment & Forest stipulates any other conditions not specified hereunder while clearing the project, same shall be complied with by the Contractor.


CONSULTANT : PROCON ENGINEERS

 MAHAGENCO <small>Maharashtra State Power Generation Co. Ltd.</small>	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 4
REV: R0	MASTER SPECIFICATIONS	Page 83 of 555
17.1.1	For Liquid Effluent	
	(a) Provision laid down in schedule-I for Thermal Power Plants and also in Schedule-VI: General Standards for discharge of Environmental pollutants Part-A: Effects of Environmental (Protection) Rules 1986, as amended till date.	
	(b) Any specific requirement of State Pollution Authorities over and above the above stipulation	
17.1.2	For Air Emission	
	(a) Suspended Particulate Matter i.e. dust burden at Chimney outlet - Maximum 50 mg/Nm ³ (with worst coal and one field out).	
	(b) NO _x : 365 ppm (maximum) or 750 mg/Nm ³ (Equivalent NO ₂).	
	(c) SO ₂ : As per prevailing Indian/ World Bank standards	
	The Bidder shall include in his scope all necessary equipment and measuring instruments to comply with above requirements. Location and accessibility of the instruments shall be properly coordinated.	
17.2	<u>NOISE LEVEL REQUIREMENT</u>	
	The plant shall be designed, constructed and provided with suitable acoustic measures to ensure the noise level criteria as per the following stipulations.	
17.2.1	Maximum noise level shall not exceed 85 dB (A) when measured at 1.0 M away from the noise emission source.	
17.2.2	Maximum noise level from its source within the premises shall not exceed 70 dB (A) as per Environment (Protection) Rules 1986, Schedule-III, 'Ambient Air Quality Standards' in respect of noise.	
17.2.3	Any statutory changes in stipulations regarding noise limitation that may occur in future according to Maharashtra Pollution Control Board or Central Pollution Control Board or Ministry of Environment & Forest regulation	


CONSULTANT : PROCON ENGINEERS

 MAHAGENCO <small>Maharashtra State Power Generation Co. Ltd.</small>	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 4
REV: R0	MASTER SPECIFICATIONS	Page 84 of 555
<p>during tenure of the contract, the Contractor shall comply with the requirement.</p> <p>An exception will be made for the plant at startup operations and other big pressure reducing devices operating during emergency periods and for the safety valves.</p> <p>18.0 <u>INSPECTION AND TESTING</u></p> <p>18.1 <u>GENERAL:</u></p> <p>18.1.1 An indicative list of Inspection and testing requirements for each package has been given for equipments across various volumes of this specification. Bidder shall note that these testing and inspections listed herein are the minimum requirements as perceived by the Owner; the bidder shall consider this only as a general guidance and is not meant to be exhaustive. The bidder shall consider requisite testing and inspections across the equipments / systems forming the proposed power plant unit based on his own experience and in line with the current industry practices for identically rated power plant for the technology under consideration. The comprehensive list of tests considered for each of the equipment/ systems shall be furnished as part of the bid.</p> <p>18.2 <u>INSPECTION AND TESTS DURING MANUFACTURE</u></p> <p>18.2.1 The method and techniques to be used by the Contractor for the control of quality during manufacture of all plant and equipment shall be agreed with the Owner prior to the Award of Contract.</p> <p>18.2.2 The Owner’s general requirements with respect to quality control and the required shop tests are set out elsewhere in this Specification.</p> <p>18.2.3 Before any item of plant or equipment leaves its place of manufacture, the Owner shall be given the option of witnessing inspections and tests for compliance with the specification and related standards.</p> <p>18.2.4 Advance notice shall be given to the Owner as agreed in the Contract, prior to the stage of manufacture being reached, and the piece of plant must be held at this stage until the Owner has inspected the piece, or has advised in</p>		


CONSULTANT : PROCON ENGINEERS

 MAHAGENCO <small>Maharashtra State Power Generation Co. Ltd.</small>	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 4
REV: R0	MASTER SPECIFICATIONS	Page 85 of 555
<p>writing that inspection is waived. If having consulted the Owner and given reasonable notice in writing of the date on which the piece of plant will be available for inspection, the Owner does not attend the Contractor may proceed with manufacture having forwarded to the Owner duly certified copies of his own inspection and test results.</p> <p>The Contractor shall forthwith forward to the engineer duly certified six (6) copies of the Test Certificates. Distribution of six (6) copies of Test Certificates for approval will be two (2) copies to Owner and four (4) copies to Consultant. These four (4) copies will be further distributed by Consultant after approval to Owner, site and bidder. One copy will be retained with the Consultant for record purpose.</p> <p>Further, nine (9) copies of Shop Test Certificates shall be bound with Instruction Manuals referred to elsewhere. Distribution of nine (9) copies of Shop Test Certificates for approval will be Two (2) copies to Owner, Three (3) copies to site, Two (2) copies to Consultant, Two (2) copies to Owner's library / record.</p> <p>18.2.5 Under no circumstances any repair or welding of castings shall be carried out without the consent of the Engineer. Proof of the effectiveness of each repair by radiographic and/or other non-destructive testing technique, shall be provided to the Engineer.</p> <p>18.2.6 All the individual and assembled rotating parts shall be statically and dynamically balanced in the works.</p> <p>Where accurate alignment is necessary for component parts of machinery normally assembled on site, the Contractor shall allow for trial assembly prior to despatch from place of manufacture.</p> <p>18.2.7 All materials used for the manufacture of equipment covered under this specification shall be of tested quality. Relevant test certificates shall be made available to the Owner. The certificates shall include tests for mechanical properties and chemical analysis of representative material.</p> <p>18.2.8 All pressure parts connected to pumping main shall be subjected to hydraulic testing at a pressure of 150% of shut-off head for a period not less than one</p>		

CONSULTANT : PROCON ENGINEERS

 MAHAGENCO <small>Maharashtra State Power Generation Co. Ltd.</small>	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 4
REV: R0	MASTER SPECIFICATIONS	Page 86 of 555
	<p>hour. Other parts shall be tested for one and half times the maximum operating pressure, for a period not less than one hour.</p> <p>18.2.9 All necessary non-destructive examinations shall be performed to meet the applicable code requirements.</p> <p>18.2.10 All welding procedures adopted for performing welding work shall be qualified in accordance with the requirements of Section-IX of ASME code or IBR, as applicable. All welded joints for pressure parts shall be tested by liquid penetrant examination according to the method outlined in ASME Boiler and Pressure Vessel code. Radiography, magnetic particle examination, magnuflux and ultrasonic testing shall be employed wherever necessary/ recommended by the applicable code. At least 10% of all major butt welding joints shall be radiographed.</p> <p>18.2.11 Statutory payments in respect of IBR approvals including inspection for design and manufacturer of equipment shall be made by the Bidder. All payment for erection and testing at site (i.e. under IBR Maharashtra Jurisdiction) shall also be made by the Bidder. In such case, Contractor's scope shall also be extended to preparation of all necessary documents, co-ordination and follow-up with IBR authorities for above approval.</p> <p>18.3 <u>PERFORMANCE TESTS AT SITE</u></p> <p>18.3.1 The full requirements for testing the system shall be agreed between the Owner and the Bidder prior to Award of Contract. The completely erected system shall be tested by the Contractor on site under normal operating conditions. The Contractor shall also ensure the correct performance of the system under abnormal conditions, i.e. the correct working of the various emergency and safety devices, interlocks etc.</p> <p>18.3.2 The Bidder shall provide complete details of his normal procedures for testing, for the quality of erection and for the performance of the erected plant. These tests shall include site pressure test on all erected pipe work to demonstrate the quality of the piping and the adequacy of joints made at site.</p> <p>18.3.3 The Contractor shall furnish the quality procedures to be adopted for assuring quality from the receipt of material at site, during storage, erection,</p>	

CONSULTANT : PROCON ENGINEERS

 MAHAGENCO <small>Maharashtra State Power Generation Co. Ltd.</small>	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 4
REV: R0	MASTER SPECIFICATIONS	Page 87 of 555

pre-commissioning to tests on completion and commissioning of the complete system/equipment.

- 18.4 For details of specific tests required on individual equipment, refer to respective section of this specification.

19.0 TRAINING OF OWNER'S PERSONNEL

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

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


19.1 TRAINING AT CONTRACTOR'S PREMISES

The Contractor shall conduct training of Thirty (30) engineers of the Owner on engineering, operation and maintenance of the Plant at the Contractor's or Associates or Sub-contractor's premises where adequate training facilities are available during the design and manufacturing stage of the Contract.

The total man-months for training of engineers shall be maximum Thirty (30), having following indicative break-up:

	Discipline	Number of Engineers	Number of Man-month
(a)	Operation	10 heads	10
(b)	Maintenance (Boiler & Turbine)	10 heads	10
(c)	Electrical Maintenance	4 heads	4
(d)	Control & Instrumentation	4 heads	4
(e)	Maintenance Planning	2 heads	2
		30 heads	30

CONSULTANT : PROCON ENGINEERS

 MAHAGENCO <small>Maharashtra State Power Generation Co. Ltd.</small>	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 4
REV: R0	MASTER SPECIFICATIONS	Page 88 of 555

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

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

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

The Contractor shall be responsible for the development of the Training Module and Programme Schedule, which shall be submitted to the Owner for approval.


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

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


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

- (a) Coal fired thermal plant principles in management and practice for operators, technicians and maintenance personnel.

CONSULTANT : PROCON ENGINEERS

 MAHAGENCO <small>Maharashtra State Power Generation Co. Ltd.</small>	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 4
REV: R0	MASTER SPECIFICATIONS	Page 89 of 555
<p>(b) Plant operation and systems training for operators including simulator training as applicable.</p> <p>(c) Maintenance training programme covering electrical, mechanical and instrumentation and control.</p> <p>Said training programme shall be submitted to the Owner for approval.</p> <p>The timing of the training should be such that the participants will be conversant with sufficient know-how to participate in the pre-commissioning and commissioning tests of the Plant.</p> <p>The Contractor shall provide qualified English speaking instructors and training coordinator (s) during the tenure of the training programme.</p> <p>19.2 <u>OPERATION AND MAINTENANCE TRAINING AT SITE</u></p> <p>The Contractor shall provide a comprehensive training programme related to design application, plant management, operation and maintenance, including trouble shooting of the Contractor's supplied system and equipment at the Site starting from Start of Commissioning and thereafter up to the Final Acceptance of the Unit.</p> <p>The following instructors shall be at the Site continuously during the training:</p> <p>(a) One (1) for Steam Generator and Auxiliaries ;</p> <p>(b) One (1) for Turbine Generator and Auxiliaries ;</p> <p>(c) One (1) for Electrical Works ;</p> <p>(d) One (1) for Instrumentation and Control (Boiler and Auxiliaries) ;</p> <p>(e) One (1) for Instrumentation and Control (Turbine and Auxiliaries).</p> <p>Instructors shall also be available for Coal handling Plant, Ash Handling Plant, Water Treatment Plant and other specific areas as per requirement.</p>		

CONSULTANT : PROCON ENGINEERS


 MAHAGENCO <small>Maharashtra State Power Generation Co. Ltd.</small>	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 4
REV: R0	MASTER SPECIFICATIONS	Page 90 of 555

19.3 ON-THE-JOB TRAINING

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

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

CONSULTANT : PROCON ENGINEERS


 MAHAGENCO <small>Maharashtra State Power Generation Co. Ltd.</small>	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 4
REV: R0	MASTER SPECIFICATIONS	Page 91 of 555

LIST OF STANDARDS FOR REFERENCE


ANNEXURE – A

- 1.0 International Standards Organisation (ISO)
- 2.0 International Electro-technical Commission (IEC)
- 3.0 American Society of Mechanical Engineers (ASME)
- 4.0 American National Standards Institute (ANSI)
- 5.0 American Society for Testing and Materials (ASTM)
- 6.0 American Institute of Steel Construction (AISC)
- 7.0 American Welding Society (AWS)
- 8.0 Architecture Institute of Japan (AIJ)
- 9.0 National Fire Protection Association (NFPA)
- 10.0 National Electrical Manufacturer's Association (NEMA)
- 11.0 Japanese Electro-technical Committee (JEC)
- 12.0 Institute of Electrical and Electronics Engineers (IEEE)
- 13.0 Federal Occupational Safety and Health Regulations (OSHA)
- 14.0 Instrument Society of America (ISA)
- 15.0 National Electric Code (NEC)
- 16.0 Heat Exchanger Institute (HEI)
- 17.0 Tubular Exchanger Manufacturer's Association (TEMA)


CONSULTANT : PROCON ENGINEERS

 MAHAGENCO <small>Maharashtra State Power Generation Co. Ltd.</small>	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 4
REV: R0	MASTER SPECIFICATIONS	Page 92 of 555
18.0	Hydraulic Institute (HIS)	
19.0	International Electro-Technical Commission (IEC) Publications	
20.0	Power Test Code for Steam Turbines (PTC)	
21.0	Applicable German Standards (DIN)	
22.0	Applicable British Standards (BS)	
23.0	Applicable Japanese Standards (JIS)	
24.0	Electric Power Research Institute (EPRI)	
25.0	Standards of Manufacturer's Standardization Society (MSS)	
26.0	Bureau of Indian Standards (BIS)	
27.0	Indian Electricity Rules	
28.0	Indian Boiler Regulations (IBR)	
29.0	Indian Explosives Act	
30.0	Indian Factories Act	
31.0	Tariff Advisory Committee (TAC) rules	
32.0	Emission regulation of Central Pollution Control Board (CPCB)	
33.0	Pollution Control regulations of Dept. of Environment, Govt. of India	
34.0	Central Board of Irrigation and Power (CBIP) Publications	
35.0	The Air Prevention and Control of Pollution Act	
36.0	The Environmental Protection Act	
37.0	The Public Liability Insurance Act	


CONSULTANT : PROCON ENGINEERS

 MAHAGENCO <small>Maharashtra State Power Generation Co. Ltd.</small>	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 4
REV: R0	MASTER SPECIFICATIONS	Page 93 of 555
<p>38.0 The Forest Conservation Act</p> <p>39.0 The Wildlife protection Act</p> <p>40.0 The EIA Notification, 1994</p> <p>41.0 IS: 14665-Specification for Electric Traction Lift</p> <p>42.0 Any other statutory Codes/Standards/Regulation</p>		


CONSULTANT : PROCON ENGINEERS

 MAHAGENCO <small>Maharashtra State Power Generation Co. Ltd.</small>	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 4
REV: R0	MASTER SPECIFICATIONS	Page 94 of 555


CONSULTANT : PROCON ENGINEERS

 MAHAGENCO <small>Maharashtra State Power Generation Co. Ltd.</small>	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 4
REV: R0	MASTER SPECIFICATIONS	Page 95 of 555
<p><u>CRITERIA FOR LAYOUT</u></p> <p><u>ANNEXURE – B</u></p>		
<u>SR. NO.</u>	<u>ITEM</u>	<u>SPECIFICATION REQUIREMENT</u>
1.0	<u>SITE CONDITIONS TO BE CONSIDERED</u>	
1.1	Prevalent wind direction during summer (for deciding cooling tower orientation)	See wind-rose in plot plan.
1.2	Prevalent wind direction (s) during dry seasons (for deciding the location of coal stock pile and ash dump/unloading areas, minimising the pollution effect due to dust)	See wind-rose in plot plan.
1.3	Location of	
1.3.1	Raw Water intake point	As shown in Plot Plan
1.3.2	Plant drainage outfall point (s)	In Existing Drainage/Effluent treatment Plant
1.3.3	Railway entries & exits	As shown in Plot Plan
1.3.4	Road entries & exits	As shown in Plot Plan
1.3.5	Electrical power transmission grid system	As shown in Plot Plan
1.3.6	Preferred / selected ash dump area	Velhala nearly 10 Km from the site
1.3.7	Nearest residential area	Existing Colony


CONSULTANT : PROCON ENGINEERS

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 4
REV: R0	MASTER SPECIFICATIONS	Page 96 of 555
<u>SR. NO.</u>	<u>ITEM</u>	<u>SPECIFICATION REQUIREMENT</u>
2.0	<u>LAYOUT REQUIREMENTS</u>	
2.1	<u>MAXIMUM PERMISSIBLE SLOPE IN</u>	
2.1.1	Rail track	1 in 400
2.1.2	Road	1 in 30
2.1.3	Sides of unpaved embankment	1 in 2
2.2	<u>REQUIRED ROAD WIDTH</u>	
2.2.1	Main roads	14.00 Metres with 1.0 m wide shoulders on either side for outer roads on western and eastern side and 7 meters with 1.5 m wide shoulders for other two sides of power block.
2.2.2	Auxiliary interconnections	Minimum 4 Metres without shoulders on either side and shall vary upto 7 m subject to availability of space. For carriage way, 5 Metre wide with 0.5 Metre shoulders and 7.0 Mtre wide with 1.5 Metre shoulders.
2.2.3	Road to the power house unloading bay	
(a)	Only for entry to the unloading bay	Yes
(b)	To pass through the unloading bay	No


CONSULTANT : PROCON ENGINEERS

 MAHAGENCO <small>Maharashtra State Power Generation Co. Ltd.</small>	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 4
REV: R0	MASTER SPECIFICATIONS	Page 97 of 555
<u>SR. NO.</u>	<u>ITEM</u>	<u>SPECIFICATION REQUIREMENT</u>
2.3	Required minimum horizontal distance between the nearest points of	
2.3.1	Plant boundary and the boundary of residential area	(Local municipality/factory rule)
2.3.2	Electrical transformer and any other	As per the Tariff Advisory Committee Rules
2.3.3	Fire water supply installation and any building / facility subject to fire risk.	As per the Tariff Advisory Committee Rules
2.3.4	Inflammable liquid (fuel oil, etc.) storage & handling installation and their fencing and other buildings/facilities	Rules of the Indian Explosive (Indian Explosives Act) and Indian Petroleum Code
2.4	Required minimum vertical clearance	
2.4.1	Under pipes/cable racks at road crossings	8.0 Metres
2.4.2	Soil coverage over underground pipes	1.0 Metre (minimum)
2.4.3	Pipe/Cable trench	Not Acceptable
2.5	Railway Wagon clearance	Rules of the Indian Railways
2.6	Minimum Clearance between any road edge and building/ structure / any fixed installation	3 Metres
2.7	Required level, above the local developed grade level, of	


CONSULTANT : PROCON ENGINEERS

 MAHAGENCO <small>Maharashtra State Power Generation Co. Ltd.</small>	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 4
REV: R0	MASTER SPECIFICATIONS	Page 98 of 555
<u>SR. NO.</u>	<u>ITEM</u>	<u>SPECIFICATION REQUIREMENT</u>
2.7.1	Top of all roads	150 mm
2.7.2	All outdoor paved areas	150 mm
2.8	Temporary storage areas, workshops, offices, residence etc. required at the time of erection work.	Yes
2.9	Green belt around power plant area	As per environmental guidelines of MOEF, Govt. of India.


CONSULTANT : PROCON ENGINEERS

 MAHAGENCO <small>Maharashtra State Power Generation Co. Ltd.</small>	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 4
REV: R0	MASTER SPECIFICATIONS	Page 99 of 555
<u>BUILDING/ EQUIPMENT LAYOUT REQUIREMENTS</u> <u>ANNEXURE – C</u>		
<u>SR. NO.</u>	<u>ITEM</u>	<u>SPECIFICATION REQUIREMENT</u>
1.0	Minimum clear space required at all working and walking areas for operating & maintenance personnel	
1.1	<u>HORIZONTAL, IN ALL DIRECTIONS</u>	
1.1.1	Adjacent to any electrical equipment, electrical cables, running (rotating / reciprocating) equipment, safety valve or vent / drain pipe outlet, pipe / equipment of surface temperature exceeding 60°C.	1200 mm
1.1.2	Adjacent to any other plant facilities (including walls / structures)	1000 mm
1.2	<u>VERTICAL</u> (head-room clearance)	
1.2.1	Under any pipe / equipment surface of temperature exceeding 60°C and any electrical cables or other electrical items.	2.0 Metre
1.2.2	Under any other plant facilities (including structures, pipes etc.)	2.0 Metre


CONSULTANT : PROCON ENGINEERS

 MAHAGENCO <small>Maharashtra State Power Generation Co. Ltd.</small>	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 4
REV: R0	MASTER SPECIFICATIONS	Page 100 of 555
<u>SR. NO.</u>	<u>ITEM</u>	<u>SPECIFICATION REQUIREMENT</u>
1.3	For all areas where any equipment (including trucks, trolleys and other material handling equipment) move or manoeuvre.	Minimum 500 mm clear in all direction from the outer edges of the equipment
1.4	Minimum clear hand space required for	
1.4.1	The application of thermal insulation	100 mm
1.4.2	Welding work	150 mm
1.4.3	Bolt tightening	150 mm
2.0	<u>FLOORS, PLATFORMS, STAIRCASE, LADDERS, WALLS, DOORS & WINDOWS</u>	
2.1	Statutory Requirement	As per the regulations of Tariff Advisory Committee, Indian National Building Code, Indian Factories Act, Local Municipal Rules, etc.
2.2	<u>OPERATION & MAINTENANCE REQUIREMENT</u>	
2.2.1	Adequate floor space shall be kept to permit dismantling, temporary storing and in-situ Maintenance of plant & equipment parts, satisfying the clear space requirements stated above. A separate unloading bay for such purpose is required.	Yes


CONSULTANT : PROCON ENGINEERS

 MAHAGENCO <small>Maharashtra State Power Generation Co. Ltd.</small>	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 4
REV: R0	MASTER SPECIFICATIONS	Page 101 of 555
<u>SR. NO.</u>	<u>ITEM</u>	<u>SPECIFICATION REQUIREMENT</u>
2.2.2	Floors or fixed/portable platforms with stairs/ ladders shall be provided for easy approach to any plant item, including valves, instruments, etc. to be operated, observed and/or to be frequently (more than once a month) maintained.	Yes
2.3	Minimum access opening required (with rolling shutter) transportation,	3.5 M wide x 4 M high or wherever entry of truck, for material depending upon the envisaged equipment size to be handled.
2.4	Plinth level of all buildings, above the local developed for power house building.	300 mm
3.0	<u>OTHER MAINTENANCE REQUIREMENT</u>	
3.1	Generator stator handling In case the Generator stator cannot be handled by the turbine house crane, all provisions for its overhauling, including the arrangement to slide the stator on the turbine house floor, the foundation work for stator jacking / lowering assembly, dismantling of building end walls / structures etc. shall be kept.	Yes


CONSULTANT : PROCON ENGINEERS

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 4
REV: R0	MASTER SPECIFICATIONS	Page 102 of 555
<u>SR. NO.</u>	<u>ITEM</u>	<u>SPECIFICATION REQUIREMENT</u>
3.2	Maintenance of the internals / impellers of all important equipment, like Boiler Feed Pumps, Feed Water Heaters, Surface Condenser, fans of the boiler draft plant, Intake and circulating water pumps, Cooling Water Pumps, Coal Mills, Air Compressors, Blowers, Heat Exchangers, Fuel Oil Pumps, Filters etc.	Shall be possible without disconnecting or dismantling any piping/ducting.
3.3	Overhauling and handling of the casings for the above items	Shall be possible without disturbing / dismantling any piping / ducting not directly connected to them.
3.4	Crane Approach Wherever required, the unobstructed approach of the crane hook / other hoisting equipment hook to various plant & equipment shall be possible.	Yes
4.0	<u>CENTRAL CONTROL ROOM</u> All electronic equipment other than those directly associated with control, operation or presentation of displays shall be mounted external to the control room in air conditioned control equipment room.	Yes


CONSULTANT : PROCON ENGINEERS

 MAHAGENCO <small>Maharashtra State Power Generation Co. Ltd.</small>	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 4
REV: R0	MASTER SPECIFICATIONS	Page 103 of 555
<u>SR. NO.</u>	<u>ITEM</u>	<u>SPECIFICATION REQUIREMENT</u>
5.0	The bidder shall describe in his bid the proposed layout philosophy of the Central Control Room and Control Equipment Room and the arrangement of equipment best suited for the system offered by him and as per good ergonomically consideration.	
5.1	However, as a guide line, following features are given:	
5.1.1	False ceiling and false flooring shall be provided.	
5.1.2	Uniform height, colouring schemes for cabinets etc. shall be available.	
5.1.3	The total area of floor space covered by Control Consoles/Panels in the Control Room shall not exceed 15% of floor area.	
5.1.4	No opening shall be provided from Boiler side.	
5.1.5	Two double leaf doors, suitably located for entering the Control room shall be provided with opening towards the turbine floor.	
5.1.6	Cable entry for the panels/consoles shall be from bottom and suitable openings shall be provided.	

CONSULTANT : PROCON ENGINEERS

 MAHAGENCO <small>Maharashtra State Power Generation Co. Ltd.</small>	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 4
REV: R0	MASTER SPECIFICATIONS	Page 104 of 555
<u>SR. NO.</u>	<u>ITEM</u>	<u>SPECIFICATION REQUIREMENT</u>
5.1.7	The Control Room lighting shall be designed to provide a glare free uniform illumination. The level of illumination shall be minimum 400 LUX.	
5.1.8	Necessary Air Conditioning shall be provided for Central Control room, Control Equipment Room and SWAS room etc.	
5.1.9	Basic amenities like toilet, Tiffin rooms, wash basins, rest rooms etc. shall be provided near the Control Room.	
6.0	Toilet and drinking water facility	Required in all buildings and on all floors wherever operating personnel are to be deployed.

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 MAHAGENCO <small>Maharashtra State Power Generation Co. Ltd.</small>	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 4
REV: R0	MASTER SPECIFICATIONS	Page 105 of 555


SPECIFIC LAYOUT CONSIDERATIONS

ANNEXURE-D


While developing the layouts, the following major layout parameters shall be ensured, as a minimum:

<u>SR.NO.</u>	<u>PARAMETER</u>	<u>REQUIREMENTS</u>
1.0	AB bay, BC & CD bay widths	36.0 M, 12.0 M & 12.0M
2.0	Arrangement of TG set	Longitudinal
3.0	Floor levels in AB bay	0.0 M, 9.0 M, 17.0 M
4.0	Floor levels in B-C bay	0.0 M, 9.0 M, 17.0 M 24.0M, 28.0 M 32.8 M, 38.0 M
5.0	Level of operating floor	17.0 M
6.0	Level of mezzanine floor	9.0 M
7.0	HT/LT Switchgear and MCC location	HT Switchgear at 3.5 M and LT Switchgear & MCC at 12.0 M in AB bay
8.0	Area of unloading bays	750 sq. M
9.0	Lay down Area (Minimum on operating floor) with EOT Crane approach	750 sq. M.
10.0	Minimum clear working space around the equipment	1200 mm
11.0	Location of Deaerator	In BC bay at EL. 38.0 M

CONSULTANT : PROCON ENGINEERS


 MAHAGENCO <small>Maharashtra State Power Generation Co. Ltd.</small>	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 4
REV: R0	MASTER SPECIFICATIONS	Page 106 of 555
<u>SR.NO.</u>	<u>PARAMETER</u>	<u>REQUIREMENTS</u>
12.0	Location of Heaters	HP Heaters/LP Heaters at Operating Floor/ Mezzanine Floor respectively in B-C Bay.
13.0	Location of BFP	TDBFP at Operating Floor and MDBFP at Ground Floor in AB Bay.
14.0	Location of Boiler MCC	At 28.0 M in BC bay
15.0	Clear Head room within Main plant Building for pipes, structures & cable trays, ducts etc.	2.5 M
16.0	Number of Fire Escape staircases in the main plant with fire doors at each landing	Minimum Four (4)
17.0	Minimum width of all staircases landings	1500 mm
18.0	Passenger Elevators	One (min)
19.0	Clear approach width in front and rear of ESP	10 M (Height = 8 M)
20.0	Head Room for pipe/cables trestles at rail, road crossing	8.0 M
21.0	Minimum straight length in Flue gas duct at ESP outlet for Opacity meters.	As required for accurate dust measurement within the battery limits.
22.0	Elevation of ID Ducts entering Chimney	12.75 M (Min.) (Bottom of steel)

CONSULTANT : PROCON ENGINEERS

 MAHAGENCO <small>Maharashtra State Power Generation Co. Ltd.</small>	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 5
REV: R0	MASTER SPECIFICATIONS	Page 107 of 555

VOLUME II
SECTION – 5
PROJECT MANAGEMENT AND SITE SERVICES


CONSULTANT : PROCON ENGINEERS

 MAHAGENCO <small>Maharashtra State Power Generation Co. Ltd.</small>	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 5
REV: R0	MASTER SPECIFICATIONS	Page 109 of 555

CONTENT

<u>CLAUSE NO.</u>	<u>DESCRIPTION</u>
1.0	PROJECT MANAGEMENT SERVICES
2.0	SITE SERVICES
3.0	PROTECTION AND CARE

CONSULTANT : PROCON ENGINEERS

 MAHAGENCO <small>Maharashtra State Power Generation Co. Ltd.</small>	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 5
REV: R0	MASTER SPECIFICATIONS	Page 111 of 555

1.0 PROJECT MANAGEMENT SERVICES

1.1 RESPONSIBILITY

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

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

Detailed responsibilities in the above areas are discussed below:


1.2 ORGANISATION

1.2.1 Headquarters


The headquarters of the Project Management Team shall be headed by a senior level executive designated as the Project Manager who shall be responsible to Owner for the execution of the project. He should have adequate financial power and authority to give decision.

Separately, designated leaders shall be identified for each of the areas mentioned under 1.1, who, in turn, will report to the Project Manager for all matters relative to this contract.


CONSULTANT : PROCON ENGINEERS

 MAHAGENCO <small>Maharashtra State Power Generation Co. Ltd.</small>	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 5
REV: R0	MASTER SPECIFICATIONS	Page 112 of 555
1.2.2	Central Co-ordination Cell	
	<p>The central coordination cell shall have sufficient technical personnel to coordinate technical matters and to quickly resolve day to day queries or references made by Owner and his Consultants without having the need to refer to his headquarters each time.</p>	
1.2.3	Site Organisation	
	<p>The site should have a competent construction manager for all site operations with adequate financial power and sufficient level of authority to take site decisions. The organisation chart for site should indicate the various levels of experts to be posted for supervision in the various fields in civil construction, erection, commissioning etc.</p>	
1.2.4	Organisation Chart	
	<p>The Bidder shall furnish a detailed organisation chart for the project management team, clearly identifying the key personnel in each of the areas mentioned above. The expected number of executives at different levels shall also be indicated, separately for headquarters, central coordination cell and site organisation.</p>	
1.3	<u>DETAILED RESPONSIBILITIES</u>	
1.3.1	Planning & Monitoring	
	(a) Planning	
	<p>The Bidder shall prepare a Master Network Schedule in the form of PERT network consisting of at least 500 activities.</p> <p>The network shall be prepared on a Work Breakdown Structure for the project which sub-divides the project into a set of manageable systems/sub-systems. The master network will identify milestones of key events for each system/ package in the areas of engineering, procurement, manufacture and despatch and erection and commissioning. The master network shall represent the Level-I plan and will form the basis for development of detailed second and third</p>	

CONSULTANT : PROCON ENGINEERS

 MAHAGENCO <small>Maharashtra State Power Generation Co. Ltd.</small>	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 5
REV: R0	MASTER SPECIFICATIONS	Page 113 of 555
<p>tier execution plans. The master network shall conform to the overall schedule prescribed by Owner.</p> <p>The master network should be submitted along with the bid which would be mutually discussed and finalised before the Award of Contract. This master network would clearly indicate the responsibility of the Bidder and project management team. This master network would form a part of the contract. The master network shall also identify a complete list of inputs to be furnished by the Owner which may be required for proper interfacing and tie-up. Scheduled dates for providing such inputs shall also be indicated, which will be mutually discussed and finalised.</p> <p>(b) Monitoring & Progress Reporting</p> <p>The progress reports would be emanated every month, one from the head office of the Contractor and another from the site office. The progress report emanating from the head office should necessarily include the following sections:</p> <ul style="list-style-type: none"> (i) Report on key milestones. (ii) Management summary indicating critical areas with details of actions initiated and effect of any on the project. (iii) Action needing attention of the Owner/Consultant. (iv) Detailed package wise status of engineering submissions, quality plan submissions and approval, procurement manufacture and despatch. <p>The monthly report generated from the site office should necessarily include:</p> <ul style="list-style-type: none"> (i) Report on key milestones. (ii) Management summary indicating critical areas with details of actions initiated and effect if any on the project. 		

CONSULTANT : PROCON ENGINEERS

 MAHAGENCO <small>Maharashtra State Power Generation Co. Ltd.</small>	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 5
REV: R0	MASTER SPECIFICATIONS	Page 114 of 555

(iii) Action needing attention of the Owner/Consultant.

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

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

1.3.2 Engineering Management

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


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

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

All such networks shall be provided in PRIMAVERA software, supported by back ups (schedule of predecessor/successors as well as floats for activities).

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

CONSULTANT : PROCON ENGINEERS

 MAHAGENCO <small>Maharashtra State Power Generation Co. Ltd.</small>	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 5
REV: R0	MASTER SPECIFICATIONS	Page 115 of 555

1.3.3 Contracts Management

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

The Contractor should also submit L-3 programmes for the manufacturing, despatch of the various items. These networks shall also show the Customer Hold Points (CHP) which have to be cleared by Owner or their authorised representative(s) before further manufacture can take place. These L-3 programmes for the manufacture and despatch would clearly identify responsibilities of the Contractor, sub-Contractor and Owner. These networks shall be submitted within one (1) month of the date of finalisation of the various sub-contracts by the Contractor.


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

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

1.3.4 Quality Assurance, Inspection and Expediting

The Contractor shall submit the list of manufacturers/sub-vendors from whom the equipment are expected to be procured and the quality assurance plans thereof for the manufacture shall be approved by the QA group of Owner before the manufacture is commenced. The list of major suppliers shall be submitted along with the bid and this shall be mutually discussed and approval will be given by the Owner during contract negotiation meeting prior to placement of Letter of Award. This approved list will be

CONSULTANT : PROCON ENGINEERS

 MAHAGENCO <small>Maharashtra State Power Generation Co. Ltd.</small>	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 5
REV: R0	MASTER SPECIFICATIONS	Page 116 of 555

binding to the bidder. In the said list, Owner reserves the right to include reputed/reliable vendors of his own choice. Regarding the various other sub-vendors, the list shall be submitted within six (6) months of the award of the contract that shall be scrutinized by the Owner to accord approval. In such list, Owner reserves the right to include vendors of his own choice. No further vendor approval will be given after six (6) months. On the quality plans, the customer hold points will also be identified based on which Owner would give clearance for the manufacture to proceed further.

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

The Contractor shall also expedite all despatches from their own works/works of their sub-vendors, so as to match with the various activities mentioned at 1.4.3 above.


1.3.5 Construction Management

The bidder shall specifically ensure smooth management of site activities with adequate planning keeping in view the quantum of parallel activities as the project picks up.


Towards ensuring orderly movement of construction vehicles and unhindered access to all construction fronts, the following activities shall be accorded priority:

- (a) Completion of all arterial roads in and around the construction fronts.
- (b) Compound wall for securing site.


CONSULTANT : PROCON ENGINEERS

 MAHAGENCO <small>Maharashtra State Power Generation Co. Ltd.</small>	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 5
REV: R0	MASTER SPECIFICATIONS	Page 117 of 555
<p>(c) Requisite drainage</p> <p>(d) All temporary buildings for office and stores.</p> <p>A detailed schedule of the above activities shall be submitted to the Owner within 15 (fifteen) days of the receipt of Letter Of Intent.</p> <p>Based on the L-1 Master Network Programme, within two (2) months of the issue of Letter of Award, the Contractor shall submit a programme of construction / erection / commissioning, either in continuation with the manufacture and despatch or separately for the implementation. These programmes would be amplified showing when the civil drawings shall be released by him and construction of civil works shall be completed by him to facilitate start of erection and subsequent activities and shall form the basis for site execution and detailed monitoring. The three monthly rolling programme with the first month's programme being tentative based on the site conditions would be prepared based on these L-3 programmes. The Contractor shall also be involved along with the Owner to tie up detailed resource mobilisation plan over the period of time of the contract matching with the performance targets.</p> <p>The L-3 programme would be jointly finalised by the site incharge of the Contractor with the Owner's project coordinator as well as the site planning representative. The erection programme shall also identify the sequential erectable tonnages that are required for various equipments which shall be taken care of in the despatch programmes.</p> <p>Erection and commissioning of the equipment shall also be done under the supervision of experts from the respective equipment/ system supplier.</p> <p>1.3.6 Spares Management</p> <p>Alongwith the proposal for the plant and equipment, the Contractor shall also submit proposals/schedule for the following:</p> <p>(a) Mandatory spares</p> <p>(b) Recommended spares</p>		


CONSULTANT : PROCON ENGINEERS

 MAHAGENCO <small>Maharashtra State Power Generation Co. Ltd.</small>	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 5
REV: R0	MASTER SPECIFICATIONS	Page 118 of 555
<p>While the award for mandatory spares will be finalised at the time of the award of contract, recommended spares will be finalised within twelve (12) months thereafter.</p> <p>1.4 <u>PROJECT PROGRESS REVIEW MEETINGS</u></p> <p>Keeping in mind the overall responsibility of the Contractor, it is intended that periodic progress reviews on the entire activities of execution in respect of Bhusawal Thermal Power Plant will be held initially at least once in two (2) months at Mumbai/site or in the country of the Contractor depending on the circumstances and mutual agreement. During peak period, it may be held once in a month. These meetings will be attended by reasonably higher officials of the Contractor and their leading sub- contractors and will be used as a forum for discussing all areas where progress needs to be speeded up. Actions will be placed on the concerned agencies and decisions will be taken to expedite/speed up the progress. Minutes of such meetings will be issued reflecting the major discussions and decisions taken and circulated to all concerned for reference and action. The Contractor shall be further responsible for ensuring that suitable steps are taken to meet various targets decided upon such meetings.</p> <p>In addition to the above, and to streamline the construction and erection at site, a suitable frequency and forum of periodic meetings between the Contractor and the Owner will be decided upon as part of erection coordination procedure. Site co-ordination meeting may be held on weekly basis.</p> <p>1.5 <u>OWNER'S CONSULTANT</u></p> <p>The Owner would appoint a Consultant to assist him in some of the areas mentioned above. The details of interaction and procedures for coordination between Owner/ Owner's Consultant and Contractor/Contractor's Project Management Team shall be finalised during contract negotiations.</p> <p>1.6 <u>COMMISSIONING MANAGEMENT</u></p> <p>1.6.1 For commissioning of the various equipment/system covered under the scope of contract, Owner shall form an organisation structure which may</p>		

CONSULTANT : PROCON ENGINEERS

 MAHAGENCO <small>Maharashtra State Power Generation Co. Ltd.</small>	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 5
REV: R0	MASTER SPECIFICATIONS	Page 119 of 555
<p>consist of the following committees. The Contractor shall nominate his representative on one or more of the committees as decided by the Owner:</p> <ul style="list-style-type: none"> (a) Steering Committee (b) Commissioning Panel (c) Working Parties (d) Testing Teams <p>1.6.2 Commissioning documents shall be prepared by the Contractor in the following manner and submitted for Owner's approval:</p> <ul style="list-style-type: none"> (a) Field Quality Plan <p>This document shall be prepared for the various equipment/systems under commissioning and shall have the following objectives to fulfill and shall be submitted for Owner's approval at least six (6) months before their actual commissioning:</p> <ul style="list-style-type: none"> (i) Establish design data against which Plant Performance will be compared. (ii) Set-out the testing objectives and proposals. (iii) Define the documentation required. (b) Testing/Commissioning Schedule: <p>These shall be prepared for the various equipment/systems under consideration and shall contain sections like detailed testing method, programme, safety, individual responsibility and results.</p> (c) Standard Check Lists <p>Standard check lists are intended for use at the completion of erection to ensure correct erection, testing and to a limited extent operation for repetitive items.</p> 		

CONSULTANT : PROCON ENGINEERS

 MAHAGENCO <small>Maharashtra State Power Generation Co. Ltd.</small>	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 5
REV: R0	MASTER SPECIFICATIONS	Page 120 of 555

1.6.3 Test Reports


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

SITE SERVICES


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

- 1.7 Arranging material despatch from the shop by rail/road and/or sea as applicable.
- 1.8 Monitoring movement of materials & follow-up as necessary with Railways, road transport, port clearance etc from the time of despatch F.O.R. works/F.O.B. port of shipment by Contractor till receipt of the same at site.
- 1.9 Unloading of materials at Railway Station/Railway Siding inside project area, transportation to site store, assessment of lost/damaged items in transit and arranging insurance claims and replacement of lost/damaged items. The Contractor shall submit to the Engineer a report detailing all the receipts during the week.
- 1.10 Issuing materials from site store/open yard from time to time for erection as per the construction programme. The Contractor shall be the custodian of all the materials issued till the plant is officially taken over by the Owner after complete erection and successful trial run & commissioning.


CONSULTANT : PROCON ENGINEERS

 MAHAGENCO <small>Maharashtra State Power Generation Co. Ltd.</small>	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 5
REV: R0	MASTER SPECIFICATIONS	Page 121 of 555
1.11	Transportation of materials to their respective places of erection and erection of the complete plant & equipment as supplied under this specification.	
1.12	<p>Trial run and commissioning of individual equipment/sub-systems and the plant as a whole to the satisfaction of the Owner, including supply of temporary equipment & services for chemical cleaning, steam blowing as well as performance guarantee tests.</p> <p>Apart from Boiler, proper chemical cleaning shall be carried out in following pipe lines/equipment before commissioning</p> <ul style="list-style-type: none"> (a) Deaerator (b) Boiler feed suction, recirculation leak-off lines (c) Boiler Feed discharge line by passing heaters (d) Attemperation lines (e) Condensate suction & discharge piping upto de-aerator by passing the feed water heaters. (f) Fuel oil lines. <p>Provision for preservation of individual equipment after trial run and commissioning e.g. Nitrogen blanketing etc as necessary shall also be in the scope of the Bidder. Safe disposal of effluent after chemical cleaning shall be done by the Contractor.</p>	
1.13	Supply and application of the final paints and first fill lubricants on all the equipment to be erected under this specification. Supply of LDO, chemicals, lubricating oils upto COD.	
1.14	For the purpose of erection and commissioning, the Contractor's scope of work shall include but not be limited to the following :	
1.14.1	Deployment of all skilled and unskilled manpower required for erection, supervision of erection, watch & ward, commissioning and other services to be rendered under this specification.	

CONSULTANT : PROCON ENGINEERS

 MAHAGENCO <small>Maharashtra State Power Generation Co. Ltd.</small>	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 5
REV: R0	MASTER SPECIFICATIONS	Page 122 of 555
1.14.2	Deployment of all erection tools & tackle, construction machinery, transportation vehicles and all other implements in adequate number and size, appropriate for the erection work to be handled under the scope of this specification.	
1.14.3	Supply of commissioning spares.	
1.14.4	Supply of all consumables, e.g. welding electrodes, cleaning agents, diesel oil, grease, lubricant etc. as well as materials required for temporary supports, scaffolding etc. as necessary for such erection work except those listed under exclusion elsewhere in this specification.	
1.14.5	Construction of all civil / structural / architectural works, including construction of foundation for all equipment supplied as required, grouting of equipment on foundation after alignment, and all other incidental civil activities as detailed elsewhere.	
1.14.6	All structural steel fabrication and erection work as detailed elsewhere in the specification.	
1.14.7	Providing support services for the Contractor's erection staff e.g. construction of site offices, temporary stores, residential accommodation and transport to work site for erection personnel, insurance cover, watch & ward for security and safety of the materials under the Contractor's custody etc. as required.	
1.14.8	Maintaining proper documentation of all the site activities undertaken by the Contractor as per the proforma mutually agreed with the Owner; submitting monthly progress reports as also any such document as and when desired by the Owner; taking approval of all statutory authorities e.g. Boiler Inspector, Factory Inspector, Inspector of Explosives etc. for respective portions of work under the jurisdiction of such statutes or laws.	
1.14.9	The Contractor shall provide 'Industrial Relations' unit and 'Medical' unit to take care of his erection staff and the Owner shall have no obligation in the regard.	
1.14.10	The successful Bidder shall arrange for Tower cranes (400 Tonnes capacity) as per requirement for speedy erection activities.	

CONSULTANT : PROCON ENGINEERS

 MAHAGENCO <small>Maharashtra State Power Generation Co. Ltd.</small>	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 5
REV: R0	MASTER SPECIFICATIONS	Page 123 of 555

1.15 SITE ORGANISATION

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

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


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

1.16 GENERAL GUIDELINES FOR FIELD ACTIVITIES


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

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


CONSULTANT : PROCON ENGINEERS

 MAHAGENCO <small>Maharashtra State Power Generation Co. Ltd.</small>	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 5
REV: R0	MASTER SPECIFICATIONS	Page 124 of 555
1.16.3	<p>The Engineer shall hold weekly meetings of all the Contractors working at Site at a time and a place to be designated by the Engineer. The Contractor shall attend such meetings and take notes of discussions during the meeting and the decisions of the Engineer and shall strictly adhere to those decisions in performing his Work. In addition to the above weekly meeting, Engineer may call for other meetings either with individual Contractors or with selected number of Contractors and in such a case the Contractor, if called will also attend such meetings.</p>	
1.16.4	<p>The Engineer shall however not be responsible for provision of additional labour and or materials or supply or any other services to the Contractor except for the co-ordination work between various Contractors as set out earlier.</p>	
1.16.5	<p>The works under execution shall be open to inspection & supervision by the Owner's engineer at all times. The Contractor shall give reasonable notice to the Owner before covering up or otherwise placing beyond the reach of inspection any work in order that same may be verified, if so desired by the Owner.</p>	
1.16.6	<p>Every effort shall be made to maintain the highest quality of workmanship by stringent supervision and inspection at every stage of execution. Manufacturer's instruction manual and guidelines on sequence of erection and precautions shall be strictly followed. Should any error or ambiguity be discovered in such documents, the same shall be brought to the notice of the Owner's engineer. Manufacturer's interpretation in such cases shall be binding on the Contractor.</p>	
1.16.7	<p>The Contractor shall comply with all the rules and regulations of the local authorities, all statutory laws including Minimum Wages, Workmen Compensation etc. All registration and statutory inspection fees, if any, in respect of the work executed by the Contractor shall be to his account.</p>	
1.16.8	<p>All the works such as cleaning, checking, leveling, blue matching, aligning, assembling, temporary erection for alignment, opening, dismantling of certain equipments for checking and cleaning, surface preparation, edge preparation, fabrication of tubes and pipes as per general engineering practice at site, cutting grinding, straightening, chamfering, filling, chipping, drilling, reaming, scrapping, shaping, fitting-up bolting/welding, etc., as</p>	


CONSULTANT : PROCON ENGINEERS

 MAHAGENCO <small>Maharashtra State Power Generation Co. Ltd.</small>	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 5
REV: R0	MASTER SPECIFICATIONS	Page 125 of 555
<p>may be applicable in such erection and are necessary to complete the work satisfactorily, are to be treated as incidental and the same shall be carried out by the Contractor as part of the work.</p> <p>1.16.9 In case of any class of work for which there is no such specification as laid down in the contract such as blue matching, welding of stainless steel parts etc., the work shall be carried out in accordance with the instructions and requirements of the Engineer.</p> <p>1.16.10 It may sometimes be necessary to remove some of the erected structural members to facilitate erection of bigger/pre-assembled equipment. In such cases, removal and re-erection of such members, which are essential, and if so agreed by the Engineer, will have to be done by the Contractor.</p> <p>1.16.11 Attachment welding of necessary instrumentation tapping points, thermocouple pads, root valves, condensing vessels, flow nozzles and control valves etc., both for regular measurement and performance testing to be provided on equipment, its auxiliaries or pipelines covered within the scope of this tender, will also be the responsibility of the Contractor and the same will be done as per the instructions of Engineer. The erection and welding of all above items will be the Contractor's responsibility, even if :</p> <p>(a) Product groups under which these items are re-leased are not covered in the scope of this tender.</p> <p>(b) Items are supplied by an agency other than the Contractor.</p> <p>1.16.12 Preservation of all materials / equipment under custody of the Contractor during storage, pre-assembly & erection, commissioning etc shall be the responsibility of the Contractor. All necessary preservatives and consumables like paints etc shall be arranged by the Contractor. Necessary touch up painting, periodic application of preservatives/ paints on pressure parts/other equipment even after erection until completion of work shall be carried out by the Contractor. The Contractor shall fabricate piping, install lub oil systems and carry out the acid cleaning of fabricated piping. The Contractor shall also service the lub oil system, carry out the hydraulic test of oil coolers etc.</p>		


CONSULTANT : PROCON ENGINEERS

 MAHAGENCO <small>Maharashtra State Power Generation Co. Ltd.</small>	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 5
REV: R0	MASTER SPECIFICATIONS	Page 126 of 555
1.16.13	It is responsibility of the Contractor to do the alignment etc if necessary, repeatedly to satisfy Engineer, with all the necessary tools & tackles, manpower etc. The alignment will be complete only when jointly certified so, by the Contractor's Engineer & Owner. Also, the Contractor should ensure that the alignment is not disturbed afterwards.	
1.16.14	Additional platforms for approaching different equipment as per site requirement, which may not be indicated in drawings, shall be fabricated and erected by the Contractor. The materials required for these works shall be supplied by the Contractor and he will have to fabricate them to suit the requirement.	
1.16.15	Equipment and material which are wrongly installed shall be removed and reinstalled to comply with the design requirement at the Contractor's expense, to the satisfaction of the Owner/ Consultant.	
1.16.16	Before erection of any equipment on a foundation, the Contractor shall check and undertake if necessary rectification of foundation bolts, reaming of holes, drilling of dowels, matching of bolts and nuts, making new dowel pin, etc	
1.16.17	Assistance for calibrating/testing the power cylinders, valves, gauges, instruments, etc., and setting of actuators coming under various groups shall be provided by Contractor.	
1.16.18	It shall be the responsibility of the Contractor to provide ladders on columns for initial works till such time stairways are completed. For this, the ladder should not be welded on the column and should be prefabricated clamping type. No temporary welding on any structural member is permitted except under special circumstances with the approval of Owner.	
1.16.19	Structural materials required for the supporting/operating platforms required for the valves at various levels for the same operation of valves will be arranged by the Contractor.	
1.16.20	For civil, structural and architectural works, Volume VI-A/B may be referred. For Electrical and Instrumentation works, Volume IV-A/B and Volume V may be referred.	


CONSULTANT : PROCON ENGINEERS

 MAHAGENCO <small>Maharashtra State Power Generation Co. Ltd.</small>	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 5
REV: R0	MASTER SPECIFICATIONS	Page 127 of 555
1.17	<u>SAFETY</u>	
	Safety and overall cleanliness of work site shall be given top priority.	
1.17.1	The Contractor shall ensure the safety of all workmen, materials and equipment either belonging to him or to others working at site. He shall observe safety rules & codes applied by the Owner at site without exception.	
1.17.2	The Contractor shall notify the Owner of his intention to bring to site any equipment or material which may create hazard. The Owner shall have the right to prescribe the conditions under which such equipment or material may be handled and the Contractor shall adhere to such instructions. The Owner may prohibit the use of any construction machinery, which according to him is unsafe. No claim for compensation due to such prohibition will be entertained by the Owner.	
1.17.3	Storage of petroleum products & explosives for construction work shall be as per rules and regulation laid down in Petroleum Act, Explosive Act and Petroleum and Carbide of Calcium Manual. Approvals as necessary from Chief Inspector of Explosives or other statutory authorities shall be the responsibility of the Contractor.	
1.17.4	The Contractor shall be responsible for safe storage of his and his sub-contractor's radioactive sources.	
1.17.5	All requisite tests & inspection of handling equipment, lifting tools & tackle shall be periodically done by the Contractor. Defective equipment shall be removed from service. Any equipment shall not be loaded in excess of its recommended safe working load.	
1.17.6	All combustible waste and rubbish shall be collected and removed from the worksite at least once in a day. Use of undercoated canvas paper, corrugated paper, and fabricated carton, plastic or other flammable materials shall be restricted to the minimum and promptly removed.	
1.17.7	The Contractor shall provide adequate number of fire protection equipment of the required types for his stores, office, temporary structures, labour	


CONSULTANT : PROCON ENGINEERS

 MAHAGENCO <small>Maharashtra State Power Generation Co. Ltd.</small>	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 5
REV: R0	MASTER SPECIFICATIONS	Page 128 of 555
<p>colony etc. Personnel trained for fire-fighting shall be made available by the Contractor at site during the entire period of the Contract.</p> <p>1.17.8 All electrical appliances used in the work shall be in good working condition and shall be properly earthed. No maintenance work shall be carried out on live equipment. The Contractor shall maintain adequate number of qualified electricians to maintain his temporary electrical installation.</p> <p>1.17.9 All workmen of the Contractor working in construction site shall wear safety helmets, safety boots and safety belts. The Contractor shall take appropriate insurance cover against accidents for his workmen as well as third party.</p> <p>1.17.10 All the worksites shall be provided with adequate lighting facilities e.g. flood lighting, hand lamps, area lighting etc. by the Contractor for proper working environment during night times.</p> <p>1.17.11 All safety precautions shall be taken for welding and cutting operations as per IS-818.</p> <p>1.17.12 All safety precautions shall be taken for foundation and other excavation marks as per IS-3764.</p> <p>1.18 <u>TAKING DELIVERY & STORAGE</u></p> <p>1.18.1 The Contractor shall arrange issue of all equipment and materials to be erected under the contract from the stores/open yard at site by signing on standard indent forms. After completion of work, detailed auditing of the materials so issued shall be submitted to the Owner.</p> <p>1.18.2 The Contractor shall arrange for proper and safe storage of materials till the same are taken over by the Owner as per terms of the contract. Manufacturer's instructions for preservation shall be strictly followed.</p> <p>1.18.3 All empty containers, packing materials, gunny bags, transport frames and also surplus and unused materials reconciliation prior to completion of contract shall be the property of the Owner and returned to the Owner by the Contractor.</p>		


CONSULTANT : PROCON ENGINEERS

 MAHAGENCO <small>Maharashtra State Power Generation Co. Ltd.</small>	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 5
REV: R0	MASTER SPECIFICATIONS	Page 129 of 555
1.19	<u>SITE WELDING & HEAT TREATMENT</u>	
1.19.1	Welding shall be done in accordance with IS-813, IS-816, IS-9595 & other relevant IS/ International standards and as per instructions of Contractor. Only those welders, who are qualified as per IS-817 for ordinary welds and as per IBR/ASME Section-IX for high pressure welds, shall be employed in the job.	
1.19.2	All welders shall be tested and approved by Engineer before they are actually engaged on the work even though they may possess the requisite certificates. The Owner reserves the right to reject any welder without assigning any reason. The welder identification code as approved by the Engineer shall be stamped by the welder on each joint done by them. The Contractor will be responsible for the periodic renewal, re-testing of the welders as demanded by Owner.	
1.19.3	The Engineer is entitled to stop Contractor's any welder from his work if his work is unsatisfactory for any technical reason or there is a high percentage of the rejection of joints welded by him, which in the opinion of Engineer will adversely affect the quality of welding even though the welder has earlier passed the tests. The welders having passed the tests do not relieve the Contractor from his contractual obligations, to check the performance of the welders.	
1.19.4	All charges for testing of welders including destructive and non- destructive tests if conducted by Owner or by the inspection authority at site shall have to be borne by the Contractor. The necessary test materials and consumables will have to be arranged by the Contractor and all testing facility made available, as required.	
1.19.5	All welded joints shall be subject to acceptance by Engineer. Inspection of welds shall be in accordance with IS-822 or equivalent code.	
1.19.6	Preheating/postheating and stress relieving after welding are part of fabrication and erection work and shall be performed by the Contractor in accordance with the instruction of Engineer. Contractor shall arrange to supply heating equipment with automatic recording devices. Also the Contractor shall have to arrange for the labour, heating elements,	

CONSULTANT : PROCON ENGINEERS

 MAHAGENCO <small>Maharashtra State Power Generation Co. Ltd.</small>	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 5
REV: R0	MASTER SPECIFICATIONS	Page 130 of 555
<p>thermocouples, compensating cables, insulation materials like mineral wools, asbestos cloth, ceramic beads, asbestos rope, etc. required for the heat-treatment and stress relieving works. During pre- heat/stress relieving operations, the temperature shall be measured at one or more points as required by attaching thermocouples and recorded on a continuous printing type recorder. All the record graphs for the heat treatment works carried out shall be got signed by the Engineer prior to the commencement of each cycle and handed over to Engineer on completion. The graphs will be the property of Owner. The Contractor has to provide thermo- chinks temperature recorders, thermocouple attachments, units, graph sheets, etc. required for the job and maintain them in good condition.</p> <p>1.19.7 All electrodes shall be baked and dried in the electric/electrode drying oven to the required temperature and for the period specified by the Engineer before they are used in erection work. The electrodes used shall be as per IS-814, IS-815, IS-1442, IS-7280 and other codes as applicable, and shall be of approved reputed manufacture. The electrodes shall meet the requirement of the pipe material. No electrode manufactured more than 12 months ago and the type covered under certificate issued after conducting tests more than 6 months ago shall be used. All electrodes shall be preserved at works and at site as per manufacturer's recommendations.</p> <p>1.19.8 Oxy-acetylene flame or Exothermic chemical heating for stress relieving is not permitted. Heating shall be by means of electric induction coil or electric resistance coil.</p> <p>1.19.9 It may become necessary to adopt inter layer radiography/MPT/UT depending upon the site/technical requirement necessitating interruptions in continuation of the work and making necessary arrangement for carrying out the above work.</p> <p>1.19.10 Gas tungsten arc welding process (TIG) shall be adopted for all root pass welds except for structural works until 4.75 mm thickness is deposited. Subsequent welding after root pass can be carried out by manual metal arc welding with coated electrodes. For pipes of thickness less than 6 mm, the entire welding has to be carried out by TIG welding.</p> <p>Fillet weld shall be made by shielded metal arc process as per applicable codes.</p>		

CONSULTANT : PROCON ENGINEERS


 MAHAGENCO <small>Maharashtra State Power Generation Co. Ltd.</small>	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 5
REV: R0	MASTER SPECIFICATIONS	Page 131 of 555

However, the Engineer will have the option of changing the method of welding as per site requirement. The method adopted for manual arc welding shall be weaving technique and the width of weaving shall not exceed 1.5 times the diameter of the electrode.


In case of deviation from welding process and electrodes, the Contractor shall take approval of the Owner prior to adoption of same.

- 1.19.11 The root pass for butt joints shall be such as to achieve full penetration with complete fusion of root edges.
- 1.19.12 Each pass shall be cleared and freed of slag before the next pass is deposited.
- 1.19.13 On completion of each run, craters, weld irregularities, slag etc. shall be removed by grinding or chipping.
- 1.19.14 Each layer of welding shall have an even and smooth appearance.
- 1.19.15 Welding sequence shall be adjusted in such a way that distortion due to welding shrinkage is minimised. Further, any movement, shock or vibration during welding shall be avoided to prevent weld cracks.
- 1.19.16 Proper protection of welders and the work shall be taken during periods of rain. No welding shall be carried out when surfaced to be welded are wet from any cause.
- 1.19.17 Following shall be stages of inspection during welding :
- (a) Two pieces to be joined shall be individually checked for the weld edge preparation and profile dimensionally and to the template. Dye penetrant check shall be carried out on edge prepared surfaces at random. The percentage will depend upon on criticality as specified by Engineer.
 - (b) Joint fit up will be a stage of inspection. Misalignment after fit up may vary from 0.3 mm to 1.6 mm depending on outside diameter and thickness.

CONSULTANT : PROCON ENGINEERS


 MAHAGENCO <small>Maharashtra State Power Generation Co. Ltd.</small>	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 5
REV: R0	MASTER SPECIFICATIONS	Page 132 of 555
<p>(c) All joints shall be offered for visual inspection after root run. Subsequent welding should be made only after the approval of root run</p> <p>1.19.18 All welded joints shall be painted with anti-corrosive paint immediately on completion of radiography and stress-relieving.</p> <p>2.0 <u>PROTECTION AND CARE</u></p> <p>2.1 All construction and erection activities for this project are to be carried out in the plant premises with proper protection and care of personnel and equipment. All safety norms have to be followed.</p> <p>2.2 Generator Stator Lifting may be considered by either of the two options as mentioned below :</p> <p>(a) With the help of Turbine room cranes.</p> <p>(b) With the help of separate lifting arrangement to be provided by the Bidder from outside the TG building A-row column before the construction of A-row building wall.</p> <p>Bidder shall indicate necessary price implication between these two modes of Generator Stator lifting arrangement.</p>		

CONSULTANT : PROCON ENGINEERS

 MAHAGENCO <small>Maharashtra State Power Generation Co. Ltd.</small>	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 6
REV: R0	MASTER SPECIFICATIONS	Page 133 of 555

VOLUME II
SECTION – 6
ENGINEERING SERVICES


CONSULTANT : PROCON ENGINEERS

 MAHAGENCO <small>Maharashtra State Power Generation Co. Ltd.</small>	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 6
REV: R0	MASTER SPECIFICATIONS	Page 135 of 555


CONTENT

<u>CLAUSE NO</u>	<u>DESCRIPTION</u>
1.0	GENERAL
2.0	DESIGN COORDINATION MEETING
3.0	GUIDELINES FOR ENGINEERING SERVICES
4.0	OPERATING MANUALS AND MAINTENANCE INSTRUCTIONS
5.0	PLANT HANDBOOK
6.0	CONTRACT STAGE DOCUMENT SUBMISSION AND APPROVAL PROCEDURE
7.0	TENDER STAGE DOCUMENT SUBMISSION


CONSULTANT : PROCON ENGINEERS

 MAHAGENCO <small>Maharashtra State Power Generation Co. Ltd.</small>	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 6
REV: R0	MASTER SPECIFICATIONS	Page 137 of 555
<p>1.0 <u>GENERAL</u></p> <p>1.1 As part of the overall project management activity, the Contractor shall be responsible for proper engineering and co-ordination of activities during various phases of execution of the contract. The Contractor shall identify a person, designated as Project Manager, with whom the Owner, the Consulting Engineer or the Review Consultant shall interact on matters related to engineering as well as execution of the contract. The Project Manager shall be the single-point contact person on behalf of the Contractor and shall be responsible for all engineering co-ordination. The Owner/Consultant/ Review Consultant shall interact with the Project Manager only on all matters of co-ordination between the Owner and the Contractor or on matters involving the Contractor, his manufacturing units and sub-vendors. For the purpose of expediting, the Owner or his representative may sometimes interact with the manufacturing units or sub-vendors of the contractors. However, such interaction will not, under any circumstance, dilute the responsibility of the Contractor to provide a fully engineered and co-ordinated package under this contract.</p> <p>1.2 On finalization of the contract, a procedure for exchange of engineering information will be mutually agreed and finalized between the Owner and the Contractor.</p> <p>2.0 <u>DESIGN COORDINATION MEETING</u></p> <p>The Contractor and his sub-vendors will be called upon to attend design co-ordination meetings with the Engineer, other Contractors and the Consultants of the Owner during the period of execution of contract. The Contractor including his sub-vendors shall attend such meetings at their own cost at Owner's or Consultant's office in Mumbai or at Bhusawal site or at mutually agreed venue as and when required and fully cooperate with such persons and agencies involved during those discussions.</p> <p>3.0 <u>GUIDELINES FOR ENGINEERING SERVICES</u></p> <p>3.1 Prior to commencement of the engineering work as part of design submissions, all aspects of design viz criteria for selection and sizing of all equipment and systems, design margins etc including that for structural steel</p>		


CONSULTANT : PROCON ENGINEERS

 MAHAGENCO <small>Maharashtra State Power Generation Co. Ltd.</small>	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 6
REV: R0	MASTER SPECIFICATIONS	Page 138 of 555
<p>and civil work shall be outlined and these shall form the basis for the detailed engineering work.</p> <p>3.2 Engineering work shall be performed on modern and proven concepts and internationally accepted good engineering practices but fully compatible with the Indian environments. Owner shall have the right to review and approve the engineering work by themselves and/or through consultant and ask for any clarifications and changes/modifications to the work performed by Contractor.</p> <p>3.3 At any stage during the performance of assignment, the Contractor may be required to make certain changes/modification/improvements in design/drawing/other documents which are applicable to any unit of 660 MW individually or severally, which in the opinion of the Owner could result in better improved design, layout, operability, plant availability, maintainability, reliability or economy of the plant and its systems/sub-systems in view of revised and more accurate information/data available at a later date (s) or feedback (s) received during execution/operation of similar units. Such changes/modifications/improvements required could be identified by Owner and/or consultant and mutually discussed. Owner requires the Bidder to incorporate such action in the subject assignment appropriately without any additional cost liability and time implication to the Owner and same shall be within the responsibilities and scope of the Contractor.</p> <p>3.4 During the course of review of detailed engineering stages, it may be essential in the opinion of Owner to obtain certain classified data for review purposes only. In case Owner so desires, the Bidder shall submit such data to Owner.</p> <p>3.5 During the course of review of detailed engineering, it may be essential in Owner's opinion to obtain data and information on similar equipment and plants engineered by the Bidder. In case Owner so desires, the Bidder shall submit such data and information to the Owner.</p> <p>3.6 It is not the intent to give details of every single task covered in the total engineering work to be carried out by Contractor, however, all engineering work required for the satisfactory completion of the plant/systems as</p>		


CONSULTANT : PROCON ENGINEERS

 MAHAGENCO <small>Maharashtra State Power Generation Co. Ltd.</small>	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 6
REV: R0	MASTER SPECIFICATIONS	Page 139 of 555
<p>specified shall be carried out by the Contractor. Broadly, the following are the minimum requirements in respect of scope of major items of work:</p> <p>4.6.1 Preparation, updating and finalisation of scheme drawings, control and interlock diagrams, detailed and fully dimensioned layout drawings (plant layout and equipment layout detailed plan, elevation and cross-sectional drawings at different elevations/ floor levels) covering all mechanical, electrical, C&I, civil and structural items, equipment, systems and facilities. Drawings and Schedules prepared by the Contractor from time to time, as detailed designs are developed, shall be submitted for Owner's/ Consultant's approval before the work is taken up. Revisions, corrections, additions to drawings and schedules shall not be considered to change the scope of work.</p> <p>4.6.2 Preparation of detailed technical specifications including data sheets, tender drawings and bill of material for all bought out items and also finalisation of corresponding sub-contractors.</p> <p>4.6.3 Review of sub-contractor's data, drawings, design calculations, schedules, bill of materials, instruction manuals etc. for all equipment, before forwarding them to Owner /Consultant for approval.</p> <p>4.6.4 Preparation of civil construction drawings for all equipment showing foundation details and full details regarding equipment loads, floor openings, details of embedments etc required for preparation of civil construction drawings and also as referred at relevant sections of Scope, Terminal Points & Exclusions. These documents shall be preceded by appropriate design calculations, static and dynamic analysis, as necessary.</p> <p>4.6.5 Preparation and finalisation of process piping and instrumentation diagrams and schematics, complete in all respects for all systems/packages of the power plant.</p> <p>4.6.6 Preparation of consolidated schedules and bills of materials, including line numbers, tag numbers, source of supply, service conditions, specifications, materials, types and connections details, quantities for items of the plant including dampers, steam traps, strainers, instrumentations, ducting.</p> <p>4.6.7 Sizing of all piping and equipment as per the stipulated design criteria, carrying out the flexibility analysis/dynamic analysis as necessary, hangers & support engineering.</p>		


CONSULTANT : PROCON ENGINEERS

 MAHAGENCO <small>Maharashtra State Power Generation Co. Ltd.</small>	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 6
REV: R0	MASTER SPECIFICATIONS	Page 140 of 555
4.6.8	Final revision of all documents including preparation and compilation of Instruction Manuals for installation, commissioning, operation and maintenance for all equipment and systems. Refer clause 5.0 for the specific requirement in this regard.	
4.6.9	Certification and submission of final as-built drawings for all areas.	
4.6.10	Preparation and compilation of all drawings, schedules and instructions which may be required at site, whether separately mentioned or not.	
4.6.11	All erection and assembly drawings which may be required at site.	
4.6.12	For all bought out item packages, the Contractor shall provide complete material/ component list along with detail specification, drawings, component part number etc during detail engineering stage prior to final approval. Such approved drawing / document shall be made available at site in adequate number prior to commencement of work. Moreover, such document/drawing shall be provided in soft form (CD).	
4.6.13	Preparation of necessary documentation, design calculations etc required for submission to statutory authorities like IBR, Chief Electric Inspector etc.	
4.0	<u>OPERATING MANUALS AND MAINTENANCE INSTRUCTIONS</u>	
4.1	The Contractor shall provide all necessary maintenance manuals and operating instructions at least six (6) months before the time of commissioning and before taking over of the plant and equipment. The instruction manual shall be submitted in the form of one (1) soft copy in CD and 15 hard copies.	
4.2	The information provided, which shall be contained in loose leaf stiff backed covers, shall include :	
4.2.1	A complete inventory of all main items of plant, with identification details.	
4.2.2	Service manuals for all plant and equipment giving full descriptions of the main items and auxiliary items such as power packs, hydraulic equipment, actuators, lubricating pumps etc.	


CONSULTANT : PROCON ENGINEERS

 MAHAGENCO <small>Maharashtra State Power Generation Co. Ltd.</small>	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 6
REV: R0	MASTER SPECIFICATIONS	Page 141 of 555
4.2.3	A separate electrical manual covering items such as switchgear, cabling, instrumentation, controls, cabling layouts and wiring diagrams.	
4.2.4	A schedule of recommendations for routine maintenance of all electrical and mechanical equipment, recommended inspection point, information on detection, cause and rectifications of troubles & faults.	
4.2.5	A lubrication schedule with all necessary drawings, diagrams to identify the lubrication points.	
4.2.6	Manufacturer's literature.	
4.3	The instruction manual shall be subject to the approval of Owner.	
4.4	The contractor shall submit the complete equipment list. The list shall be updated every three (3) months.	
5.0	<p><u>PLANT HANDBOOK</u></p> <p>The Contractor shall submit to the Engineer, a preliminary plant handbook preferably in A-4 size sheets which shall contain the design and performance data of various plant, equipment and systems, covering the complete project including single line flow diagrams, within twenty four (24) months from the date of his acceptance of the Letter of Award. The final plant handbook complete in all respects shall be submitted by the Contractor six (6) months before start-up and commissioning activities. The plant handbook shall be submitted in the form of two (2) soft copy in CD/DVD (one to Owner and one to Consultant) and twenty five (25) hard copies in decent bound forms.</p>	
6.0	<p><u>CONTRACT STAGE DOCUMENT SUBMISSION AND APPROVAL PROCEDURE</u></p>	
6.1	<p>Within fifteen (15) days of issue of Letter of Award (LOA) by the Owner, the Contractor shall furnish a schedule of drawings and design document to be submitted by him to the Owner/Engineer indicating dates against each document.</p> <p>The documents shall be divided into two categories:</p>	


CONSULTANT : PROCON ENGINEERS

 MAHAGENCO <small>Maharashtra State Power Generation Co. Ltd.</small>	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 6
REV: R0	MASTER SPECIFICATIONS	Page 142 of 555
<p>(a) for approval and</p> <p>(b) for information/further engineering and co-ordination by the Owner.</p> <p>This document submission schedule shall require approval by the Owner/Engineer.</p> <p>6.2 All contract documents shall be marked, without fail, with the name of the Owner, the Project, the specification title and number and the unit designation.</p> <p>All dimensions shall be in metric units.</p> <p>All notes, markings etc. shall be in English.</p> <p>6.3 Documents/Drawings, submitted during tender stage, shall be revalidated or revised as required and submitted as certified contract document for approval/information of the Owner/Engineer.</p> <p>6.4 Unless specified otherwise, the following categories of documents/drawings would require approval of the Owner/Consultant:</p> <p>6.4.1 List of sub-vendors (from Owner only)</p> <p>6.4.2 System scheme and instrumentation diagrams</p> <p>6.4.3 Design basis justifying selection of equipment & process parameters where not specified in the Contract</p> <p>6.4.4 Equipment data sheets and general arrangement drawings</p> <p>6.4.5 Predicted performance curves of equipment**</p> <p>6.4.6 Materials of construction</p> <p>6.4.7 Layout drawings</p>		


CONSULTANT : PROCON ENGINEERS

 MAHAGENCO <small>Maharashtra State Power Generation Co. Ltd.</small>	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 6
REV: R0	MASTER SPECIFICATIONS	Page 143 of 555
6.4.8	Operation logic diagrams	
6.4.9	Typical control circuit	
6.4.10	Drawings of Instrumentation and Control	
6.4.11	Any deviation from contract (by Owner)	
	** For all critical equipments (boiler and turbine auxiliaries etc), submission of this data shall be mandatory for approval of equipment data sheets / GA drawings.	
6.5	Unless specified otherwise, the following categories of documents/ drawings would be treated for information/further engineering by the Owner/Engineer. The Contractor shall, however, incorporate all additional information and clarifications in these documents/ drawings as and when desired by the Owner/Engineer.	
6.5.1	Equipment foundation drawings	
6.5.2	Equipment cross-section drawings, product literature etc which are of proprietary nature	
6.5.3	Various bills of quantity, schedules etc	
6.5.4	Piping fabrication drawings, isometrics etc	
6.5.5	Panel wiring diagrams	
6.5.6	Instruction/Operation manuals	
6.5.7	Service manuals and troubleshooting guide for C & I system including field instruments	
6.5.8	Cable schedule and interconnection chart	
6.5.9	Drive/feeder wise control scheme showing all external interfaces.	


CONSULTANT : PROCON ENGINEERS

 MAHAGENCO <small>Maharashtra State Power Generation Co. Ltd.</small>	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 6
REV: R0	MASTER SPECIFICATIONS	Page 144 of 555
<p>In essence, the Contractor is solely responsible for corrections and adequacy of design & engineering for documents under this category.</p> <p>6.6 Upon review, the Owner/Engineer shall put his remarks and one of the following action stamps on the drawing/document:</p> <p>6.6.1 Approved</p> <p>6.6.2 Approved except as noted, forward final drawing</p> <p>6.6.3 Approved except as noted, resubmission required</p> <p>6.6.4 Disapproved</p> <p>6.6.5 For information/reference only</p> <p>For action stamps in category (c) & (d), documents must be resubmitted for review by the Owner / Engineer. For action stamp in category (b), further review by Owner / Engineer would not be necessary provided the Contractor agrees & incorporates the minor comments made on the document.</p> <p>Except for action stamp under category (c) & (d), the Contractor can proceed with manufacturing and other sequential activities for those areas of a drawing/document which do not have any review comment by the Owner/Engineer.</p> <p>The Owner/Engineer may accord approval in category (c) or (d) in more than one submission of a document till he is satisfied that the intent of the specification has been fully complied with. The Contractor shall be responsible for delay in such cases and no extension of time shall ordinarily be allowed on such grounds. Approval of contract documents by the Owner/Engineer shall not relieve the Contractor of his responsibility for any errors and fulfillment of contract requirements.</p> <p>The Contractor's work shall be in strict accordance with the finally approved drawings and no deviation shall be permitted without written approval of the Owner/Engineer.</p>		


CONSULTANT : PROCON ENGINEERS

 MAHAGENCO <small>Maharashtra State Power Generation Co. Ltd.</small>	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 6
REV: R0	MASTER SPECIFICATIONS	Page 145 of 555
6.7	Except key plan/general yard plan, any layout drawing requiring scrutiny shall not be drawn to a scale less than 1:50.	
6.8	For review by the Consulting Engineer, the Contractor shall furnish three (3) prints of each drawing. Two (2) prints of such submission shall also be sent to the Owner. After review, one (1) stamped print will be returned to the Contractor. Upon action under category (a) or (e), the Contractor shall directly distribute the documents to the various offices of the Owner and other agencies in number of copies as specified in the contract document. Such distribution copies shall be marked with the reference and date of the letter by which the Owner/Engineer has accorded his final approval. Penal action shall be taken against the Contractor for any unauthorised revision in the drawings so distributed from the drawings approved by the Owner/Engineer. The contractor shall furnish three (3) CD's of all as built/final drawings for Owner / Consultant site.	
6.9	In case of contradiction between the stipulations above and those stated elsewhere in the specification, the stipulations herein shall prevail.	
6.10	For details of documentation for Civil, Structural and Architectural works, Volume VI may be referred.	
7.0	<u>TENDER STAGE DOCUMENT SUBMISSION</u>	
8.1	The Bidder shall submit along with his bid all documents/drawings as requested in respective specifications. The documents shall include but not be limited to the following:	
8.1.1	All Bid proposal sheets duly filled up. (The data mentioned in Bid proposal sheets is minimum required only. The Bidder shall submit the additional data asked for at any later stage).	
8.1.2	Detailed experience list and financial resources of the prime bidder, his collaborators/ associates in this bid as well as the sub-vendors proposed.	
8.1.3	Scheme drawings indicating scope of supply and service as offered by the Bidder indicating clearly exclusions, if any.	

CONSULTANT : PROCON ENGINEERS


 MAHAGENCO <small>Maharashtra State Power Generation Co. Ltd.</small>	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 6
REV: R0	MASTER SPECIFICATIONS	Page 146 of 555
8.1.4	List of terminal points of the package offered together with quality and quantity of various input (i.e. water, air, electricity etc.) as required from the Owner at such interfaces.	
8.1.5	Equipment GA, Layout, Design Calculations, interlock and other write-up, catalogues/ literature etc as required for clear understanding of the bid submitted.	
8.1.6	L-1 network indicating target dates for intermediate milestones and final commissioning of equipment supplied. This network shall be supplemented by a detailed write-up on proposal procedure of project implementation, deployment schedule for Key personnel with their bio-data, schedule of construction machinery etc.	
8.1.7	List of suppliers for all bought out items.	

CONSULTANT : PROCON ENGINEERS

 MAHAGENCO <small>Maharashtra State Power Generation Co. Ltd.</small>	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 7
REV: R0	MASTER SPECIFICATIONS	Page 147 of 555

VOLUME II
SECTION – 7
QUALITY ASSURANCE REQUIREMENTS


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 MAHAGENCO <small>Maharashtra State Power Generation Co. Ltd.</small>	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 7
REV: R0	MASTER SPECIFICATIONS	Page 149 of 555

CONTENT

<u>CLAUSE NO</u>	<u>DESCRIPTION</u>
1.0	QUALITY ASSURANCE PROGRAMME
2.0	GENERAL REQUIREMENTS-QUALITY ASSURANCE
3.0	QUALITY ASSURANCE DOCUMENTS
4.0	INSPECTION, TESTING & INSPECTION CERTIFICATES
	<u>ENCLOSURES</u>
ANNEXURE-A	FORMAT OF QUALITY ASSURANCE PROGRAMME
ANNEXURE-B	FIELD WELDING SCHEDULE

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 MAHAGENCO <small>Maharashtra State Power Generation Co. Ltd.</small>	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 7
REV: R0	MASTER SPECIFICATIONS	Page 151 of 555

1.0 QUALITY ASSURANCE PROGRAMME

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

1.1.1 His organisation structure for the management and implementation of the proposed quality assurance programme.

1.1.2 Documentation control system.

1.1.3 Qualification data for Bidder's key personnel.

1.1.4 The procedure for purchase of materials, parts, components and selection of Sub-contractor's services including vendor analysis, source inspection, incoming raw-material inspection, verification of materials purchased etc.

1.1.5 System for shop manufacturing and site erection control including process controls and fabrication and assembly controls.

1.1.6 Control of non-conforming items and system for corrective actions.

1.1.7 Inspection and test procedure both for manufacture and all site related works.


1.1.8 Control of calibration and testing of measuring and testing equipments.

1.1.9 System for quality audit.


1.1.10 System for indication and appraisal of inspection status.

1.1.11 System for authorising of release of manufactured product to the Owner.


CONSULTANT : PROCON ENGINEERS

 MAHAGENCO <small>Maharashtra State Power Generation Co. Ltd.</small>	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 7
REV: R0	MASTER SPECIFICATIONS	Page 152 of 555
1.1.12	System for handling storage and delivery.	
1.1.13	System for maintenance of records.	
1.1.14	Furnishing of quality plans for manufacturing and field activities, detailing out the specific quality control procedure adopted for controlling the quality characteristics relevant to each item of equipment/component.	
2.0	<u>GENERAL REQUIREMENTS - QUALITY ASSURANCE</u>	
2.1	All materials, components and equipment covered under this specification shall be procured, manufactured, erected, commissioned and tested at all the stages, as per a comprehensive Quality Assurance Programme. An indicative programme of inspection /tests to be carried out by the Contractor 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 Contractor's responsibility to draw up and implement such programme duly approved by the Owner/Consultant. The detailed Quality Plans for manufacturing and field activities shall be drawn up by the Bidder, separately in the format attached at Annexures and shall be submitted to Owner/ Authorised representative for approval. Schedule of finalisation of such quality plans will be finalised before award.	
2.2	Manufacturing Quality Plan shall 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 Contractor's Quality Control organisation, the relevant reference documents and standards, acceptance norms, inspection documents raised etc, during all stages of materials procurement, manufacture, assembly and final testing/performance testing.	
2.3	Field Quality Plans shall detail out for all the equipment, the quality practices and procedures etc to be followed by the Contractor's site Quality Control organisation, during various stages of site activities from receipt of materials/equipment at site.	
2.4	The Bidder shall also furnish copies of the reference documents / plant standards / acceptance norms/tests and inspection procedure etc as referred	


CONSULTANT : PROCON ENGINEERS

 MAHAGENCO <small>Maharashtra State Power Generation Co. Ltd.</small>	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 7
REV: R0	MASTER SPECIFICATIONS	Page 153 of 555
<p>in Quality Plans along with Quality Plans. These Quality plans and reference documents/standards etc shall be subject to Owner's approval without which manufacture shall not proceed. These approved documents shall form a part of the contract. In these approved quality plans, Owner/Authorised representative shall identify Customer Hold Points (CHP), test/ checks which shall be carried out in presence of the Owner's Engineer or his authorised representative and beyond which the work will not proceed without consent of Owner/Authorised representative in writing. All deviations to this specification, approved quality plans and applicable standards must be documented and referred to Owner/Authorised representative for approval and disposal.</p> <p>2.5 No material shall be despatched from the manufacturer's works before the same is accepted subsequent to pre-despatch final inspection including verification of records of all previous tests/inspections by Owner's Engineer/Authorised representative and duly authorised for despatch issuance of Material Despatch Clearance Certificate (MDCC).</p> <p>2.6 All materials used or supplied shall be accompanied by valid and approved materials certificates and tests and inspection report. These certificates and reports shall indicate the sheet numbers or other such acceptable identification numbers of the material. The material certified shall also have the identification details stamped on it.</p> <p>2.7 Castings and forgings used for construction shall be of tested quality. Details of results of chemical analysis, heat treatment record and mechanical property test results shall be furnished.</p> <p>2.8 All welding and brazing shall be carried out as per procedure drawn and qualified in accordance with requirements of ASME Section-IX/BS-4870 or other International equivalent standard acceptable to the Owner.</p> <p>All brazers, welders etc employed on any part of the contract at Contractor's / Sub-Contractor's works or at site shall be qualified as per ASME Section-IX or BS- 4871 or equivalent international standard approved by the Owner. Such qualification tests shall be conducted in presence of Owner/his authorised representative.</p>		


CONSULTANT : PROCON ENGINEERS

 MAHAGENCO <small>Maharashtra State Power Generation Co. Ltd.</small>	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 7
REV: R0	MASTER SPECIFICATIONS	Page 154 of 555
	<p>For welding of pressure parts and high pressure piping, the requirements of IBR shall also be complied with.</p> <p>2.9 All Non-Destructive Tests (NDT) shall be carried out in accordance with approved International Standard. The NDT operator shall be qualified as per SNT-TC-IA (of American Society of non- destructive examination). Results of NDT shall be properly recorded and submitted for approval.</p> <p>2.10 List of all the sub-vendors proposed by the Contractor for procurement of major bought out items including castings, forgings, semi-finished and finished components/ equipment shall be drawn up by the Contractor and finalised with the Owner. Such list shall be subject to Owner's approval. Quality Plans of the successful vendors shall be discussed, finalised and approved by the Owner/Authorised representative and form part of the Purchase Order between the Contractor and the Vendor.</p> <p>2.11 All the purchase specifications for the major bought-out items, list of which shall be drawn up by the Contractor and finalised with the Owner shall be furnished to the Owner for comments and subsequent approval before orders are placed.</p> <p>Owner reserves the right to carry out quality audit and quality surveillance of the systems and procedures of the Contractor's or their sub-vendor's quality management and control activities. The Contractor shall provide all necessary assistance to enable the Owner carry out such audit and surveillance.</p> <p>Quality audit/approval of the results of tests and inspection will not prejudice the right of the Owner to reject equipment not giving the desired performance after erection and shall not in no way limit the liabilities and responsibilities of the Contractor in earning satisfactory performance of equipment as per specification.</p> <p>2.12 Quality requirements for main equipment shall equally apply for spares and replacement items.</p> <p>2.13 Repair/rectification procedures to be adopted to make any job acceptable shall be subject to the approval of the Owner.</p>	


CONSULTANT : PROCON ENGINEERS

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 7
REV: R0	MASTER SPECIFICATIONS	Page 155 of 555
2.14	For quality assurance of all civil works refer to the specifications for civil works.	
3.0	<u>QUALITY ASSURANCE DOCUMENTS</u>	
3.1	The Contractor shall be required to submit two (2) copies and two (2) sets of softcopies in the form of CD of the following Quality Assurance documents within three (3) weeks after despatch of the equipment :	
3.1.1	Material mill test reports on components as specified by the specification.	
3.1.2	The inspection plan with verification, inspection plan check points, verification sketches, if used and methods used to verify that the inspection and testing points in the inspection plan were performed satisfactorily.	
3.1.3	Non-destructive examination results/reports including radiography interpretation reports.	
3.1.4	Factory tests results for testing required as per applicable codes and standards referred in the specification.	
3.1.5	Welder identification list incorporating welder's and welding operator's qualification procedure and welding identification symbols.	
3.1.6	Sketches and drawings used for indicating the method of traceability of the radiographs to the location on the equipment.	
3.1.7	Stress relief time temperature charts.	
3.1.8	Inspection reports duly signed by QA personnel of the Owner and Contractor for the agreed inspection hold points. During the course of inspection, the following shall also be recorded :	
	(a) When some important repair work is involved to make the job acceptable.	
	(b) The repair work remains part of the accepted product quality.	


CONSULTANT : PROCON ENGINEERS

 MAHAGENCO <small>Maharashtra State Power Generation Co. Ltd.</small>	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 7
REV: R0	MASTER SPECIFICATIONS	Page 156 of 555
3.2	Letter of conformity certifying that the requirement is in compliance with finalised specification requirements.	
4.0	<u>INSPECTION, TESTING AND INSPECTION CERTIFICATES</u>	
4.1	The Engineer, his duly authorised 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 Contractor shall obtain for the Engineer and for his duly authorised representative permission to inspect as if the works were manufactured or assembled on the Contractor's own premises or works.	
4.2	The Contractor shall give the Engineer/Inspector fifteen (15) days written notice of any material being ready for testing. Such tests shall be to the Contractor's account except for the expenses of the Inspector. The Engineer/Inspector, unless the witnessing of the tests is virtually waived, shall attend such tests within fifteen (15) days of the date on which the equipment is notified as being ready for test/inspection failing which the Contractor 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 Six (6) copies of test reports.	
4.3	The Engineer or Inspector shall within fifteen (15) days from the date of Inspection as defined herein give notice in writing to the Contractor, on any objection to any drawings and all or any equipment and workmanship which is in his opinion not in accordance with the contract. The Contractor shall give due consideration to such objections and shall either make modifications that may be necessary to meet the said objections or shall confirm in writing to the Engineer/Inspector giving reasons therein, that no modifications are necessary to comply with the contract.	
4.4	When the factory tests have been completed at the Contractor's or sub-contractor's works, the Engineer/Inspector shall issue a certificate to this effect within fifteen (15) days after completion of tests but if the tests are not witnessed by the Engineer/ Inspectors, the certificate shall be issued within fifteen (15) days of the receipt of the Contractor's test certificate by the Engineer/Inspector. Failure of the Engineer/ Inspector to issue such a	

CONSULTANT : PROCON ENGINEERS

 MAHAGENCO <small>Maharashtra State Power Generation Co. Ltd.</small>	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 7
REV: R0	MASTER SPECIFICATIONS	Page 157 of 555
<p>certificate shall not prevent the Contractor 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.</p> <p>4.5 In all cases where the contract provides for tests whether at the premises or works of the Contractor or any sub-contractor, the Contractor, except where otherwise specified shall provide free of charge such items as labour, materials, electricity, fuel, water, stores, apparatus and instruments as may be reasonably demanded by the Engineer/ Inspector or his authorised representatives to carry out effectively such tests on the equipment in accordance with the Contractor and shall give facilities to the Engineer/ Inspector or to his authorised representative to accomplish testing.</p> <p>4.6 To facilitate advance planning of inspection in addition to giving inspection notice, the Contractor shall furnish quarterly inspection programme indicating schedule dates of inspection at customer hold point and final inspection stages. Updated quarterly inspection plans shall be made for each three consecutive months and shall be furnished before beginning of each calendar month.</p>		

CONSULTANT : PROCON ENGINEERS


 MAHAGENCO <small>Maharashtra State Power Generation Co. Ltd.</small>	MAHARASHTRA STATE POWER GENERATION CO. LTD.			Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1			Section – 7
	MASTER SPECIFICATIONS			Page 159 of 555
REV: R0				

FORMAT OF QUALITY ASSURANCE PROGRAMME

ANNEXURE – A

Sl. No.	Name of Company/ Contractor	NAME OF CONTRACT PACKAGE	QUALITY PLAN FOR							Agency	Remark
			Package No. : _____	Q.P No. : _____	Reference Document	Acceptance Norm	Format of Record	Agency	Remark		
			Package No. : _____	Q.P No. : _____	Reference Document	Acceptance Norm	Format of Record	Agency	Remark		
			Contractor : _____	Rev. No. : _____	Reference Document	Acceptance Norm	Format of Record	Agency	Remark		
			Component & Operation	Class	Type of Check	Quantum of Check	Acceptance Norm	Format of Record	Agency	Remark	

CONSULTANT : PROCON ENGINEERS

 MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II	
	Section - 7	
	Page 161 of 555	
REV: R0	MASTER SPECIFICATIONS	

BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1


FIELD WELDING SCHEDULE

ANNEXURE - B


PROJECT : :
 CONTRACTOR : :
 PACKAGE : :
 SYSTEM : :

SI No	Drawing No. for Weld Locations & Identification mark	Description of parts to be welded	Material specification	Dimensions	Process of Welding	Type of Weld	Electrode Filler Specification	WPS No.	Minimum Preheat Temperature	Heat Treatment [Holding Time in secs]	NDT Method Quantum	NDT Specification Number	Acceptance Norm Ref.	Remarks
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 <p>MAHAGENCO Maharashtra State Power Generation Co. Ltd.</p>	<p align="center">MAHARASHTRA STATE POWER GENERATION CO. LTD.</p> <p align="center">BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1</p>	<p align="right">Volume: II</p>
<p>REV: R0</p>	<p align="center">MASTER SPECIFICATIONS</p>	<p align="right">Section – 7</p>
<p>The Field Welding schedule shall be submitted for:</p> <ul style="list-style-type: none"> (a) Pressure Parts (b) Tanks/Vessels (c) Piping (d) Heavy/Important Structural Steel (e) Heat Exchangers (f) Bus Ducts 		

CONSULTANT : PROCON ENGINEERS


 MAHAGENCO <small>Maharashtra State Power Generation Co. Ltd.</small>	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 8
REV: R0	MASTER SPECIFICATIONS	Page 163 of 555

VOLUME II
SECTION – 8
PERFORMANCE GUARANTEES SCHEDULES


CONSULTANT : PROCON ENGINEERS

 MAHAGENCO <small>Maharashtra State Power Generation Co. Ltd.</small>	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 8
REV: R0	MASTER SPECIFICATIONS	Page 165 of 555
<p>1.0 <u>PERFORMANCE GUARANTEES</u></p> <p>1.1 <u>GENERAL REQUIREMENTS</u></p> <p>1.1.1 The equipment shall meet the ratings and performance requirements stipulated for various equipments. The guaranteed performance parameters shall be without any tolerance values and all margins required for instrument inaccuracies and other uncertainties shall be deemed to have been included in the guaranteed figures.</p> <p>1.1.2 All the guarantees shall be demonstrated during functional guarantee/ acceptance test. The various tests which are to be carried out during performance guarantee/ acceptance test are listed in this Sub-section. The guarantee tests shall be conducted at site.</p> <p>1.1.3 All instruments required for performance testing shall be of the type and accuracy required by the code and prior to the test, these shall be calibrated in an independent test Institute. The protecting tubes, pressure connections and other test connections required for conducting guarantee test shall conform to the relevant codes.</p> <p>1.1.4 Tools and tackles, thermowell (both screwed and welded) instruments/ devices including flow devices, matching flanges, impulse piping & valves etc and any special equipment, required for the successful completion of the tests, shall be provided by the bidder.</p> <p>1.1.5 All cost associated with the tests shall be included in the bid price.</p> <p>1.1.6 Detailed Performance/Capability Test procedures containing the following shall be furnished:</p> <p style="padding-left: 40px;">(a) Objective of the test.</p> <p style="padding-left: 40px;">(b) Various guaranteed parameters & tests as per contract.</p> <p style="padding-left: 40px;">(c) Method of conductance of test and test code.</p> <p style="padding-left: 40px;">(d) Duration of test, frequency of readings & number of test runs.</p>		


CONSULTANT : PROCON ENGINEERS

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 8
REV: R0	MASTER SPECIFICATIONS	Page 166 of 555
<p>(e) Method of calculation.</p> <p>(f) Correction curves</p> <p>(g) Instrument list consisting of range, accuracy, least count and location of instruments.</p> <p>(h) Scheme showing measurement points.</p> <p>(i) Sample calculation.</p> <p>(j) Acceptance criteria.</p> <p>(k) Any other information required for conducting the test.</p> <p>1.1.7 The test procedure for all conditions shall be furnished one year before the scheduled commissioning date. Heat balance diagram shall be furnished for all test conditions.</p> <p>1.1.8 In case during performance guarantee test(s), it is found that the equipment/ system has failed to meet the guarantees, all necessary modifications and/or replacements shall be carried out to make the equipment/system comply with the guaranteed requirements & the same shall be demonstrated by conducting another performance guarantee test. However, if the specified performance guarantee(s) are still not met but are achieved within the Acceptable Shortfall Limit specified, the equipment will be accepted after levying liquidated damages. If, however, the demonstrated guarantee(s) continue to be more than the stipulated Acceptable Shortfall Limit, even after the above modifications/replacements within ninety (90) days or a reasonable period allowed, after the tests have been completed, the Owner will have the right to either of the following :</p> <p>(I) For Category-I Guarantees</p> <p>Reject the equipment/system/plant and recover from the contractor.</p> <p>OR</p>		


CONSULTANT : PROCON ENGINEERS

 MAHAGENCO <small>Maharashtra State Power Generation Co. Ltd.</small>	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 8
REV: R0	MASTER SPECIFICATIONS	Page 167 of 555
<p>Accept the equipment/system/plant after levying Liquidated Damages</p> <p>(II) For Category-II Guarantees</p> <p>Reject the equipment/system/plant and recover from the Contractor the payments already made. The performance guarantees under this category shall be called 'Category II' Guarantees. Conformance to the performance requirements under Category-II is mandatory.</p> <p>(III) For Category-III Guarantees</p> <p>Reject the equipment/system/plant and recover from the Contractor.</p> <p>OR</p> <p>Accept the equipment/system after assessing the deficiency in respect of the various ratings, performance parameters and capabilities and recover from the contract price an amount equivalent to the damages as determined by the Owner. Such damages shall however be limited to the cost of replacement of the equipment(s)/system(s), replacement of which shall remove the deficiency so as to achieve the guaranteed performance.</p> <p>The P. G. test shall be carried out within four (4) months after first synchronisation. If the P.G. test is conducted beyond four (4) months from first synchronisation due to any reason attributable to Owner, the deterioration in performance shall be increased by the following amount for each month or part of the month by which the period between the first synchronisation and PG test exceeds four (4) months.</p> <p>(i) 0.1 % for the following eight (8) months</p> <p>(ii) 0.06 % for the period following thereafter.</p>		


CONSULTANT : PROCON ENGINEERS

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 8
REV: R0	MASTER SPECIFICATIONS	Page 168 of 555
1.2	<u>GUARANTEES UNDER CATEGORY- I</u> The performance guarantees which attract liquidated damages are as follows:	
1.2.1	Efficiency of the steam generator at 100% TMCR while firing the design coal at rated steam parameters, rated coal fineness and rated excess air.	
1.2.2	Steam generating capacity in T/hr of steam at rated steam parameters at superheater outlet (with any combination of mills working) with the coal being fired from within the range specified.	
1.2.3	Guaranteed Turbine Cycle Heat rate in kCal/kWh under rated steam conditions, design condenser pressure with zero make up at 100% and 80 % rated load. A weightage of 4 (four) and 3 (three) shall be considered for 100 % and 80 % heat rate values for arriving at the net heat rate.	
1.2.4	Guaranteed Continuous TG output under rated steam conditions, design condenser pressure with zero make-up. Note: The condenser pressure while conducting the guarantee tests shall be measured at 300 mm above the top row of condenser tubes.	
1.2.5	The total auxiliary power consumption for all specified plant auxiliaries (as listed in Volume- I, Section -3) required for continuous unit operation at 100% of rated load under rated steam conditions and at design condenser pressure with 1% make-up.	
1.2.6	The particulate emission from ESP as specified.	
1.3	<u>GUARANTEES UNDER CATEGORY-II</u> It shall be guaranteed that maximum total NOx emission from the unit will not be more than 260 grams of NOx per giga joule of heat input to the boiler during the entire operating range of steam generator for the range of coals specified.	


CONSULTANT : PROCON ENGINEERS

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 8
REV: R0	MASTER SPECIFICATIONS	Page 169 of 555
1.4	<u>GUARANTEES UNDER CATEGORY-III</u> The parameters/capabilities to be demonstrated for various systems/ equipments shall include but not be limited to the following:	
1.4.1	Steam generator parameters with Blended Coal : The steam generator shall be run continuously for 168 (one hundred and sixty eight) hours with blended coal at 70 : 30 ratio between domestic coal and imported coal for demonstration of stable operation at rated parameters.	
1.4.2	Steam turbine generator rated capacity at 89 mm Hg Condenser pressure.	
1.4.3	Run back capabilities. The automatic runback capability of the unit (boiler- turbine-generator) on loss of critical auxiliary equipment (such as tripping of one ID/FD/PA fan/airheater/BFP/ CEP etc) shall be demonstrated ensuring smooth and stable runback operation.	
1.4.4	Rate of change of load and sudden load change withstand capability The capability of boiler-turbine-generator in regard to ramp rate and step load change as specified shall be demonstrated.	
1.4.5	Mill capacity at rated fineness Performance testing shall be done on coal mills toward establishing its capacity specified at the rated fineness, applying corrections for the variation in coal characteristics i.e. HGI (Hardgrove Grindability Index) and total moisture. Capacity demonstration test shall be carried out for the following conditions:	
	(a) Capacity output of one coal pulverizer (of Owner's choice) shall be demonstrated for establishing its capacity at 100% mill loading, at rated pulverized coal fineness with specified design coal with new set of grinding elements.	


CONSULTANT : PROCON ENGINEERS

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II				
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 8				
REV: R0	MASTER SPECIFICATIONS	Page 170 of 555				
<p>(b) Capacity output shall also be demonstrated on four coal pulverizers (of Owner's choice) of Steam Generator, not less than the 90% of guaranteed value of (a) above, at 100% mill loading with the originally installed grinding elements in nearly worn-out condition or at the end of guaranteed wear life of grinding elements, whichever is earlier.</p> <p>Capacity test as mentioned at (a) & (b) above shall be demonstrated at the following conditions occurring simultaneously during testing:</p> <table border="0"> <tr> <td>Coal fineness</td> <td>Not less than 70% through 200 mesh and not less than 99% through 50 mesh screen</td> </tr> <tr> <td>Test Coal</td> <td>Any available coal from the specified range</td> </tr> </table> <p>In case the guaranteed capacity of coal pulverizers as stated above are successfully demonstrated, remaining coal pulverizers will also be considered to have successfully met the above capacity guarantee requirement. However, in the event of any of the coal pulverizers not meeting the guarantee test, all the coal pulverizers will have to be tested to demonstrate guaranteed capacity.</p> <p>1.4.6 Life of mill wear parts</p> <p>Life of mill wear parts, in hours of operation, for the entire range of coal characteristics specified.</p> <p>1.4.7 No fuel oil support above 30% BMCR load</p> <p>It shall be guaranteed that oil support for flame stabilization shall not be required beyond 30% of BMCR load when firing the coals from the range identified. It shall be demonstrated that with any combination of mills/ adjacent mills in service, the steam generator does not require any oil firing for stable and efficient boiler operation at and above 30% BMCR loads.</p>			Coal fineness	Not less than 70% through 200 mesh and not less than 99% through 50 mesh screen	Test Coal	Any available coal from the specified range
Coal fineness	Not less than 70% through 200 mesh and not less than 99% through 50 mesh screen					
Test Coal	Any available coal from the specified range					


CONSULTANT : PROCON ENGINEERS

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 8
REV: R0	MASTER SPECIFICATIONS	Page 171 of 555
1.4.8	<p>Performance characteristics of fans</p> <p>The performance characteristics of FD, ID and PA fans including their capacity, head developed, power consumption and margins envisaged on capacity and head shall be demonstrated.</p>	
1.4.9	<p>Equal load sharing of pumps/fans while running in parallel shall be demonstrated.</p>	
1.4.10	<p>Steam temperature imbalance</p> <p>It shall be demonstrated at SH and RH outlets (in case of more than one outlet) that the temperature imbalance between the outlets does not exceed 10^o C under all loads including transients.</p>	
1.4.11	<p>It shall be guaranteed and demonstrated that the spray water flow to SH attemperation system does not exceed the value considered for design (to be indicated in the bid) while maintaining the rated SH outlet steam temperature at BMCR. It shall also be guaranteed and demonstrated that the RH temperature is maintained at the rated value without any spray water requirement, at all loads for which the specified RH steam temperature is required to be maintained at the rated value.</p>	
1.4.12	<p>Furnace Exit Gas Temperature (FEGT)</p> <p>It shall be demonstrated that maximum furnace exit gas temperature (FEGT) shall be minimum 60^oC below the minimum initial deformation temperature (IDT) of ash. A comprehensive thermal performance test (TPT) shall be conducted for this purpose. FEGT shall be demonstrated through such TPT by indirect measurement.</p>	
1.4.13	<p>Air Heater exit temperature.</p>	
1.4.14	<p>Air heater air-in-leakage</p> <p>It shall be demonstrated that the air-heater air-in-leakage and maximum drift in air leakage do not exceed the specified value.</p>	

CONSULTANT : PROCON ENGINEERS

 MAHAGENCO <small>Maharashtra State Power Generation Co. Ltd.</small>	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 8
REV: R0	MASTER SPECIFICATIONS	Page 172 of 555
<p>1.4.15 Electrostatic Precipitator</p> <p>(a) The performance/acceptance tests shall be carried out in accordance with method-17 of EPA (Environmental Protection Agency of USA) code ASME PTC.</p> <p>(b) The ESP air in leakage shall not be more than 1% of total gas flow at ESP inlet at the guarantee point condition and shall be demonstrated.</p> <p>(c) The maximum pressure drop through the ESP at the guarantee point flow condition shall not exceed 20 mmWC which shall be demonstrated.</p> <p>(d) The gas distribution in the various stream and fields shall be demonstrated.</p> <p>1.4.16 Turbine-Generator set capability</p> <p>The steam turbine generator shall be capable of delivering at generator terminals the output as indicated in the heat balances under the following conditions:</p> <p>(a) Continuous TG output corresponding to VWO condition under rated steam conditions with 1% make up. While conducting this test, the condenser pressure measurement shall be done at 300 mm above the top row of condenser tubes.</p> <p>(b) Maximum continuous output at generator terminals corresponding to all HP Heaters out of operation under rated steam conditions with 1% make up.</p> <p>1.4.17 Start-up, Loading, Unloading and Shutdown capabilities (For Turbine Generator)</p> <p>(a) Unit Start Up</p> <p>Start-up time (upto full load) and loading capabilities for Turbine Generator together for cold start condition (greater than 36 hrs</p>		

CONSULTANT : PROCON ENGINEERS

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 8
REV: R0	MASTER SPECIFICATIONS	Page 173 of 555

shutdown), warm start conditions (between 8 and 36 hrs shutdown) and hot start conditions (less than 8 hours shutdown) as indicated by the contractor in the offer and accepted by the Owner shall be demonstrated ensuring that the various turbine operational parameters like vibration, absolute and differential expansion, eccentricity and steam-metal temperature mismatch etc are within design limits.

(b) Sudden Total Loss of External Load

On occasions, the steam turbine generator unit may experience sudden total loss of all external load. Under these conditions, the steam turbine generator unit shall not trip but shall continue to be in operation under the control of its speed governor to supply power for the plant auxiliary load with HP-LP bypass in operation while staying within the agreed limits of steam to metal temperature mismatch, exhaust hood temperature, absolute and differential expansion, vibration and eccentricity. The same shall be demonstrated.

(c) Steam Metal Temperature Mismatch Limitation


The steam-metal temperature differential for cold, warm and hot start up, loading/unloading and shutdown conditions shall be within the permissible limits indicated by the Bidder in the offer and accepted by the Owner.

1.4.18 Constant Pressure and Sliding Pressure Operation


The constant pressure operation from 0 to 35/40% of TMCR & 90% TMCR to VWO condition and sliding pressure operation from 35/40% to 90% TMCR in conjunction with the steam generator, HP-LP bypass system and Instrumentation & Control system shall be demonstrated.

In sliding pressure mode of operation, during quick load increase, the idle control valve (s) must respond rapidly to pick up 20% of operating load, so that immediate increase of boiler pressure is not required. The load response capability shall be demonstrated in steps of 5%.


CONSULTANT : PROCON ENGINEERS

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 8
REV: R0	MASTER SPECIFICATIONS	Page 174 of 555
1.4.19	<p>Changeover from constant pressure mode to sliding pressure mode and vice-versa shall also be demonstrated.</p> <p>Generator Capability</p> <p>The Generator stator and rotor windings inclusive of main and neutral leads shall be provided with Class-F insulations but rated for class-B temperature rise. The maximum permissible temperature of different parts of the generator for continuous operation shall be as specified in IEC 34-1/34-3 as applicable.</p>	
1.4.20	<p>Short Circuit Capability</p> <p>The Generator shall be capable of withstanding a 3-phase short circuit at the generator terminals when operating at maximum continuous rated MVA and rated power factor, 105% rated voltage and with fixed excitation for 3 seconds as per IEC 34-4.</p>	
1.4.21	<p>Excitation System Performance</p> <p>(a) The excitation system shall be capable of supplying field forcing for Thirty (30) seconds in case of all types of faults, including close in faults of the generator.</p> <p>(b) The ceiling voltage shall not be less than 150% of the machine excitation voltage.</p> <p>(c) Nominal excitor response ratio shall not be less than 3.0 per second.</p>	
1.4.22	<p>Capacity with Reduced Hydrogen Pressure</p> <p>Generator shall be capable of operating at reduced capacity at reduced generator hydrogen pressure in accordance with values furnished.</p>	
1.4.23	<p>Steam Condensing plant</p> <p>(a) The value of design condenser pressure to be measured at 300 mm above the top row of condenser tubes shall be guaranteed under VWO condition, 1% make-up, design C.W. inlet temperature and</p>	


CONSULTANT : PROCON ENGINEERS

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 8
REV: R0	MASTER SPECIFICATIONS	Page 175 of 555
<p>C.W. flow. The condenser vacuum shall be measured with a vacuum grid utilizing ASME basket tips.</p> <p>(b) Temperature of condensate, at outlet of condenser, shall not be less than saturation temperature corresponding to the condenser pressure at all loads.</p> <p>(c) Oxygen content in condensate at hotwell outlet shall not exceed 0.015 cc/litre over 50-100% load range and shall be determined according to calorimetric Indigo-Carmine method.</p> <p>(d) Air leakage in the condenser under full load condition shall not exceed more than 50% of design value taken for sizing the condenser air evacuation system.</p> <p>(e) When one half of the condenser is isolated, condenser shall be capable of taking at least 60% T.G. load under TMCR conditions.</p> <p>(f) The capacity of each vacuum pump in free dry air under standard conditions at a condenser pressure of 25.4 mm Hg (abs) and sub cooled to 4.17°C below the temperature corresponding to absolute suction pressure shall be demonstrated. Correction curves for establishing the capacity at site conditions shall also be furnished.</p> <p>(g) The air and vapour mixture from air cooling zone of condenser shall be 4.17°C below the saturation temperature corresponding to 25.4 mm Hg (abs) suction pressure. Correction curves for establishing the same at site conditions shall also be furnished.</p> <p>1.4.24 Condensate Extraction Pumps</p> <p>(a) Each CEP set shall be capable of delivering flow and total dynamic head corresponding to run out point as specified.</p> <p>(b) The vibration, noise level and parallel operation of any two of the three pumps shall be demonstrated.</p>		


CONSULTANT : PROCON ENGINEERS

 MAHAGENCO <small>Maharashtra State Power Generation Co. Ltd.</small>	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 8
REV: R0	MASTER SPECIFICATIONS	Page 176 of 555
<p>1.4.25 Vacuum Pump</p> <p>(a) Each pump shall be capable of meeting functional requirements.</p> <p>(b) The vibration, noise level and parallel operation of the pumps shall be demonstrated.</p> <p>1.4.26 Boiler Feed Pumps</p> <p>(a) Each Boiler Feed Pump set shall be capable to deliver flow and total dynamic head corresponding to runout point as specified elsewhere.</p> <p>(b) The vibration, noise level and parallel operation of the pumps shall be demonstrated as per specification requirements.</p> <p>(c) Cold startup/hot startup of the unit using TDBFP with motive steam from auxiliary steam header shall be demonstrated.</p> <p>1.4.27 Drip Pumps (if envisaged)</p> <p>(a) Each Drip Pump shall be capable of delivering flow and total dynamic head corresponding to design point as specified.</p> <p>(b) The vibration, noise level shall be demonstrated.</p> <p>1.4.28 Lube Oil Purification system capacity and purity</p> <p>(a) Lube Oil Purification system capacity and purity shall be demonstrated (with requisite correction curves for variation in inlet oil purity).</p> <p>(b) The maximum solid particle size and free moisture in the purified oil shall not exceed the specified values and quality of oil shall confirm to class 15/12 (as per ISO 4406) when centrifuging oil is heated to a temperature of not more than 65°C.</p>		

CONSULTANT : PROCON ENGINEERS

 MAHAGENCO <small>Maharashtra State Power Generation Co. Ltd.</small>	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 8
REV: R0	MASTER SPECIFICATIONS	Page 177 of 555
1.4.29	<p>Auxiliary/Equipment Cooling Water system</p> <p>(a) Vibration, parallel operation and noise level of all pumps at the rated duty point shall be demonstrated at site.</p> <p>(b) Design heat load of plate type heat exchangers and inlet and outlet temperatures of the plate type heat exchangers on the primary and secondary side to be demonstrated at site. Pressure drop across the plate type heat exchanger on the primary and secondary water circuit to be demonstrated at site.</p>	
1.4.30	<p>Condenser Cooling Water Pumps</p> <p>(a) Each Condenser Cooling Water pump set shall be capable to deliver flow and total dynamic head corresponding to runout point as specified elsewhere.</p> <p>(b) Vibration, parallel operation and noise level of all pumps shall be demonstrated at site.</p>	
1.4.31	<p>HP/LP Bypass capabilities</p> <p>The HP/LP Bypass system shall satisfy the following functional requirements under automatic interlock action. It shall come into operation automatically under the following conditions:</p> <p>(a) Generator Circuit breaker opening.</p> <p>(b) HP/IP stop valves closing due to turbine tripping.</p> <p>(c) Sudden reduction in demand to house load</p> <p>Under all these conditions while passing the required steam flows as per the relevant heat balances, the condenser shall be able to swallow the entire steam without increasing the exhaust hood temperature and condenser pressure beyond the maximum permissible value indicated by the BIDDER in his offer and accepted by the OWNER.</p>	

CONSULTANT : PROCON ENGINEERS

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 8
REV: R0	MASTER SPECIFICATIONS	Page 178 of 555

1.4.32 Feed Water Heaters and Deaerator

The following parameters shall be demonstrated:

- (a) Dissolved O₂ content in feed water at deaerator outlet without chemical dosing at all loads, not to exceed 0.005 cc/litre determined as per ASTM-D-888 – Reference method-A or Indigo Carmine method.
- (b) Free carbondioxide in deaerator effluent shall be non-traceable at all loads from zero to VWO with 1% cycle make up.
- (c) Continuous and efficient operation and performance of feed heating plant without undue noise and vibrations at all loads and duty conditions.

1.4.33 Automatic on-line Turbine Testing (ATT) system

On-load testing of turbine protective equipments shall be demonstrated without disturbing normal operation and keeping all protective functions operative during the test.


1.4.34 Noise

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


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

Sound pressure shall be measured all around the equipment at a distance of 1.0 m horizontally from the nearest surface of any equipment/ machine and at a height of 1.5 m above the floor level in elevation. Corrections for background noise shall be considered in line with the applicable standards.

CONSULTANT : PROCON ENGINEERS

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 8
REV: R0	MASTER SPECIFICATIONS	Page 179 of 555
1.4.35	Condensate Polishing Unit (a) Effluent quality at outlet of each vessel at its rated design flow and design service length between two regenerations (with requisite correction curves for variation in the influent quality). (b) Pressure drop across the polisher service vessel, as specified, in clean and dirty condition of resin at rated design flow.	
1.4.36	Superheater and Reheater Temperature Control Test This test shall be conducted to guarantee that SH/RH temperatures are maintained within +/- 5°C of rated temperature condition from 40% to 100% TMCR including conditions: HP Heaters out of operations, HP-LP Bypass operation.	
1.4.37	Flue Gas Temperature demonstration The Bidder shall demonstrate that flue gas temperature at the entry and exit of various Boiler heating surfaces and also the variation across the cross section perpendicular to gas flow do not exceed the values considered for the pressure parts design at all loads of boiler.	
1.4.38	Control & Instrumentation System Requirements Performance guarantee tests for closed loop control system shall be carried out at site to verify the integrated performance of the total plant C&I and to verify as to whether all the important parameters remain within stipulated permissible limits under all the operating conditions. In case during this tests or otherwise it is observed that the behavior/response of Contractor's system (drives actuators/valves etc.) is not satisfactory/acts as a limitation/restriction in achieving the permissible limits, the Bidder shall carry out all required modifications, rectification etc. in his system whatsoever so that the permissible limits can be achieved. He shall also depute his experts for associating in the above tests and also for carrying out the necessary modifications, rectification etc.	

CONSULTANT : PROCON ENGINEERS

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 8
REV: R0	MASTER SPECIFICATIONS	Page 180 of 555

1.4.39 Balance of Plants:

For Balance of Plants, functional guarantees like capacities and parameters (except power consumption at individual system level) shall be demonstrated as per the specification furnished under respective sections forming part of this specification. Wherever applicable, Owner may, at his sole discretion, consider shop test result as primary indicators of the performance.

1.4.40 Utility Consumption

Bidder shall have to indicate and demonstrate utility (e.g. DM Water, Clarified Water etc) consumptions.


1.5 TEST CODES, CONDITIONS ETC

1.5.1 Steam Generator Efficiency

(a) The steam generator efficiency (by loss method) shall be determined as per the requirements of BS EN 12952- 15, 2003 (by loss method) and other stipulations brought out hereunder.

(i)	Test loads	100% TMCR
(ii)	Test conditions	Boiler operating at rated steam parameter, excess air, coal fineness and firing design coal
(iii)	Ambient conditions	27°C dry bulb temperature and 60% relative humidity. The reference air temperature for the efficiency guarantee/ testing shall be taken as the temperature of air (i.e. 27°C) entering PA and FD fans
(iv)	Number of readings	Two sets of consistent readings for each of test loads. Average of the test efficiencies based on above two readings for each load shall be considered for guaranteed efficiency

CONSULTANT : PROCON ENGINEERS

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 8
REV: R0	MASTER SPECIFICATIONS	Page 181 of 555

(v)	APH leakages to be considered	Guaranteed or actual whichever is higher
(vi)	Test Duration	Four hours. No soot blowing shall be allowed during the test period or during stabilization period of four hours prior to commencement of the test.
(vii)	Heat Credits	No heat credits allowed. The guaranteed steam generator efficiency shall be without any heat credit.

- (b) The guaranteed efficiency shall comply with following limiting parameters with design coal firing:

(i)	Excess air at economizer outlet at 100% TMCR load	20% (minimum)
(ii)	Corrected flue gas temperature (at 100% TMCR load)	135°C or as predicted by the bidder at air preheater outlet

1.5.2 Auxiliary Power Consumption

The unit auxiliary power consumption shall be calculated using the following relationship.


$$P_a = P_u + P_{bbfp}$$

$$P_a = \text{Guaranteed Auxiliary Power Consumption}$$


$$P_u = \text{Power consumed by the auxiliaries under test.}$$

$$P_{bbfp} = \text{Power consumed by motor drive of turbine driven boiler feed booster pump (in case booster pump is driven by independent motor)}$$


CONSULTANT : PROCON ENGINEERS

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 8
REV: R0	MASTER SPECIFICATIONS	Page 182 of 555
<p>Note: Pbbfp will be zero if the turbine drive is used to drive both main pump and booster pump).</p> <p>While guaranteeing the auxiliary power consumption, all continuously operating unit auxiliaries as specified shall be included. (Please refer Volume – I, Section 3)</p> <p>1.5.3 Performance/Acceptance Test for Steam generator</p> <p>The performance tests shall be conducted in accordance with the latest version of ANSI PTC 4.0 except for the specific requirements brought out herein below. This test shall be done simultaneously with P-G test of Turbine Generator set. During this test, Boiler unit shall be fully on automatic control under steady load condition.</p> <p>The efficiency tests shall be carried out with the steam generator operating at the guaranteed point condition i.e. corresponding to 100%, 75%, 60% TMCR, or at the agreed loads as near these as possible, with the boiler operating at the rated excess air, rated SH/RH attemperation flows, flue gas temperature, coal fineness, etc. corresponding to the loads on boiler. At control load, the stable and efficient operation of the unit with the rated excess air, rated mill outlet coal fineness, while achieving the rated S/H, R/H steam parameters shall be demonstrated by the Contractor to the satisfaction of the Owner.</p> <p>For finding out the performance values, corresponding code requirements to be fulfilled.</p> <p>The measurement and computation of heat losses shall be carried out as per the stipulations of ASME PTC 4.0 and shall include but not be limited to the following items:</p> <ul style="list-style-type: none"> (a) Dry gas loss. (b) Loss due to hydrogen in fuel. (c) Loss due to moisture in fuel. (d) Loss due to moisture in air. 		

CONSULTANT : PROCON ENGINEERS

 MAHAGENCO <small>Maharashtra State Power Generation Co. Ltd.</small>	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 8
REV: R0	MASTER SPECIFICATIONS	Page 183 of 555
<p>(e) Loss due to unburnt carbon in ash.</p> <p>Ash samples shall be collected from the furnace bottom hopper, air heater hoppers, duct hoppers and ESP hoppers. The ash collection rates for computation of losses shall be assumed as 20%, 5% and 3% in the furnace bottom hopper, duct hopper and air heater hopper respectively.</p> <p>(f) Radiation loss.</p> <p>(g) Loss due to Carbon Monoxide (CO) in flue gas.</p> <p>(h) Any other unaccountable loss through sensible heat in ash and due to radiation to furnace bottom hopper.</p> <p>(i) Manufacturer's margin.</p> <p>1.5.4 Corrections shall be applied to the tested efficiency, to correct it to the design conditions, for variations in the following parameters only:</p> <p>(i) Feed water temperature at economiser inlet.</p> <p>(ii) Ambient air temperature</p> <p>(iii) Relative humidity of ambient air.</p> <p>(iv) Hydrogen in coal.</p> <p>(v) Moisture in coal.</p> <p>(vi) Gross calorific value of coal.</p> <p>The Bidder shall furnish correction curves, for Owner's approval, covering the expected ranges of variations for all these parameters for the range of coals specified.</p> <p>In all other aspects, not spelt out above, or in specifications, where ANSI code stipulates agreement between the parties concerned before the test, Bidder shall get these approved by the Owner.</p>		

CONSULTANT : PROCON ENGINEERS

 MAHAGENCO <small>Maharashtra State Power Generation Co. Ltd.</small>	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 8
REV: R0	MASTER SPECIFICATIONS	Page 184 of 555

No negative tolerance on account of instrument in-accuracies or otherwise shall be allowed on the guaranteed values.

Performance tests shall also be conducted to prove the steam generating capacity of the steam generator at rated parameters at stipulated loads.

Necessary write ups, schemes, instrument schedules, detailed procedures clearly indicating periods of tests, frequency of observations, etc. shall be prepared and submitted for all the tests for Owner's review and shall be got specifically approved from the Owner within one year of L.O.A. issue.

1.5.5 Performance / Acceptance Test for Electrostatic precipitator :


The performance test on electrostatic precipitator will commence after a minimum period of three thousand (3000) hours of continuous operation after completion of trial operation. During the interval between the commencement of trial operation and the commencement of performance test only routine maintenance shall be carried out. No physical or chemical cleaning of ESP shall be permitted during this period or immediately before the conductance of the performing tests.

The test efficiency shall be based on the overall performance of the electrostatic precipitator over a mutually agreed period of operation under the conditions given in this specification and following the normal operation of the unit including rapping and normal soot blowing and/or warm-up guns. Outlet dust concentration of ESP with one field out in each stream while firing worst coal shall be 50 mg/NM³ (max) subjected to applicable modification adopted by Environmental Department, Government of India, at the time of project execution.


The performance tests shall be carried out in accordance with Method-17 of EPA (Environmental Protection Agency of USA) code. The details of the tests shall, however be mutually agreed upon between the OWNER and the CONTRACTOR.

All calibration procedures and standards shall be subjected to the approval of the Owner. The protecting tubes, pressure connections and other test connections required for conducting guarantee test and maintenance testing shall conform to the relevant codes. The Bidder shall fully elaborate, in his


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 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 8
REV: R0	MASTER SPECIFICATIONS	Page 185 of 555
<p>proposal, the provisions made to this effect. Method of measurement for all air leakage test and power consumption test proposed by the Bidder shall be clearly indicated in his offer, and shall be subject to Owner's approval.</p> <p>1.5.6 Performance/Acceptance Test for Steam turbine generator</p> <p>(a) Performance test for the turbine generator set will be conducted in accordance with the latest edition of ASME PTC-6.</p> <p>(b) Power consumed by the auxiliaries mentioned which is to be deducted from electrical power generated, shall be measured during the performance/ Acceptance Test. Wherever the measurement is not possible, design values of power consumption by an auxiliary shall be considered.</p> <p>(c) Corrections to the test results for steam turbine shall be applied as per the correction curves provided. When the system is properly isolated for a performance test, the unaccounted leakages should not be more than 0.1% of the design throttle flow at that load. However, during the test, if it is found that the unaccounted for leakage is more than 0.1% of design throttle flow at that load, then heat rate will be increased by an amount equal to half the difference between actual unaccounted for leakage expressed as percentage of design throttle flow at that load and 0.1% (allowed by the code).</p> <p>(d) The tests shall be arranged in a manner that the normal unit operation is not disrupted. Duplicate test runs shall be performed at 100% TMCR and 80 % TMCR loads. The results of corrected heat rate shall agree within 0.25%. If they differ by more than 0.25%, third test shall be run at the same point. The corrected result of any one of the three test runs, which deviates from the corrected averaged result of all the runs by more than 0.25%, shall be eliminated; otherwise the results of all the three tests runs shall be accepted.</p> <p>1.5.7 Performance test for the condensers</p> <p>Performance test for the condensers shall be conducted in accordance with the latest edition of ASME PTC-12.2 with the exception at (a) mentioned below:</p>		

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	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 8
REV: R0	MASTER SPECIFICATIONS	Page 186 of 555
	<p>(a) Condenser pressure shall be measured at 300 mm above the top row of tubes under VWO conditions, 1% make-up and design C.W. flow & design temperature. The condenser pressure shall be measured with a vacuum grid utilizing ASME basket tips. The grid is fitted at 300 mm above top row of condenser tubes.</p> <p>(b) Combined pressure drop in condenser tube, water box and inlet and outlet piping shall be measured in between intake and discharge point of the C.W. system with cleanliness factor of 0.9 and COLTCS in service.</p>	
1.5.8	<p>Performance test for Feed Water Heaters and Drain Cooler</p> <p>Performance test for feed water heaters shall be conducted in accordance with the latest edition of ASME PTC-12.1.</p>	
1.5.9	<p>Performance test for Deaerator</p> <p>Performance test for deaerator shall be conducted in accordance with the latest edition of ASME PTC-12.3.</p>	
1.5.10	<p>For Balance of plant</p> <p>For the Balance of plant equipment, performance test shall be conducted as per the relevant codes. The results of the shop test shall be used wherever applicable as the base for conducting the test.</p>	
1.6	<p><u>TEST INTERRUPTIONS</u></p> <p>In the event of a test interruption resulting from an Event of Force Majeure or Employer-Caused-Delay, contractor shall be entitled to relief as provided in the contract, provided that (except for certain interruptions of a Availability Test as specified below), the interrupted Performance test must be started again and test data that were collected during the interrupted test must be ignored.</p> <p>In the event of test interruptions as a result of Force Majeure or Employer-Caused-Delay during Availability test the test shall not be deemed a successful Performance Test where</p>	

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 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 8
REV: R0	MASTER SPECIFICATIONS	Page 187 of 555
<p>(a) The total cumulative interrupted time during the test is more than twenty-four (24) hours</p> <p>(b) The total number of interruptions during the test is more than four (4)</p> <p>Except as provided above, the test resulting from Force Majeure or Employer-Caused-Delay shall be extended by an amount equal to the length of the interruptions, including time to return to steady-state operation. The test data for the period of interruptions shall be excluded from analysis and the test data that were collected both before and after the interruptions shall be included in the analysis.</p> <p>1.7 <u>TEST REPORTS</u></p> <p>The contractor shall prepare test reports for the Availability Test, Efficiency Test, Capacity Test and the Emissions Test in which the methods followed, instrument readings, graphs, observations, final results obtained etc shall be recorded.</p> <p>Amount of Liquidated Damages (LD) applicable for Category-I guarantees shall be as stipulated in Volume I.</p> <p>The contractor shall also prepare Heat Balance Diagrams and Correction curves for all tests.</p> <p>The contractor shall also furnish detail information about:</p> <p>(a) Start up trials of the equipments</p> <p>(b) Initial trial of total system</p> <p>(c) Trial operation</p> <p>(d) Procedure for performance guarantee/ acceptance tests.</p>		

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**1X660 MW BHUSAWAL TPS UNIT-6
TECHNICAL SPECIFICATION
FOR
ELEVATORS**

SPECIFICATION NO.: PE-TS-415-502-A001

SECTION: I

SUB-SECTION: IA

REV. 01

DATE: SEP'22

SHEET 1 OF 2

**FUNCTIONAL/PERFORMANCE / DEMONSTRATION GUARANTEE
(AS APPLICABLE)**



**1X660 MW BHUSAWAL TPS UNIT-6
TECHNICAL SPECIFICATION
FOR
ELEVATORS**

SPECIFICATION NO.: PE-TS-415-502-A001

SECTION: I

SUB-SECTION: IA

REV. 01

DATE: SEP'22

SHEET 2 OF 2


**TRIAL OPERATION, COMMISSIONING, PERFORMANCE/ DEMONSTRATION
GUARANTEE TESTS:**

Demonstration / Functional guarantee tests of elevator shall be carried out at site as follows:

The parameters/ capability is to be demonstrated of various equipments/system as listed below.

- i. Overload test.
- ii. Travel speed and hoist speed checks.
- iii. Drop test.
- iv. Checks for interlocks & safety systems.
- v. Checks for operation from inside the cage.
- vi. Rated capacity of the elevator.
- vii. Accurate positioning of the elevator.

**ANNEXURE-III
QUALITY ASSURANCE PLAN**

		MANUFACTURING QUALITY PLAN FOR=M/S vendor	PROJECT: PACKAGE: ITEM: ELEVATOR BHEL REF. NO.:					Q.P/FQP. NO & REV: DATE:1 PAGE: 1of 4 JOB NO:					
1	2	3	4	5	6	7	8	9	10				11
Sr. No.	COMPONENT & OPERATION	CHARATERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMATE OF RECORD	AGENCY				REMARKS
									D	VE	M	B	
A. Boughtout Items :													
1	Raw materials, Round Hexagon & Structural. Type : EN-8/EN-8D to EN-9,B and En-24	A: Chemical Composition B: Mechanical Properties C: Dimensional Checks	Major Major Major	Analysis Hardness Measurement	Sample Sample 100%	IS/BS : 970 IS/BS : 970 DRG.	IS/BS : 970 IS/BS : 970 DRG.	O.S.L/ T.C QA REG. D.I.R/Q.C.R		V V V	V V w	V V V	
2	Raw material Rounds, En-8, EN-9, EN-24	Crack Detection	Major	Ultrasonic testing	100%	ASTM-388	ASTM -388	QA/FMT/03		V	W	V	
3	Casting : a. C.I. Graded Castings	A: Chemical Composition B: Mechanical Properties C: Dimensional Checks D: Blow Holes	Major Major Major Major	Analysis Hardness on traction sheave Measurement Visual	Sample Sample Sample 100%	IS-vendor DRG vendor-DRG IS : 210 vendor-DRG —	AS PER DRG. vendor-DRG IS : 210 vendor-DRG -	S.T.C S.T.C QA/FMT/02 QA/REG	√ √ - -	V V - W	V V W W	V V - -	
4	Suppliers Item : a. Manufactured Items b. Moldings Rubber Items (ABSORBER) c. Springs (Buffer) d. Guide Rail. e. Wire rope	Dimensional Check A: Dimensional Checks B: Hardness A: Dimensional Check B: Spring Constant compression. A.Chemical Test. B. Dimension check. A: Dimensional Check B: Mechanical Properties.	Major Major Major Major Major Major Major Major	Measurement Measurement Compression Test Measurement Compression Analysis Measurement Measurement of O.D/ Const. Measurement	100% 100% Sample 100% Sample Sample Sample Correlate S.T.C	vendor/DRG. vendor-DRG. vendor-DRG. vendor-DRG. vendor-DRG. vendor- DRG vendor-DRG. IS/2365 & IS : 2266	vendor/DRG. vendor/DRG. vendor-DRG. vendor-DRG. vendor-DRG. vendor -DRG vendor-DRG. IS/2365 & IS : 2266	D.I.R QA/FMT/02 QA/FMT/02 QA/FMT/02 S.T.C S. T.C QA/FMT/02 QA/FMT/02 S.T.C	 - - - √ √ - √	 W W W V V W W V	 - - - V W W V	 - - - V V - V	
*V= Verification as appropriat. *M= Manufacturer/Sub contractor. *W=Witness , *VE= Manufacturer/ sub contractor Vendor. *S.T.C= Supplier Test Certificate, *B =BHEL/Nominated inspection agency. *O.S.L = Out Side Lab, *D.I.R=Daily inspection register. *R.Q.C = Rvendoript Quality Control (vendedor) . *P =Perform. *Q.C.R = Qua;ity Control Register (vendedor) . *T.C. = Test Certificate, *D.I.R = Daily inspection register. * D = Documents. *U.E.R. =Ultra Sonic Examination Record .			MANUFACTURER SEAL AND SIGN	CONTRACTOR SIGN AND SEAL .	NAME & SIGN OF APPROVING AUTHORITY & SEAL								

1	2	3	4	5	6	7	8	9	10				11
Sr. No.	COMPONENT& OPERATION	CHARATERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMATE OF RECORD	AGENCY				RMARKS
									D	VE	M	B	
	f. Power & control (PVC)cable	a- FRLS , b- Insulation resistance.	Major do	Electrical do	Sampling do	IS - 694 do	IS - 694 do	S.T.C do	√ √	V V	V V	V V	
5	Raw material for motor. (1) Enameled wire. (2) Copper base (Flat)	a) Dimension Check b) High voltage test Chemical check	Major Major Major	Measurement Elect. Analysis	Sample One Sample each roll Sample	vendor -STD IS:4800 Cu=min 99.5%	vendor -STD IS:4800 Cu=min 99.5%	D.I.R D.I.R O.S.L / T.C		V V V	W W V	V V V	
6	Finished Manufactured Components	Plating thickness control	Major	Measurement	Sample	vendor-STD.	vendor-STD.	vendor-STD		V	W	V	
B. Inspection During mfg.													
1	Machine Shop :	A: Dimensional Check B: Crack detection Motor bodies C: Surface check	Major Major Major	Measurement D.P. Test Visual	100% 100% 100%	vendor-DRG. vendor-STD. vendor-STD.	vendor-DRG. vendor-STD. vendor-STD.	QA/FMT/01 - -	- - -	W W W	- - -		
2	Fabrication Shop :	Dimensional Checks of critical items Welding	Major minor	Measurement Visual	100% Sampling	vendor-DRG. do	vendor-DRG. do	Q.C.R .	- .	W W	- .		Welding by approved welder
C. Assembly Inspection.													
1	Winding gear.	A- Back lash of gears& Maching contact. B- Vibration . C- Noise level. D- Visual .	Major Major Major Oil leakage	Measurement Measurement Measurement Visual	100% 100% 100% 100%	vendor INSP NORMS vendor INSP NORMS vendor INSP NORMS vendor INSP NORMS	vendor INSP NORMS vendor INSP NORMS vendor INSP NORMS vendor INSP NORMS	QA/FMT/11 do do do	V V V V	W W W W	- - - -		
*V= Verification as appropriat. *M= Manufacturer/Sub contractor. *W=Witness , *VE= Manufacturer/ sub contractor Vendor. *S.T.C= Supplier Test Certificate, *B =BHEL/Nominated inspection agency. *O.S.L = Out Side Lab, *D.I.R=Daily inspection register. *R.Q.C = Rvendoript Quality Control (vendor) . *P =Perform. *Q.C.R = Qua;ity Control Register (vendor) . *T.C. = Test Certificate, *D.I.R = Daily inspection register. *D = Documents. *U.E.R. =Ultra Sonic Examination Record .			MANUFACTURER SEAL AND SIGN	CONTRACTOR SIGN AND SEAL .	NAME & SIGN OF APPROVING AUTHORITY & SEAL /HPGCIL								

1	2	3	4	5	6	7	8	9	10				11
Sr. No.	COMPONENT & OPERATION	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMATE OF RECORD	AGENCY				REMARKS
									D	VE	M	B	
2	Motor Assembly :	A-Winding Insulation test. B-Insulation Resistance C-Motor testing for elect. Pmt. D-Vibration measurement & noise lev	Major Major Major Major	High Volt. Test Measurement Elect. Measurement	100% 100% 100% 100%	IS :325-96 1.5 KV for 5 SEC > 10 mega ohms IS : 325 vendor - Norms	IS :325-96 1.5 KV for 5 SEC. > 10 mega ohms IS : 325 vendor -Norms	D.I.R QA/FMT/13 Test report Test report Test report		V V V V	W W W W	V V V .	
3	Speed Governor Assembly :	Tripping speed Easy Run test	Major	Function Check	100%	IS : 9878 LCH -112	IS : 9878 LCH - 112	T.C IN Pant.		V	W	V	
4	Controller Assembly / VVVF Unit.	1. Visual Inspection 2. Electrical Checks (Routine Test). 3. Functional Checks 4. Pretreatment in seven tank for sheet & paint thickness.	Major do do Major	Visual Electrical Function Measurement + Visual	100% 100% 100% Sampling	vendor Norms do do do	vendor Norms do do do	T.C do do vendor - FMT.		V V V V	W W W W	V V V V	
*V= Verification as appropriat. *M= Manufacturer/Sub contractor. *W=Witness , *VE= Manufacturer/ sub contractor Vendor. *S.T.C= Supplier Test Certificate, *B =BHEL/Nominated inspection agency. *O.S.L = Out Side Lab, *D.I.R=Daily inspection register. *R.Q.C = Rvendoript Quality Control (vendor) . *P =Perform. *Q.C.R = Qua;ity Control Register (vendor) . *T.C. = Test Certificate, *D.I.R = Daily inspection register. *D = Documents. *U.E.R. =Ultra Sonic Examination Record .			MANUFACTURER SEAL AND SIGN	CONTRACTOR SIGN AND SEAL.	NAME & SIGN OF APPROVING AUTHIRITY & SEAL.								

1	2	3	4	5	6	7	8	9	10				11
Sr. No.	COMPONENT & OPERATION	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMATE OF RECORD	AGENCY				REMARKS
									D	VE	M	B	
5	Mechanical assembly :	Cage assembly .	Major	Measurement	100%	Appd. L/o DRG. vendor-INSP. Norms	Appd. L/o DRG. vendor-INSP. Norms	QA/FMT/15		V	W	V	
6	Painting	Parts & Components	Major	Cross Hatch Test	Sampling	vendor-INSP. Norms	vendor-INSP. Norms	QA / REG.		V	W	V	
			Major	Powder Coating Thickness Test	Sampling	vendor-INSP. Norms	vendor-INSP. Norms	QA / REG.		V	W	V	
6	Electrical Assembly	1- Break assembly .	Minor	Function check	Sampling	vendor- NORMS	vendor - NORMS	TC		V	W	V	
*V= Verification as appropriat. *M= Manufacturer/Sub contractor. *W=Witness , *VE= Manufacturer/ sub contractor Vendor. *S.T.C= Supplier Test Certificate, *B =BHEL/Nominated inspection agency. *O.S.L = Out Side Lab, *D.I.R=Daily inspection register. *R.Q.C = Rvendoript Quality Control (vendor) . *P =Perform. *Q.C.R = Qua;ity Control Register (vendor) . *T.C. = Test Certificate, *D.I.R = Daily inspection register. *D = Documents. *U.E.R. =Ultra Sonic Examination Record .			MANUFACTURER SEAL AND SIGN	CONTRACTOR SIGN AND SEAL.	NAME & SIGN OF APPROVING AUTHORITY & SEAL								



1X660 MW BHUSAWAL TPS UNIT-6
TECHNICAL SPECIFICATION
FOR
ELEVATORS

SPECIFICATION NO.: PE-TS-415-502-A001

SECTION: I

SUB SECTION: IA

REV: 01

DATE: SEP'22

Page: 1 of 1

ANNEXURES



1X660 MW BHUSAWAL TPS UNIT-6
TECHNICAL SPECIFICATION
FOR
ELEVATORS

SPECIFICATION NO.: PE-TS-415-502-A001

SECTION: I

SUB SECTION: IA

REV: 01

DATE: SEP'22

Page 1 of 7

ANNEXURE-I
LIST OF MAKES

SR. NO.	ITEM	SUPPLIERS	PLACE	REMARKS
1.	WIRE ROPES	USHA MARTIN	RANCHI	
		BHARAT WIRE ROPE	MUMBAI.	
2.	TRAILING CABLE	GEBUR & GRILLER- AUSTRIA		
		DAETWYLER (THELMA) CABLES-SWITZERLAND	SWITZERLAND	
		LAPP	GERMANY	
		UNIVERSAL	-	
		INCABSTEP	-	
3.	BUFFER SPRINGS	INDUSTRIAL STEEL SPRING	-	
		ALL INDIA STEEL SPRING MANUFACTURING COMPANY	-	
		KOLKATA SHAW COMPANY	KOLKATA	
		SUPER INDIA SPRINGS	KOLKATA	
		MESCO SPRING.	MUMBAI.	
4.	GEAR INTERNALS	PREMIUM ENERGY TRANSMISSION LTD,	PUNE	
		SICOR S.P.A-	ITLY	
		OEM		
5.	DRIVER MOTOR	Seimens-	MUMBAI	
		ABB	FARIDABAD	
		BHARAT BIJILI	-	
		CGL	-	
		KIRLOSKER	-	
6.	STAINLESS STEEL	OEM	-	
		SAIL,	-	
		MINOX METAL,	-	
		JINDAL	-	
			-	
7.	CR SHEET	ESSAR STEELS,	-	
		BHUSHAN STEELS	-	
8.	CABLES	DELTON,	-	
		NICCO	-	
		UNIVERASL,	-	
		FINOLEX,	-	
		CCI	-	
		MACROTHREM,	-	
		VARSHA CABLES	-	
		KEI.	-	
		PARAMOUNT	-	
POLYCAB.	-			
9.	RELAYS	SIEMENS	-	
		SCHNEIDER TELEMCHANIQUE	-	



**1X660 MW BHUSAWAL TPS UNIT-6
TECHNICAL SPECIFICATION
FOR
ELEVATORS**

SPECIFICATION NO.: PE-TS-415-502-A001

SECTION: I

SUB SECTION: IA

REV: 01

DATE: SEP'22

Page 2 of 7

SR. NO.	ITEM	SUPPLIERS	PLACE	REMARKS
		SALZER,	-	
		SCHNIDER ELECTRIC.	-	
		OEN	-	
10.	CONTACTORS	SIEMENS	-	
		L&T	-	
		GE	-	
		SCHNEIDER TELEMECHANIQUE.	-	
11.	TRANSFORMERS	SHARP ELECTRONICS	-	
		MELCON CONTROLS	CHENNAI	
		LOGITECH	-	
		GUNHAWA ELECTRIC CO LTD.	-	
12.	INVERTOR (V3F)	YASKAWA-	GERMANY	
		TOSHIBA	JAPAN.	
13.	T GUIDES	SAVERA	CHINA	
		D.D HITECH	-	
		MARAZZI	-	
14.	CAR DOOR OPERATOR	Wittur GMBH	AUSTRIA	
		FERMATOR	-	
		OEM	-	
15.	INFRA-RED DOOR CURTAIN	MEMCO	UK	
		WECO	-	
		TLJONES	-	
16.	BATTERY (LEAD ACID)	EXIDE.		
		HBL POWER SYSTEM-	HYDERABAD	
		AMAR RAJA	TIRUPATI	
		AMCO SAFT INDIA LTD	BANGALORE.	

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. IN CASE OF ASSEMBLED IMPORTED ELEVATOR, MAKES OF BOI SHALL BE SUBJECT TO BHEL/ CUSTOMER APPROVAL DURING DETAIL ENGINEERING STAGE WITHOUT ANY COMMERCIAL IMPLICATION AT CONTRACT STAGE.
3. DEALERS ARE NOT ACCEPTABLE FOR ANY ITEM OF THE PACKAGE. BIDDER SHALL PROCURE ALL ITEMS INCLUDING PLATES, STRUCTURAL ETC. FROM APPROVED SUB VENDOR ONLY.



1X660 MW BHUSAWAL TPS UNIT-6
TECHNICAL SPECIFICATION
FOR
ELEVATORS

SPECIFICATION NO.: PE-TS-415-502-A001

SECTION: I

SUB SECTION: IA

REV: 01

DATE: SEP'22

Page 3 of 7

ANNEXURE-II
List of Mandatory Spares for Elevators

Mandatory spares shall be provided as follows:

1. One (01) set of Mandatory Spares for FGD Control Room Building Elevators.

i.e. Total One (01) sets of Mandatory Spares shall be provided.

Sl. No.	Description	Quantity (Units)
1.1	Friction block	Two (2) Nos.
1.2	Guide roller of each type	20% of total population or Three (3) Nos. whichever is higher
1.3	Contactors of each type	Two (2) Nos.
1.4	Control transformer	One (1) Nos. of each type
1.5	Time device	Two (2) Nos. of each type
1.6	Rectifiers	Two (2) Nos. of each type
1.7	Over current relay	Two (2) Nos. of each type
1.8	Auxiliary relay	Three (3) Nos. of each type
1.9	Resistor	Three (3) Nos. of each type
1.10	Fuses of each rating	20% of the total population
1.11	Limit switches of each type	Three (3) Nos.
1.12	Push button	Three (3) Nos. of each type
1.13	Contact device (if applicable)	Three (3) Nos. of each type
1.14	Brake motor	Two (2) Nos. of each type
1.15	Transmitters	Two (2) Nos. of each type
1.16	Switches of each type	Three (3) Nos.
1.17	Receiver	Two (2) Nos. of each type
1.18	Bearings of each type and size	Two (2) Nos.
1.19	Roller of each type	Three (3) Nos.
1.20	Spares for worm gear	
1.20.1	'O' rings	Three (3) sets
1.20.2	Sealing ring of each type	Three (3) sets
1.21	Spares for brake	
1.21.1	Fan	Two (2) Nos. of each type
1.21.2	Magnetic coil	Three (3) Nos. of each type
1.21.3	Brake disc	Two (2) sets
1.21.4	Brake pad	Two (2) sets
1.22	Bushing (for door front)	Two (2) sets
1.23	Pinion	Two (2) Nos. of each type

Note:

- 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 equipment system; 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



1X660 MW BHUSAWAL TPS UNIT-6
TECHNICAL SPECIFICATION
FOR
ELEVATORS

SPECIFICATION NO.: PE-TS-415-502-A001

SECTION: I

SUB SECTION: IA

REV: 01

DATE: SEP'22

Page 4 of 7

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 applicable 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, the same will have to be supplied free of cost, in case it is found applicable during detail engineering.
- f) Any change or variation in equipment or systems during detailed engineering stage which would cause changes / variations in the essential spares, shall be supplied by Bidder without any commercial implications.
- g) Mandatory spares shall not be dispatched before dispatch of corresponding main equipment.
- h) Wherever quantity is specified both as a percentage and a value, the Bidder has to supply the higher quantity until & unless specified otherwise.
- i) The spares shall be treated and packed for a long storage under the climatic condition prevailing at site.
- j) Each spare part shall be clearly marked and labelled on the outside of the packing with its description. When more than one spare part is packed in a single case, a general description of the content shall be shown on the outside of such case and a detailed list enclosed. All cases, containers, and other packages must be suitably marked and numbered for the purpose of identification.
- k) The Bidder shall note that if there is any change/ variation in equipment/ system during detail engineering which causes any change/ variation in the essential spares quantity, the same shall be supplied without any commercial implications. The price indicated for the mandatory spares shall be considered for the purpose of evaluation.



1X660 MW BHUSAWAL TPS UNIT-6
TECHNICAL SPECIFICATION
FOR
ELEVATORS

SPECIFICATION NO.: PE-TS-415-502-A001

SECTION: I

SUB SECTION: IA

REV: 01

DATE: SEP'22

Page 5 of 7

ANNEXURE-III
List of Tools & tackles for Elevators

Sl. No.	DESCRIPTION	Qty.	Remarks
1	Spanner of all sizes required for maintenance	2 Sets	
2	Adjustable Spanner	1 No.	
3	Allen Key set all sizes required for maintenance	1 No.	
4	Screw driver set	1 Set	
5	Cutting plier	1 No.	
6	Grease gun	1 No.	
7	Nose plier	1 No.	
8	Grip plier	1 No.	
9	Hook spanner	1 No.	
10	Box spanner	1 No.	
11	Oil can	1 No.	
12	Measurement Taps	1 No.	
13	Paint brush 1/4,1/2,3/4 inch	1 No.	
14	Line tester	1 No.	
15	Multimeter	1 No.	
16	Soldering iron	1 No.	
17	Torch Light	1 No.	
18	Knife cutter	1 No.	
19	Steel rule	1 No.	
20	Wire Striper	1 No.	
21	Tube Spanner Combination	1 No.	
22	Hammer 1/2 Kg	1 No.	
23	Dial rench	1 No.	
24	Multi-purpose meter	2 Nos.	
25	Other tools if any (Please specify)		



**1X660 MW BHUSAWAL TPS UNIT-6
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SECTION: I

SUB SECTION: IA

REV: 01

DATE: SEP'22

Page 6 of 7

ANNEXURE-IV

Drawing document submission schedule

S.NO.	Description	Schedule
1	First submission of dwg/ docs as per MDL	Within two (2) weeks from placement of LOI.
2	Every repeat submission	Within one (1) week.
3	Response time by BHEL	Within three (3) weeks after receiving of drawing.

Note:

- 1.0 The above are the minimum quantity of drawings/documents required. The exact requirement shall be informed to the successful bidder during detail engineering stage for which no commercial implication shall be entertained by BHEL.
- 2.0 Bidder to note that BHEL reserves the right for drawing/document submission through web based Document Management System. Bidder would be provided access to the DMS for drawing/document approval and adequate training for the same. Detailed methodology would be finalized during the kick-off meeting. Bidder to ensure following at their end.
 - Internet explorer version – Minimum Internet Explorer 7.
 - Internet speed – 2 mbps (Minimum preferred).
 - Pop ups from our external DMS IP (124.124.36.198) should not be blocked.
 - Vendor's internal proxy setting should not block DMS application's link (<http://124.124.36.198/wrenchwebaccess/login.aspx>).



1X660 MW BHUSAWAL TPS UNIT-6
TECHNICAL SPECIFICATION
FOR
ELEVATORS

SPECIFICATION NO.: PE-TS-415-502-A001

SECTION: I

SUB SECTION: IA

REV: 01

DATE: SEP'22

Page 7 of 7


ANNEXURE-V


MDL FOR ELEVATOR

SL. NO.	BHEL DOC NO.	TITLE	APP. CAT
1	PE-V0-415-502-A002	GAD OF FGD CONTROL BUILDING ELEVATOR	A
2	PE-V0-415-502-A003	DATA SHEET FOR FGD CONTROL BUILDING ELEVATOR	A
3	PE-V0-415-502-A004	MQP OF FGD CONTROL BUILDING ELEVATOR	A
4	PE-V0-415-502-A005	O & M MANUAL FOR FGD CONTROL BUILDING ELEVATOR	I
5	PE-V0-415-502-A006	WIRING DIAGRAM & POWER DISTRIBUTION SCHEMATIC FOR FGD CONTROL BUILDING	I

A= APPROVAL

I= INFORMATION

	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: I
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section: 2
REV: 00	GENERAL TERMS & CONDITIONS OF THE CONTRACT	Page: 186
<p>24.2 The contractor shall proceed with the works in accordance with the decisions, instructions and orders given by the Engineer in accordance with these conditions.</p> <p>24.3 If in the opinion of the Contractor, a decision made by the Engineer is not in accordance with the meaning and intent of the contract, the Contractor may file with the Engineer within 30 (Thirty) days after receipt of the decision, a written objection to the decision giving his reasons for so doing. Failure to file an objection within the allotted time shall be considered as acceptance of the Engineer's decision and the decision shall become final and binding.</p> <p>24.4 The Engineer's decision and filing of the written objection thereto shall be a condition precedent to the right to request for arbitration.</p> <p>24.5 Either party to the contract shall be at liberty to refer the matter to arbitration as provided in the contract but such intimation from the Contractor for referring any decision of Engineer to arbitration shall not relieve the contractor of his obligation to proceed with the works in accordance with the said decision, instruction or order in respect of which intimation has been given. It is the intent of this contract that there shall be no delay in execution of the works and the decision of the Engineer as rendered shall be promptly abided by.</p> <p>25.0 <u>Submission & Approval of Design Documents:</u></p> <p>25.1 The contractor shall submit all the General Arrangement drawings, Mechanical, Electrical and Civil Design Basis/Criteria, Drawings, Data Sheets, Documents, Equipment and their Capacity Selection, Test Procedure etc. and other engineering documents stipulated elsewhere in the contract (hereinafter referred to and called as 'design document') for approval of the engineer along with the design calculations and general write up wherever involved. All electrical and mechanical drawings shall be properly coordinated.</p> <p>25.2 The Design document so submitted shall be approved/commented upon generally within 10 working days from the date of its submission at the office of the respective engineer. Both the parties shall put their efforts together to complete the activity of design document approval in good faith in order to complete the same within stipulated period as above. However, the contractor acknowledges that the duration of approval/commenting largely depends upon quality of the submission and also bunching of submission and hence agrees with the owner that neither any</p>		

	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: I
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section: 2
REV: 00	GENERAL TERMS & CONDITIONS OF THE CONTRACT	Page: 187

specific period for approval can be ascertained nor the delay if any in the same (unless the delay is due to sheer negligence on the part of the engineer/his authorised personnel/owner's consultant) can be considered as the reason for extension of work completion period.

25.3 In the event of any discrepancy observed in the design document submitted during its scrutiny, the same shall be communicated to the contractor promptly. The contractor shall either arrange to correct the design document or shall justify the correctness of his submission.

25.4 On approval of the design document by the engineer, the contractor shall furnish six copies and soft copy on CD in AUTOCAD form (*.dwg) of these approved drawings to the recipients as per the distribution to be intimated by the engineer during the first co-ordination meeting (kick-off meeting). As the drawings shall be approved based on the basic information furnished by the contractor, approval by the Engineer shall not absolve the contractor of his responsibilities towards correctness of design & performance of the equipment.


25.5 If the Owner/Engineer is of opinion that any design document submitted and the approval thereof were erroneous, the Owner/Engineer reserves right to ask the contractor to revise/ modify approved design document and submit the same for approval of the Engineer without any financial liability to the owner.

25.6 During the currency of the contract, if any approved design document are required to be modified, such details of the modifications required to be carried out shall be separately maintained.

25.7 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/engineer.


~~26.0 Flow Model Test:~~

~~26.1 The Contractor shall carry out flow model tests of various packages/equipment as applicable, on the models prepared by him and furnish the model test reports to the Owner for his review. The Contractor shall give advance notice to the Owner to enable Owner to depute his representative to witness the flow model test. Such flow model tests shall be carried out as applicable for the various packages. The expenditure for deputing the Owner's engineer to witness the flow model test shall be borne by the owner.~~

 MAHAGENCO <small>Maharashtra State Power Generation Co. Ltd.</small>	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 9
REV: R0	MASTER SPECIFICATIONS	Page 189 of 555

VOLUME II
SECTION – 9
REQUIREMENT OF SPARES, TOOLS & TACKLE,
LUBRICANTS/OIL/CONSUMABLES/LABORATORY
EQUIPMENTS


CONSULTANT : PROCON ENGINEERS

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 9
REV: R0	MASTER SPECIFICATIONS	Page 191 of 555

CONTENT

<u>CLAUSE NO.</u>	<u>DESCRIPTION</u>
1.0	TOOLS AND TACKLE
2.0	SPARES
3.0	ELECTRICAL LABORATORY AND TESTING EQUIPMENTS
ANNEXURE – A	MANDATORY SPARE LIST (MECHANICAL)
ANNEXURE – B	MANDATORY SPARE LIST (ELECTRICAL)
ANNEXURE – C	MANDATORY SPARE LIST (CONTROL & INSTRUMENTATION)
ANNEXURE – D	ELECTRICAL LABORATORY AND EQUIPMENTS
ANNEXURE – E	SPECIAL TOOLS AND TACKLES FOR ELECTRICAL EQUIPMENTS

CONSULTANT : PROCON ENGINEERS

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	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 9
REV: R0	MASTER SPECIFICATIONS	Page 193 of 555

1.0 TOOLS & TACKLE

The Contractor shall supply with the equipment one complete set of special tools and tackles required for the erection, assembly, dis-assembly & maintenance of the equipment. These special tools shall also include special material handing equipment, jigs & fixtures for maintenance and calibration/ re-adjustment, checking & measurement aids etc. A list of such tools & tackles shall be submitted by the Bidder along with the offer. Detailed description of each tool/tackles, its function along with the equipment / part for which it is meant for and the price of each tool / tackles shall also be indicated in the offer. These tools & tackles shall be separately packed and sent to site before commissioning. The Bidder shall also ensure that these tools are not used for erection purpose.

2.0 SPARES

2.1 GENERAL


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

2.1.1 All spares supplied under this contract shall be strictly interchangeable with the parts which they are intended to replace. The spares shall be treated and packed for long storage under the climatic conditions prevailing at the site, e.g. small items shall be packed in sealed transparent plastic bags with dessicator packs, as necessary.


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

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


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	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 9
REV: R0	MASTER SPECIFICATIONS	Page 194 of 555
2.1.4	All mandatory spares shall be delivered to site within one to three months prior to the scheduled date of the trial operation of the plant. However, they shall not be despatched before the despatch of the associated main equipment.	
2.1.5	The Bidder shall also guarantee supply of spare parts, which will be made, based on manufacturer's drawings on special order from the Owner for 30 years after commissioning of the plant.	
2.1.6	Warranty period for all kinds of spares shall be six thousand (6000) hours of operation, except normal wear or eighteen (18) months from the date of receipt at site, whichever is later. In case of failure or non-conformance to specifications, the Contractor shall replace them free of cost.	
2.1.7	Design & Engineering details of all spares (make, model, rating, drawing, data sheet etc.) shall be submitted to the Owner prior to dispatch from manufacturers' works.	
2.2	<u>RECOMMENDED SPARES</u>	
2.2.1	The Contractor shall provide a list of recommended spares giving unit prices and total prices for Three (3) years of normal operation of the plant. This list shall take into consideration the mandatory spares specified elsewhere in the specification and shall be a separate list.	
2.2.2	The price of recommended spares will not be used for the evaluation of bids. The price of these spares shall remain valid for a period as specified elsewhere in the specification from the date of Award of the Contract. Where the recommended spares are the same as mandatory spares, the prices shall be the same. The prices of any recommended spares, which are not common with mandatory spares, shall be subject to review by the Owner and shall be finalised after mutual discussion.	
2.3	<u>START-UP COMMISSIONING SPARES</u>	
2.3.1	Start-up commissioning spares are those spares which may be required during the start-up and commissioning of the equipment/system. All spares used until the plant is handed over to the Owner shall come under this category. Said spares, properly marked, shall be supplied together with the	

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	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 9
REV: R0	MASTER SPECIFICATIONS	Page 195 of 555
<p>main equipment and shall be used by the Contractor, if needed, during erection & commissioning stage. All such spares which remain unused till issuance of Taking Over Certificate by the Owner, along with an equipment-wise quantitative consumption report shall be returned to the Owner during time of handover. The list of commissioning spares to be brought by the Contractor to ensure smooth commissioning of the plant shall be subject to the Engineer's approval.</p> <p>2.3.2 The Contractor shall submit a complete list of all such start-up spares. Costs of the above spares, which are consumed before the handing-over of the plant, shall be deemed to have been included in the lump sum proposal price of the package, and the Contractor shall have no claim on this account to the Owner.</p> <p>2.4 <u>MANDATORY SPARE PARTS</u></p> <p>2.4.1 The Owner considers some of the spares as essential for running the equipment irrespective of whether they are included in the list of recommended spares by the Bidder as mentioned above.</p> <p>2.4.2 Since the components involved can not be foreseen at the bidding stage, only broad requirements of the Owner in this respect are outlined hereinafter. The Bidder shall include in his proposal, an item-wise list of all components and the quantity, unit prices & total price thereof, offered as mandatory spares for each and every equipment. This list shall be separate from the list of recommended spares and shall be used for bid evaluation purposes. Any clarification in this respect may be obtained by the Bidder at the pre-bidding stage. During finalization of detailed engineering if some component, equipment, system, sub-system found to undergo change, then the Owner/Consultant shall revise the list for compliance by the contractor without any cost implication.</p> <p>2.4.3 The mandatory spares should be supplied to the Owner at least one month before the trial run of the Unit. The despatch programme is subject to approval of the Owner/ Consultant after award of contract.</p> <p>2.4.4 Criteria for selection of Quantity of Mandatory Spares:</p>		

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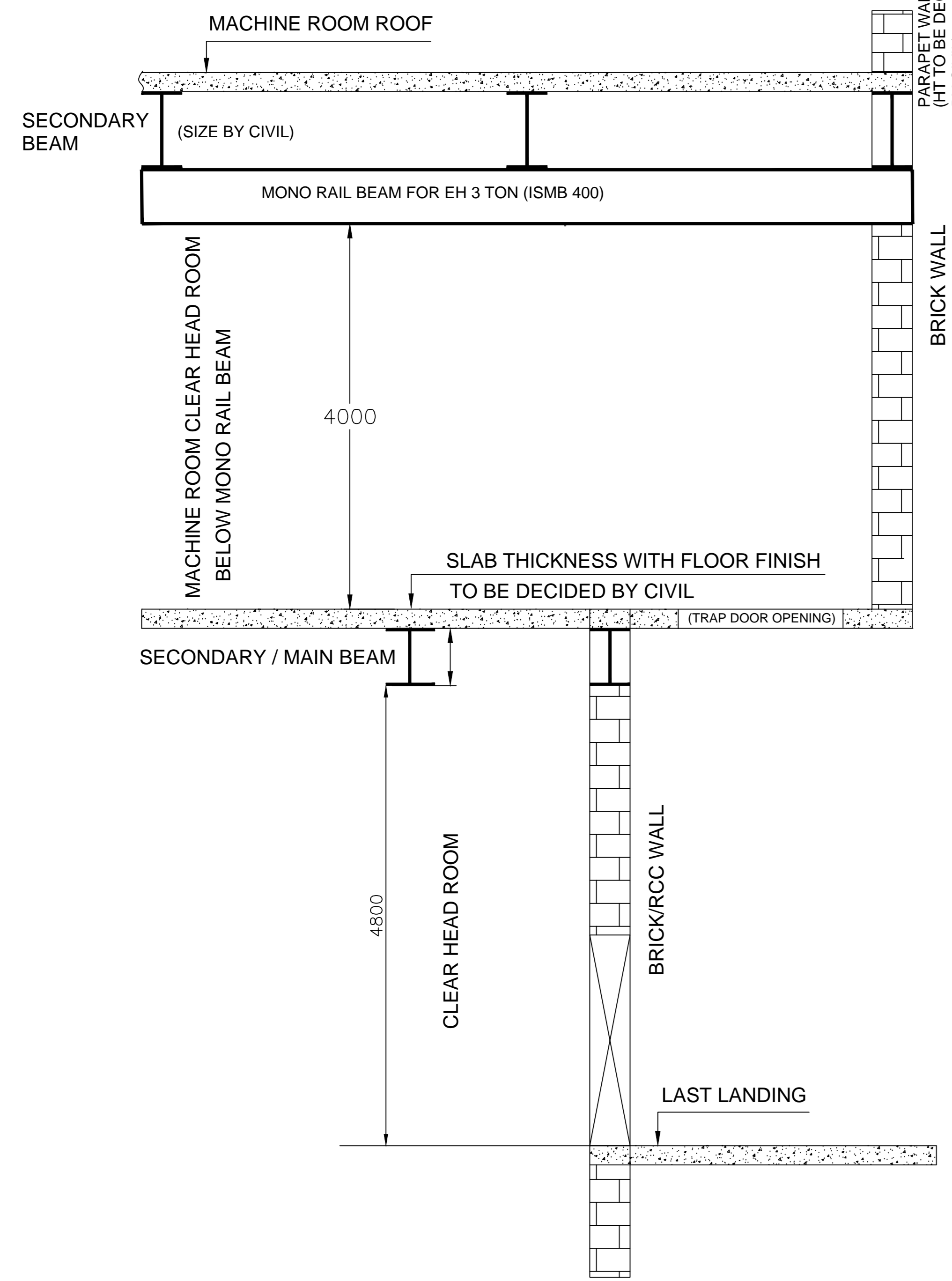
 MAHAGENCO <small>Maharashtra State Power Generation Co. Ltd.</small>	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 9
REV: R0	MASTER SPECIFICATIONS	Page 196 of 555
<p>2.4.4.1 The list of mandatory spares considered essential by the Owner is enclosed in Annexures of this specification. The Bidder shall indicate the prices for each and every item (except for items not applicable to the Bidders design) whether or not he considers it necessary for the Owner 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 of each item. Whenever the quantity is mentioned in “sets”, the Bidder has to give the item details and prices of each item.</p> <p>2.4.4.2 Whenever the quantity is indicated as a percentage, it shall mean percentage of total population of that item in the station (project) unless specified otherwise, and the fraction will be rounded off to the next higher whole number. Wherever the requirement has been specified a ‘set’, it will include the total requirement of the item for a unit, module or the station or as specified. Where it is not specified, a ‘set’ would mean the requirement for the single equipment/system as the case may be. Also, the ‘set’ would include all components required to replace the item; for example, a set of bearings shall include all hardware normally required while replacing the bearings.</p> <p>2.4.4.3 The prices of mandatory spares indicated by the Bidder in the Bid Proposal shall be used for bid evaluation purposes.</p> <p>2.4.4.4 Wherever quantity is specified both as a percentage and a value, the bidder has to supply the higher quantity until and unless specified otherwise.</p> <p>2.4.4.5 For Mandatory Spares, refer Annexures of Mechanical, Electrical and C&I packages.</p> <p>2.4.5 Owner will have the option to procure any or all of the mandatory spares at his discretion.</p> <p>3.0 <u>ELECTRICAL LABORATORY AND TESTING EQUIPMENTS</u></p> <p>The bidder shall furnish Electrical Laboratory & Testing Equipment as specified in Annexure D of this section & include any other equipment considered necessary for the satisfactory operation of the unit and associated 400 kV switchyard and other systems in the power plant.</p>		

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CIVIL INPUT DETAILS

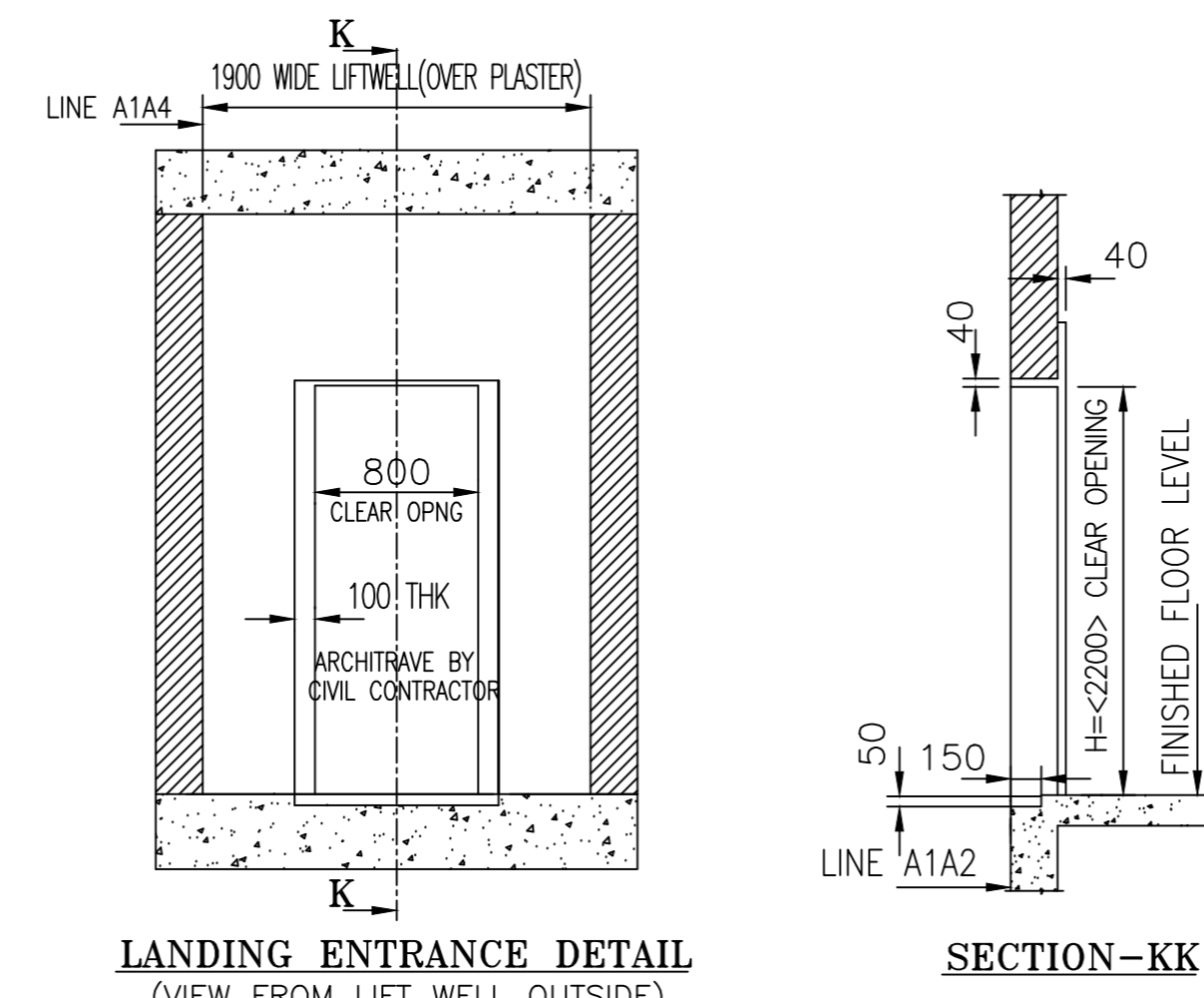
Refer attached civil input assignment drawings. (for FGD Control building elevators)

ELEVATION ON MACHINE ROOM



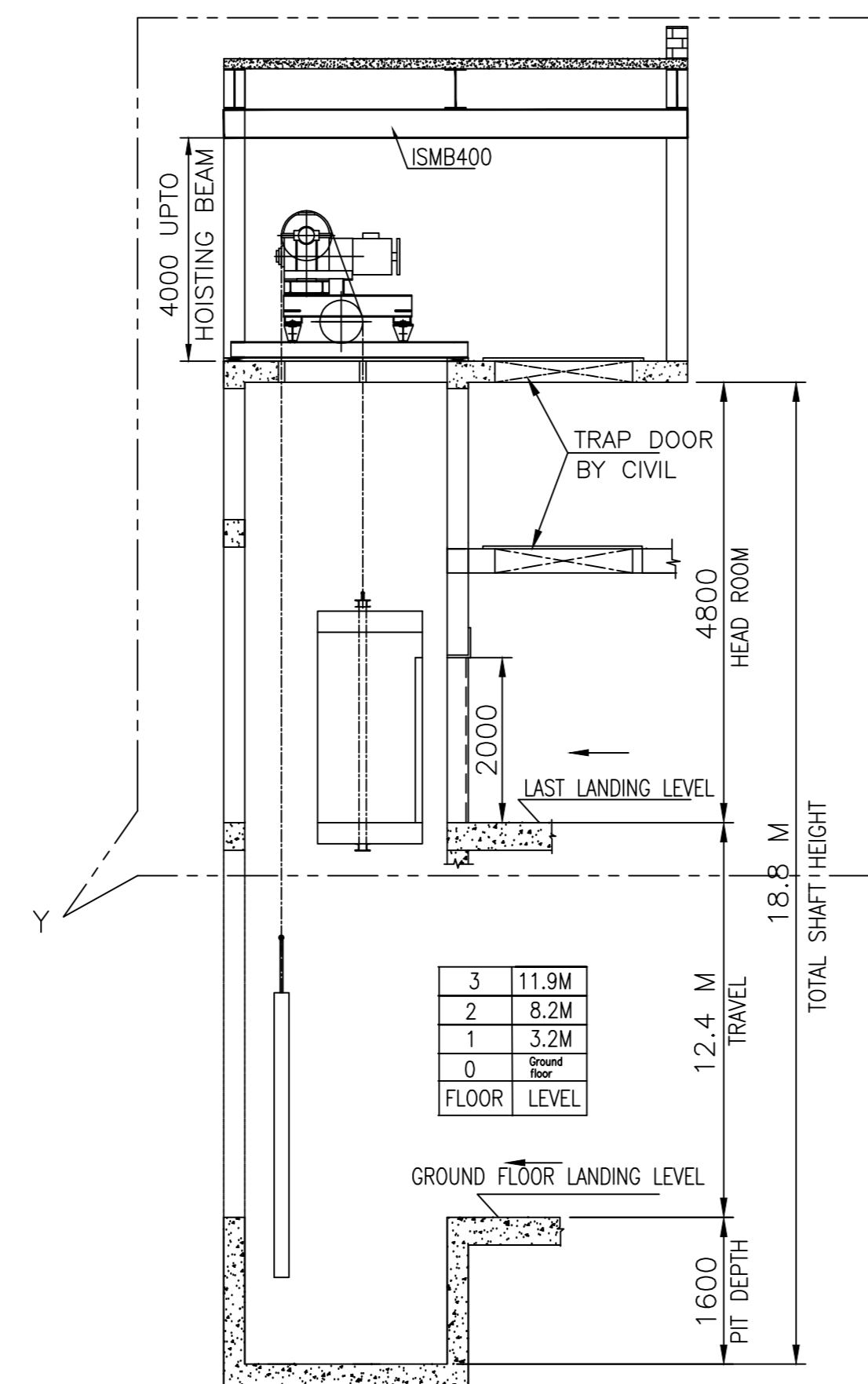
DETAIL-Y

STANDARD DETAILS OF SHAFT



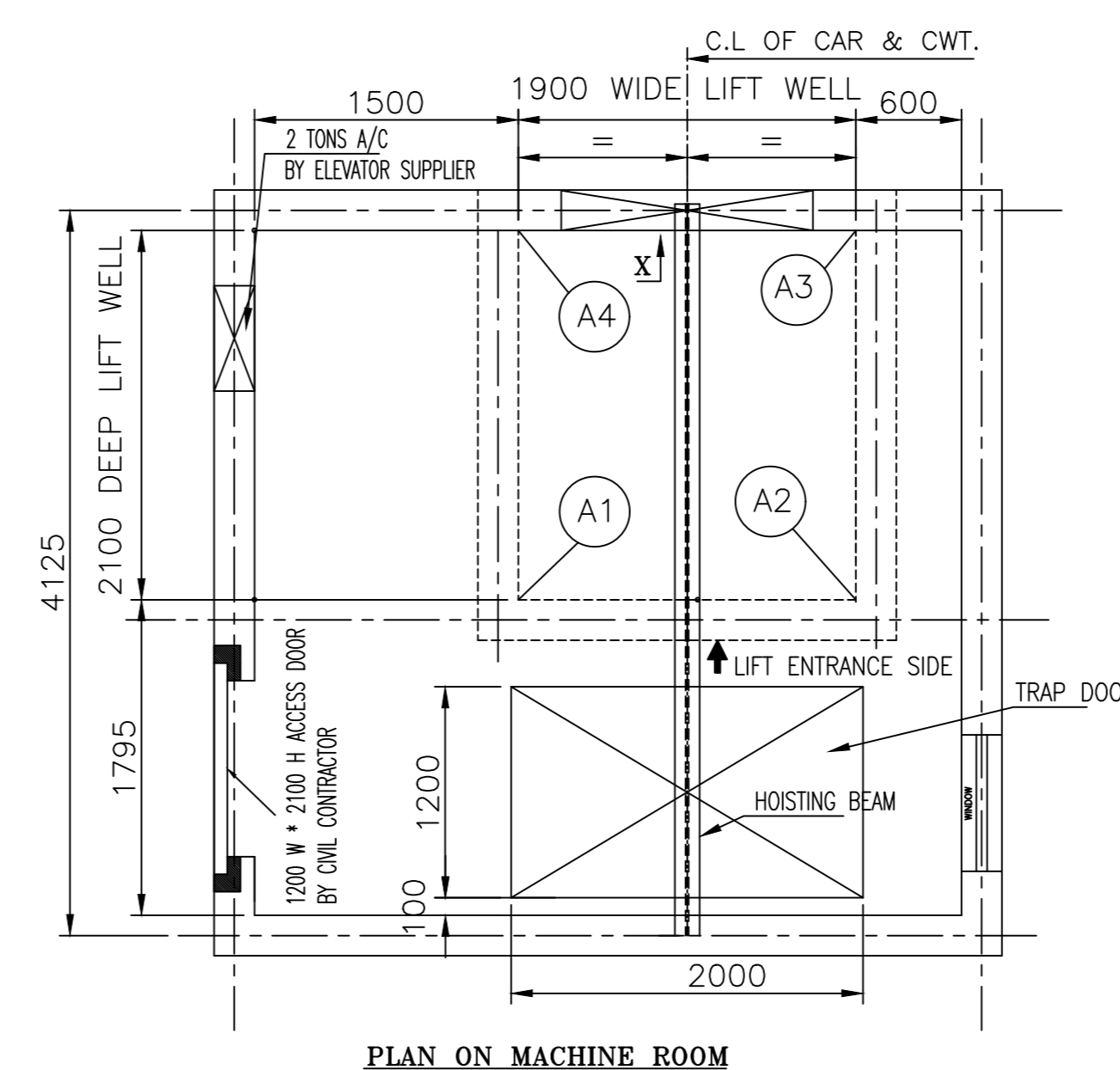
LANDING ENTRANCE DETAIL
(VIEW FROM LIFT WELL OUTSIDE)
(TYPICAL FOR ALL FLOORS)

SECTION-KK

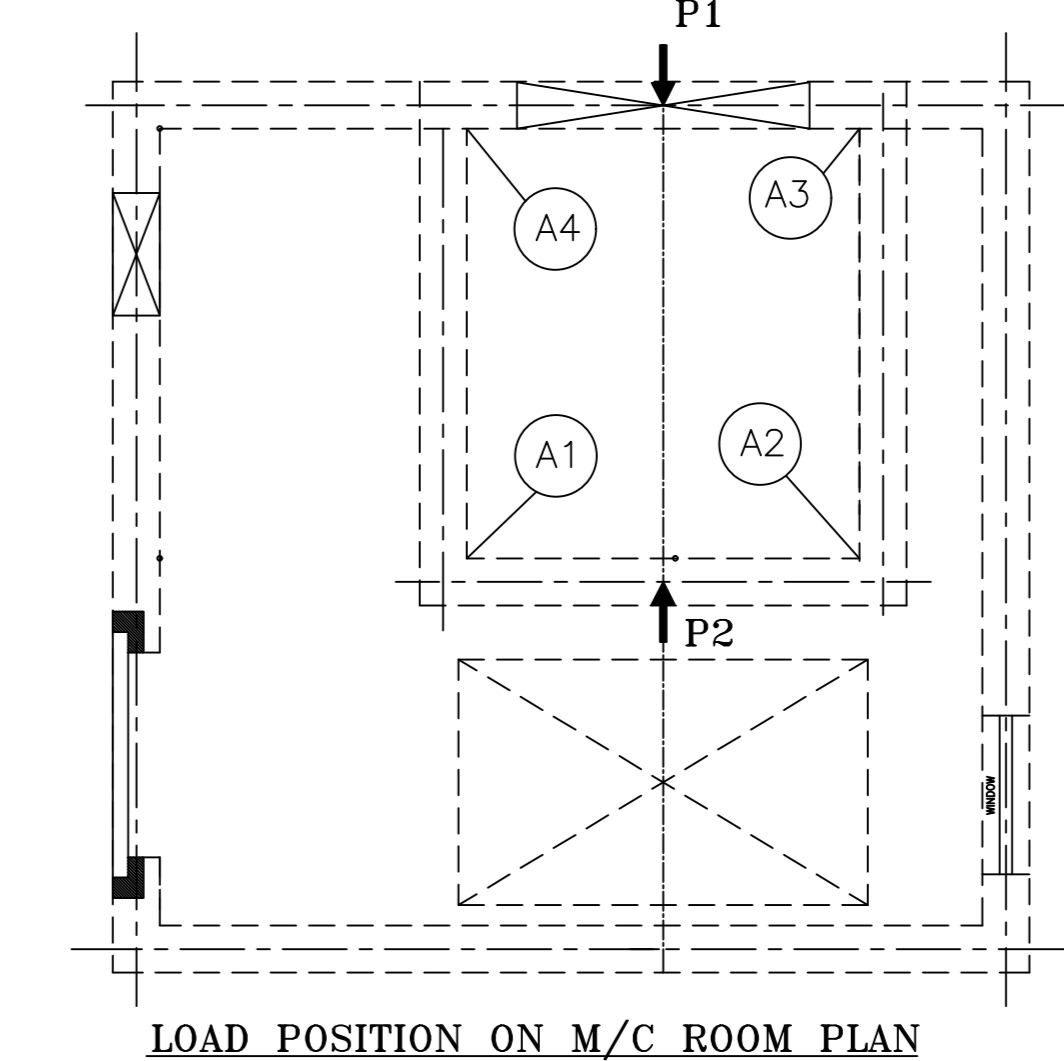


ELEVATIONAL DETAILS
(NOT FOR SCALE)

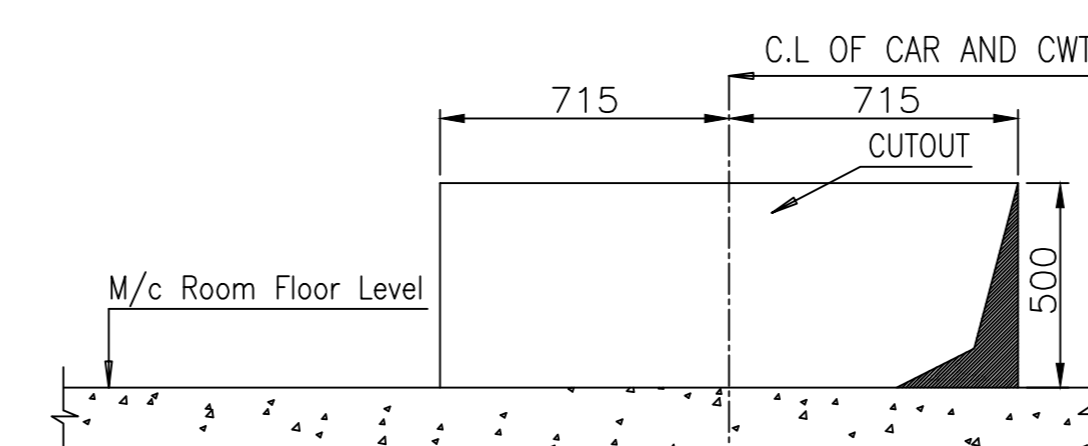
STANDARD DETAILS OF MACHINE ROOM



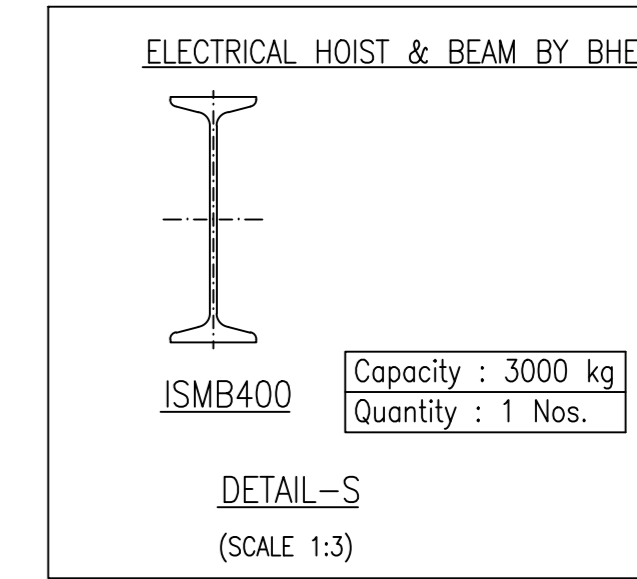
PLAN ON MACHINE ROOM



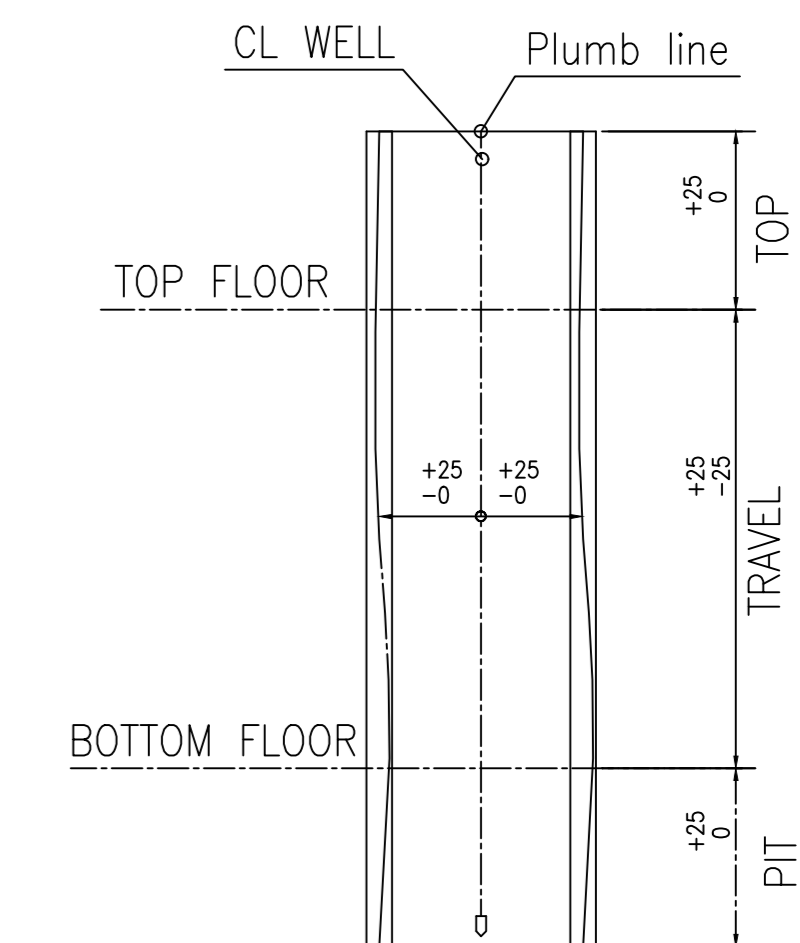
LOAD POSITION ON M/C ROOM PLAN



VIEW - X



DETAIL-S
(SCALE 1:3)

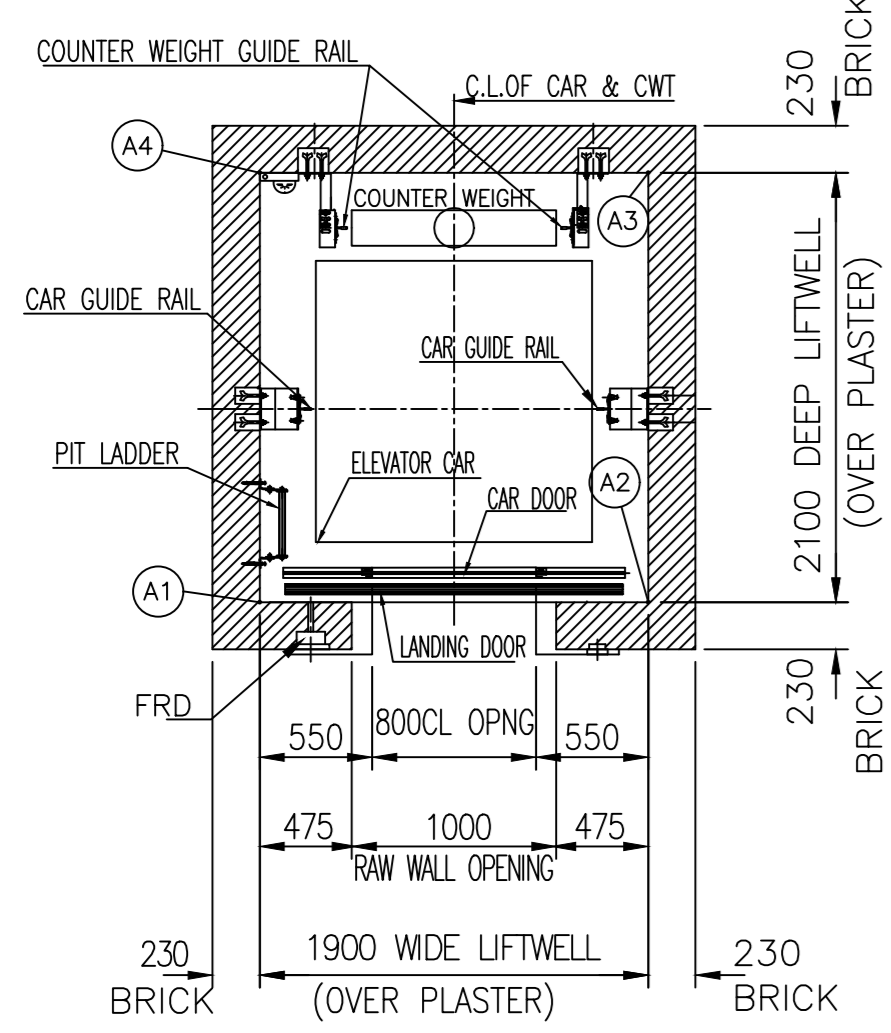


WELL TOLERANCES
(NOT FOR SCALE)

S.NO	AREA	SCOPE	DESCRIPTION OF WORK	AGENCY
1	PIT	CIVIL	PIT LADDER AND SCAFFOLDING IN ELEVATOR SHAFT.	BY VENDOR
2	PIT	CIVIL	PIT SHALL BE MADE DRY AND WATER PROOF.	BY CIVIL CONTRACTOR
3	PIT	CIVIL	BARE PIT SHALL BE PROVIDED. SUPPORTING MS STRUCTURE FOR CAR & CW BUFFER SHALL BE PROVIDED BY VENDOR.	BY VENDOR
4	PIT	CIVIL	PIT SLAB SHALL BE CASTED TO TAKE CARE OF CAR & COUNTERWEIGHT BUFFER LOADS (MAX. LOAD OF 21T) AS THE POSITION OF LOAD & STRUCTURED BUFFER IS VENDOR SPECIFIC. HENCE, CIVIL CONTRACTOR SHALL SIZE THE SLAB THICKNESS ACCORDINGLY WRT TOTAL LOAD OF 21T.	BY CIVIL CONTRACTOR
5	ELEVATOR CAR	ELECTRICAL	ELEVATOR CAR LIGHTING	BY VENDOR
6	ELEVATOR CAR	MECHANICAL	1/2 Kg CO / SUITABLE TYPE FIRE EXTINGUISHER ALONG WITH FIXING ARRANGEMENT.	BY VENDOR
7	AT EVERY LANDING	CIVIL	POCKET CUTTING / HOLES FOR LOP, FRD, LANDING DISPLAY & ANY OTHER FOR EVERY LANDING LEVEL SHALL BE DONE BY VENDOR.	BY VENDOR
8	AT EVERY LANDING	CIVIL	GROUTING FOR LOP, FRD, LANDING DISPLAY & ANY OTHER FOR FIXATION AT EVERY LANDING LEVEL SHALL BE DONE BY VENDOR.	BY VENDOR
9	ELEVATOR SHAFT	CIVIL	SHAFT WHITE WASHING.	BY CIVIL CONTRACTOR
10	ELEVATOR SHAFT	CIVIL	ALL ANCHOR BOLTS FOR FIXING GUIDE BRACKET AND BEAMS IN MACHINE ROOM.	BY VENDOR
11	ELEVATOR SHAFT	CIVIL	LIFT SHAFT HAS TO BE IN THE PLUMB LINE WITH A LIMIT OF -0 +25MM.	BY CIVIL CONTRACTOR
12	ELEVATOR SHAFT	ELECTRICAL	BULK HEAD FITTINGS OF MINIMUM 60 WATTS/ 18W CFL SHALL BE PROVIDED AT EVERY 3 METERS AND A PLUG POINT 15A/5A, 3 PIN AT EVERY 6 METERS-ADJACENT TO THE BULK HEAD FITTINGS. THE POSITION SHOULD BE AT ANY CORNER OF THE WALL OF COUNTER WEIGHT.	BY VENDOR
13	ELEVATOR SHAFT	ELECTRICAL	FIREMAN SWITCH & PIT SWITCHES.	BY VENDOR
14	ELEVATOR SHAFT	MECHANICAL	WIRE MESH BETWEEN CAR & COUNTER WEIGHT.	BY VENDOR
15	MACHINE ROOM	CIVIL	ELEVATOR MACHINE ROOM SHALL BE DESIGNED AS PER THE LOAD REQUIREMENTS GIVEN IN THE ENGG. INPUTS DRAWING FOR ELEVATOR.	BY CIVIL CONTRACTOR
16	MACHINE ROOM	CIVIL	PROVIDE THE REQUIRED HOLES/POCKETS FOR MAIN ROPES / OSG ROPES/ SHAFT ELECTRIFICATION IN THE MACHINE ROOM FLOOR AS PER THE DIMENSIONS GIVEN IN THE ENGG. INPUTS DRAWING FOR ELEVATOR.	BY CIVIL CONTRACTOR
17	MACHINE ROOM	CIVIL	THE MONORAIL BEAM (3 TONS) FOR HOISTING THE MACHINE & HOIST TO BE PROVIDED AS PER THE ENGG. INPUTS DRAWING FOR ELEVATOR.	BY CIVIL CONTRACTOR (SUPPLY & ERECTION OF MONORAIL BEAM SHALL BE DONE BY CIVIL CONTRACTOR)
18	MACHINE ROOM	CIVIL	TRAP DOOR SHALL BE PROVIDED AS PER ENGG. INPUTS DRAWING FOR ELEVATOR.	BY CIVIL CONTRACTOR
19	MACHINE ROOM	CIVIL	SECONDARY BEAM ARRANGEMENT SHALL BE PERPENDICULAR TO MONORAIL BEAM.	BY CIVIL CONTRACTOR
20	MACHINE ROOM	CIVIL	STANDARD MACHINE ROOM DIMENSIONS AS REQUIRED ARE INDICATED IN THE DRAWING. TO SUIT CIVIL DESIGN WRT CIVIL STRUCTURE STABILITY, MACHINE ROOM SIZE CAN BE INCREASED (AS PER CIVIL REQUIREMENT) AND THEN SIZE OF MONORAIL BEAM (ISMB 400) AS MENTIONED IN DETAIL-Y VIEW SHALL BE FINALIZED BY CIVIL AGENCY.	BY CIVIL CONTRACTOR
21	MACHINE ROOM	CIVIL	PROPER ACCESS TO THE MACHINE ROOM SHALL BE PROVIDED AND IT SHOULD BE SAFE AND RIGID WITH HANDRAILS FOR ADEQUATE GRIP.	BY CIVIL CONTRACTOR
22	MACHINE ROOM	ELECTRICAL	THE MACHINE ROOM SHALL BE ADEQUATELY ILLUMINATED. THE MACHINE ROOM SHALL HAVE MINIMUM 200 LUX ILLUMINATION AT THE FLOOR LEVEL.	BY VENDOR
23	MACHINE ROOM	ELECTRICAL	CONVENIENT OUTLET (15A /5A) IN THE MACHINE ROOM TO BE PROVIDED FOR POWER TOOL USAGE.	BY VENDOR
24	MACHINE ROOM	ELECTRICAL	ONLY TWO (3 PHASE) SUPPLY FEEDERS PER ELEVATOR SHALL BE PROVIDED ONE FEEDER SHALL BE DEDICATED TO ELEVATOR MOTOR AND OTHER 3 PHASE SUPPLY FEEDER SHALL BE PROVIDED BY BHFL FOR AIR CONDITIONER, MACHINE ROOM AND SHAFT LIGHTING AND MAINTENANCE /INSTALLATION REQUIREMENT. VENDOR SHALL PROVIDE CT FOR STEPPING DOWN THE VOLTAGE AS PER THEIR REQUIREMENT.	BY ELECTRICAL CONTRACTOR (VENDOR TO CONSIDER CT IN THEIR SCOPE FOR STEPPING DOWN THE VOLTAGE AS PER THEIR REQUIREMENT)
25	MACHINE ROOM	ELECTRICAL	THE TERMINATION & TERMINATION BOX FOR THE FEEDERS SHALL BE PROVIDED.	BY VENDOR
26	MACHINE ROOM	ELECTRICAL	THE EARTHING LEADS / EARTH STRIPS SHALL BE PROVIDED NEAR ELEVATOR SHAFT AT GROUND FLOOR BY ELECTRICAL CONTRACTOR AND FROM GROUND FLOOR TO MACHINE ROOM SHALL BE ROUTED BY VENDOR.	BY ELECTRICAL CONTRACTOR & BY VENDOR
27	MACHINE ROOM	ELECTRICAL	EPABX CONNECTIVITY SHALL BE PROVIDED TILL MACHINE ROOM BY ELECTRICAL CONTRACTOR & FROM MACHINE ROOM TO ELEVATOR BY VENDOR	BY ELECTRICAL CONTRACTOR & BY VENDOR
28	MACHINE ROOM	MECHANICAL	SPLIT AC (MIN 2 TONS) TO BE PROVIDED IN THE EACH ELEVATOR MACHINE ROOM.	BY VENDOR
29	ELEVATOR SHAFT	CIVIL	ELEVATOR SHAFT SHALL BE OF CLAY BRICK (MIN. 230MM THK) OR R.C.C ONLY. (FLY ASH BRICKS NOT TO BE USED). LINTEL BEAM AT EVERY 2.3 M TO 2.5 M SHALL BE PROVIDED FOR COUNTER WEIGHT & CAR BRACKET FIXING.	BY CIVIL CONTRACTOR
30	ELEVATOR SHAFT	CIVIL	LIFT ENTRANCE SIDE WALL (ON ALL FLOORS) SHALL BE KEPT ON HOLD & SHALL BE CONSTRUCTED AFTER ORDERING/ RECEIVING INPUT FROM FINALLY SELECTED BIDDER. UPON LIFTING HOLD, FINAL WALL CONSTRUCTION SHALL BE DONE BY CIVIL CONTRACTOR ONLY.	BY CIVIL CONTRACTOR
31	ELEVATOR SHAFT	CIVIL	CLEAR HEADROOM OF 4.8M IS REQUIRED ABOVE LAST LANDING LEVEL OF ELEVATOR (EXCLUDING MACHINE ROOM SLAB THICKNESS & SECONDARY BEAM (IF ANY)). THE SAME IS TO BE ENSURED ACCORDINGLY BY CIVIL CONTRACTOR.	BY CIVIL CONTRACTOR
32	ELEVATOR SHAFT	CIVIL	IN CASE OF DUPLEX ARRANGEMENT OF ELEVATORS, WHERE ELEVATORS ARE PLACED SIDE BY SIDE. BRACKET OF GUIDE RAILS FOR BOTH THE ELEVATORS SHALL BE FIXED ON THE COMMON WALL BETWEEN BOTH LIFT SHAFTS. HENCE, THIS WALL MAY BE SUITABLY DESIGNED/ STRENGTHENED SO AS TO SUSTAIN REQUIRED GUIDE RAIL LOADS AS THIS WALL SHALL BE SUBJECT TO GUIDE RAIL FORCES FROM BOTH SIDES.	BY CIVIL CONTRACTOR
33	ELEVATOR SHAFT	CIVIL	DUMMY LANDINGS ARE REQUIRED IN CASE TRAVEL BETWEEN TWO CONSECUTIVE LANDINGS IS MORE THAN 10 M, AS PER CODAL REQUIREMENT. CORRESPONDING LANDING PLATFORMS & SUITABLE ACCESS LADDER/ STAIRS FOR DUMMY LANDING PLATFORMS ARE ALSO TO BE PROVIDED ACCORDINGLY.	BY CIVIL CONTRACTOR
34	ELEVATOR SHAFT	CIVIL	CIVIL LOADS SHALL BE TRANSFERRED TO WALLS (TYPICAL LOCATION AS SHOWN IN DRAWING). WALLS SHALL BE DESIGNED ACCORDINGLY.	BY CIVIL CONTRACTOR
35	MACHINE ROOM	CIVIL	CLEAR HEIGHT OF 4M IS REQUIRED IN THE ELEVATOR MACHINE ROOM BELOW MONORAIL BEAM (I.E. EXCLUDING MONORAIL BEAM (FOR ELECTRIC HOIST), SECONDARY BEAMS (IF ANY) & SLAB THICKNESS). HENCE, ELEVATION OF TOP OF MACHINE ROOM ROOF TO BE CALCULATED ACCORDINGLY BY CIVIL CONTRACTOR.	BY CIVIL CONTRACTOR
36	MACHINE ROOM	CIVIL	TRAP DOOR IS TO BE PLACED IN MACHINE ROOM TOWARDS ELEVATOR LANDING SIDE CONSIDERING THAT NO EQUIPMENTS/ OBJECTS SHALL BE LOCATED BELOW THE SAME AT LAST LANDING LEVEL FLOOR, ELSE IT WOULD CAUSE HINDRANCE IN MOVEMENT OF ELEVATOR MACHINERY OUT OF THE MACHINE ROOM DURING MAINTAINANCE.	BY CIVIL CONTRACTOR
37	PIT, SHAFT & MACHINE ROOM	CIVIL	NO PROJECTIONS ARE ALLOWED INSIDE THE LIFT SHAFT / PIT AND MACHINE ROOM. HENCE PLEASE ENSURE THAT ANY COLUMN / COLUMN FOUNDATIONS/ PLINTH BEAMS/ FLOOR SUPPORTING BEAMS SHOULD NOT BE PROJECTED INSIDE THE LIFT SHAFT/ PIT & ELEVATOR MACHINE ROOM.	BY CIVIL CONTRACTOR
38	MACHINE ROOM	CIVIL	MINIMUM REQUIREMENT OF MACHINE ROOM ALONG WITH TRAP DOOR ARE INDICATED HERE. HOWEVER PROJECT SPECIFIC REQUIREMENTS SHALL BE DISCUSSED ON CASE TO CASE BASIS.	BY CIVIL CONTRACTOR

NOTE: ALL DIMENSIONS ARE IN MM

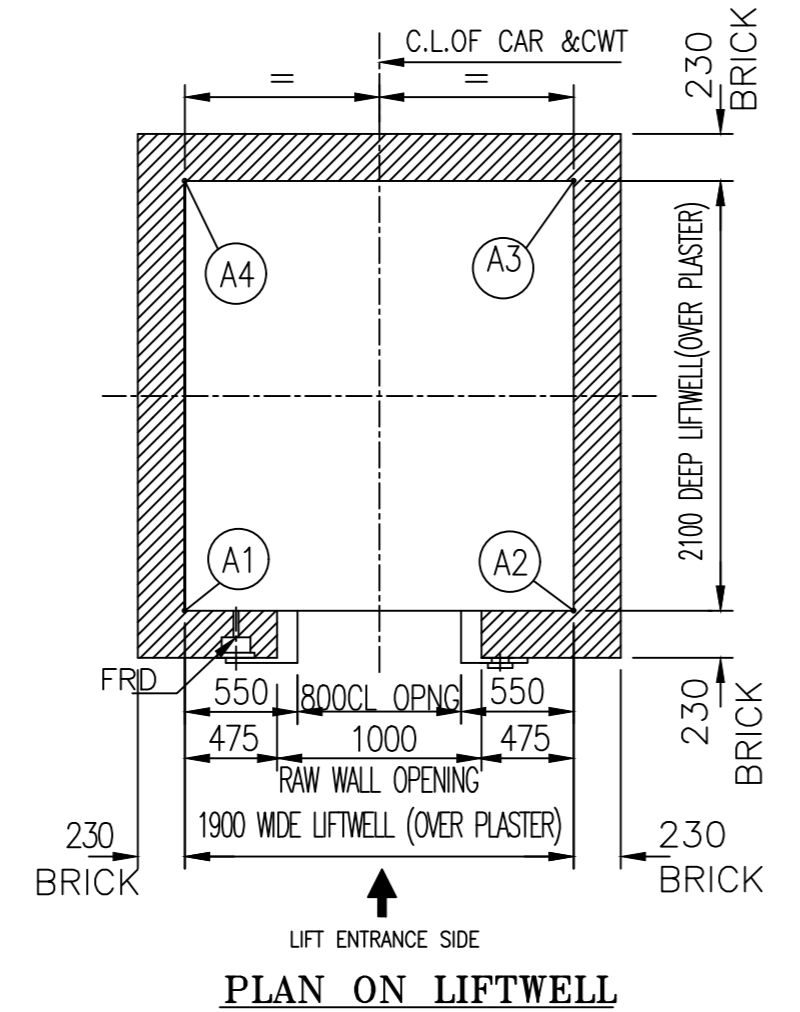
STANDARD DETAILS OF PIT



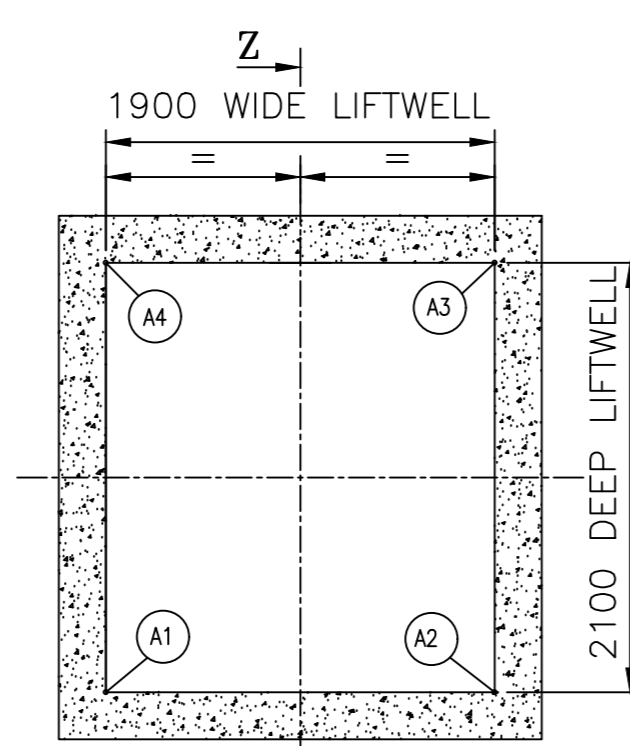
FORCES ON CAR & CWT GUIDE RAIL	
Fx	700 N
Fy	600 N
J	19000 N

GUIDE RAIL FORCES

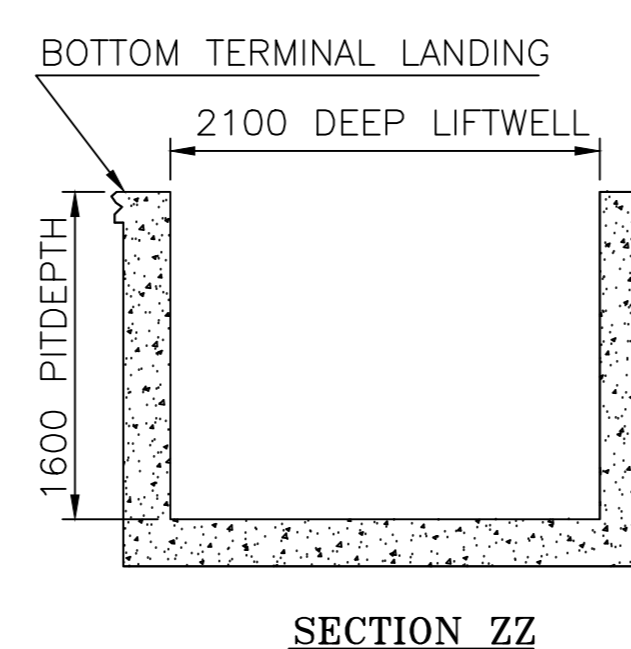
PLAN ON LIFTWELL- TYPICAL LOCATION OF GUIDERAILS FOR CAR & COUNTERWEIGHT



PLAN ON LIFTWELL



R.C.C DETAILS OF PIT



SECTION ZZ

CUSTOMER:	MAHARASHTRA STATE POWER GENERATION CO. LTD. (MAHAGENCO)								
CONSULTANT:	---								
PROJECT:	1X660 MW BHUSAWAL TPS								
DRIVEN BY:	BHARAT HEAVY ELECTRICALS LTD POWER SECTOR PROJECT ENGINEERING MANAGEMENT NOIDA								
JOB NO.:	415								
STATUS:	CONTRACT								
DISTRIBUTION:									
REV.	DATE	ALD	CHD	APPD	DEPT	CODE	NAME	SIGN	DATE
					DESIGN	BS			23.09.22
					CHD	PKK			23.09.22
					APPD	GB			23.09.22
TITLE: ENGG. INPUTS DRAWING FOR 10 PASS. (680KG) ELEVATOR-FGD CONTROL BUILDING									
DEPT. SCALE:		DRAWING NO.:							
SIGN:		PE-DG-415-502-A004							
		SHEET 01 OF 01							
		REV. 00							



1X660 MW BHUSAWAL TPS UNIT-6
TECHNICAL SPECIFICATION
FOR
ELEVATORS

SPECIFICATION NO.: PE-TS-415-502-A001

SECTION: I

SUB SECTION: IB

REV: 01

DATE: SEP'22

Page: 1 of 1

SECTION – I

SPECIFIC TECHNICAL REQUIREMENTS

IB – Specific Technical Requirement (Electrical)



TECHNICAL SPECIFICATION FOR
ELEVATORS
(ELECTRICAL PORTION)

SPECIFICATION NO.
SECTION-C
REV 00 DATE 23.01.19
PAGE 1 OF 1

SPECIFIC TECHNICAL REQUIREMENTS: ELECTRICAL

1.0 EQUIPMENT & SERVICES TO BE PROVIDED BY BIDDER/ PURCHASER

- a) Services and equipment as per "Electrical Scope between BHEL and Vendor".
- b) Any item/work either supply of equipment or erection material which have not been specifically mentioned but are necessary to complete the work for trouble free and efficient operation of the plant shall be deemed to be included within the scope of this specification. The same shall be provided by the bidder without any extra charge.
- c) Supply of mandatory spares as specified in the specifications of mechanical equipments.
- d) Electrical load requirement for Elevators.
- e) All equipment shall be suitable for the power supply fault levels and other climatic conditions mentioned in the enclosed project information.
- f) Bidder to furnish list of makes for each equipment at contract stage, which shall be subject to customer/BHEL approval without any commercial and delivery implications to BHEL
- g) Various drawings, data sheets as per required format, Quality plans, calculations, test reports, test certificates, operation and maintenance manuals etc shall be furnished as specified at contract stage. All documents shall be subject to customer/BHEL approval without any commercial implication to BHEL.
- h) Motor shall meet minimum requirement of motor specification.
- i) Vendor to clearly indicate equipment locations and local routing lengths in their cable listing furnished to BHEL.
- j) Cable BOQ worked out based on routing of cable listing provided by the vendor for "both end equipment in vendor's scope" shall be binding to the vendor with +10 % margin to take care of slight variation in routing length & wastages.
- k) Technical requirements shall be as per specifications listed in Clause 4.1, 4.2, 4.3, 4.4 & 4.5 below.

3.0 DOCUMENTS TO BE SUBMITTED ALONG WITH BID

3.1 Bidder shall confirm total compliance to the electrical specification without any deviation from the technical/ quality assurance requirements stipulated. In line with this, the bidder as technical offer shall furnish two signed and stamped copies of the following:

- a) A copy of this sheet "Electrical Equipment Specification for ELEVATORS" and sheet "Electrical Scope between BHEL and Vendor" with bidder's signature and company stamp.
- b) Electrical load requirement in the load data format.

3.2 No technical submittal such as copies of data sheets, drawings, write-up, quality plans, type test certificates, technical literature, etc, is required during tender stage. Any such submission even if made, shall not be considered as part of offer.

4.0 LIST OF ENCLOSURES

- 4.1 Electrical scope between BHEL & vendor (Annexure-A).
- 4.2 Technical specification for Motors DG/BSL U-6/2011/T-1
- 4.3 Data Sheet- A along with Annexure-I.
- 4.4 Constructional details of cables.
- 4.5 Quality Plan
- 4.6 Load data format (Annexure-B).

STANDARD ELECTRICAL SCOPE BETWEEN BHEL AND VENDOR (FOR EPC PROJECTS)


PACKAGE: ELEVATORS

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

PROJECT: 1 X 660 MW BHUSAWAL TPP

ANNEXURE-A

<u>S. NO</u>	<u>DETAILS</u>	<u>SCOPE SUPPLY</u>	<u>SCOPE E&C</u>	<u>REMARKS</u>
1	Isolating Switch	Vendor	Vendor	BHEL will provide two number 415V (3ph, 4W) supply feeder only up to isolating switches for elevators. Any other voltage level (AC/DC) required will be derived by the vendor. Motor starter shall be part of elevator control panel.
2	Power cables, control cables, screened control cables and any special cables (if required) between equipment supplied by vendor.	Vendor	Vendor	Cable from supply feeder to isolating switch shall be in BHEL scope.
3	Cabling material (cable trays, accessories, cable tray supporting system, conduits etc).	Vendor	Vendor	
4	Equipment Earthing	Vendor	Vendor	All equipment metallic enclosures / frames, metal structure etc. shall be grounded at two points each to the nearest grounding points / risers provided by BHEL.
5	Motors	Vendor	Vendor	
6	Cable glands and lugs for equipment supplied by vendor	Vendor	Vendor	<ol style="list-style-type: none"> 1. Double compression Ni-Cr plated brass cable glands 2. Solder less crimping type heavy duty tinned copper lugs for power & control cables.
7	<ol style="list-style-type: none"> a) Input cable schedules (C & I) b) Cable interconnection details for above c) Cable block diagram 	Vendor Vendor Vendor	- - -	Cable listing for Control and Instrumentation Cable in enclosed excel format shall be submitted by vendor during detailed engineering stage.
8	Equipment layout drawings	Vendor	-	
9	Electrical Equipment GA drawing	Vendor	-	For necessary interface review.

 MAHAGENCO <small>Maharashtra State Power Generation Co. Ltd</small>	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: IV-A
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 10
REV: R0	ELECTRICAL EQUIPMENT & ACCESSORIES	Page 365 of 440

1.0 **SCOPE**

- 1.1 This section covers the general requirements of the drive motors for power station auxiliary equipment.
- 1.2 Motors shall be furnished in accordance with both this general specification and the accompanying driven equipment specification.
- 1.3 In case of any discrepancy, the driven equipment specification shall govern etc.


2.0 **STANDARDS**

- 2.1 All motors shall conform to the latest applicable IS, IEC and CBIP Standards/ Publications except when otherwise stated herein or in the driven equipment specification.
- 2.2 Major standards, which shall be followed, are listed below other applicable Indian Standards for any component part even if not covered in the listed standards shall also be followed
- (a) IS-325
 - (b) IS-12615
 - (c) IEC-34

3.0 **SERVICE CONDITIONS**


- 3.1 The motors will be installed in hot, humid and tropical atmosphere, highly polluted at places with coal dust and/or fly ash canopy to be provided to all outdoor install motors.
- 3.2 Unless otherwise noted, electrical equipment/system design shall be based on the service conditions and auxiliary power supply given in the annexure to this specification.

CONSULTANT : PROCON ENGINEERS


 MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: IV-A
	Section – 10
REV: R0	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1 ELECTRICAL EQUIPMENT & ACCESSORIES
Page 366 of 440	

3.3	For motor installed outdoor and exposed to direct sunrays, the effect of solar heat shall be considered in the determination of the design ambient temperature
4.0	<u>TYPE AND RATING</u>
4.1	<u>A.C. MOTORS</u>
4.1.1	Motors shall be general purpose, constant speed, squirrel cage, three phase, induction type.
4.1.2	All motors shall be rated for continuous duty. They shall also be suitable for long period of inactivity.
4.1.3	The motor name-plate rating at 50°C shall have at least 10% margin over the input power requirement of the driven HT equipment at rated duty point unless stated otherwise in driven equipment specification or in general electrical specification.
4.1.4	The motor characteristics shall match the requirements of the driven equipment so that adequate starting, accelerating, pull up, break down and full load torques are available for the intended service.
4.1.5	All LT motors used in this project are proposed to be energy efficient type suitable for EFF1 efficiency rating.
4.1.6	The motor name plate rating shall have at least 10% margin over the input power requirement of the HT driven equipment and 15% for LT driven equipments at rated duty point.
4.1.7	Motors located in hazardous area shall be flame proof type.
4.2	<u>D.C. MOTORS</u>
4.2.1	D.C. Motor provided for emergency service shall be shunt/compound wound type.
4.2.2	Motor shall be sized for operation with fixed resistance starter for maximum reliability.

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 MAHAGENCO <small>Maharashtra State Power Generation Co. Ltd</small>	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: IV-A
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 10
REV: R0	ELECTRICAL EQUIPMENT & ACCESSORIES	Page 367 of 440
4.2.3	Starter panel complete with all accessories shall be included in the scope of supply.	
4.3	For equipment installed outdoor and exposed to direct sun rays, the effect of solar heat shall be considered in determining the design ambient temperature.	
5.0	<u>PERFORMANCE</u>	
5.1	<u>RUNNING REQUIREMENTS</u>	
5.1.1	Motor shall run continuously at rated output over the entire range of voltage and frequency variations as given in the annexure.	
5.1.2	The motor shall be capable of operating satisfactorily at full load for 5 minutes without injurious heating with 75% rated voltage at motor terminals.	
5.1.3	The motor shall be designed to withstand momentary overload of 60% of full load torque for 15 second without any damage.	
5.1.4	Motor shall not be stalled if the supply voltage drops to 70% of the rated voltage for 2 seconds duration.	
5.2	<u>STARTING REQUIREMENTS</u>	
	Motor shall be designed for direct online starting at full voltage. Starting current shall not exceed 6 times full load current for all auxiliaries except boiler feed pump where the starting current shall be limited to 4.5 times. No further tolerances are applicable on starting current specified above for HT motors	
5.2.1	The motor shall be capable of withstanding the stresses imposed if started at 110% rated voltage	
5.2.2	Motor shall start with rated load and accelerate to full speed with 80% rated voltage at motor terminal except BFP motor. In case of BFP motor, it shall	

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 MAHAGENCO <small>Maharashtra State Power Generation Co. Ltd</small>	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: IV-A
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 10
REV: R0	ELECTRICAL EQUIPMENT & ACCESSORIES	Page 368 of 440

be 75% rated voltage. Minimum starting requirement for mill motor (double cage) shall be 85% rated voltage at motor terminals.

5.2.3 Motor shall be capable of three equally spread starts per hour, two starts in quick succession from cold condition and one restart from hot condition.

Cranking motor shall be capable of six equally spread starts per hour, three starts in quick succession from cold condition and one restart from hot condition. The coal conveyor and crusher motors shall be suitable for 3 consecutive hot starts with maximum 20 starts per day.

Pump motor subject to reverse rotation shall be designed to withstand the stresses encountered when starting with shaft rotating at 125% rated speed in reverse direction.

5.2.4 HT pump motors shall be suitable to start with forward rotation.

5.2.5 The motors shall be designed to withstand 120% of rated speed for 2 minutes without any mechanical damage

5.3 STRESS DURING BUS TRANSFER.


5.3.1 The motor may be subjected to sudden application of 150% rated voltage during bus transfer, due to the phase difference between the incoming voltage and motor residual voltage.

5.3.2 The motor shall be designed to withstand any torsional and/or high current stresses, which may result, without experiencing any deterioration in the normal life and performance characteristics.


5.4 LOCKED ROTOR WITHSTAND TIME

5.4.1 The locked rotor withstand time under hot condition at 110% rated voltage shall be more than motor starting time by at least 2.5 seconds for motors up to 20 seconds starting time and by 5 seconds for motor with more than 20 seconds starting time.

CONSULTANT : PROCON ENGINEERS

 MAHAGENCO <small>Maharashtra State Power Generation Co. Ltd</small>	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: IV-A
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 10
REV: R0	ELECTRICAL EQUIPMENT & ACCESSORIES	Page 369 of 440
5.4.2	Starting time mentioned above is at minimum permissible voltage of 80% rated voltage.	
5.4.3	Hot thermal withstand curve shall have a margin of at least 10% over the full load current of the motor to permit relay setting utilizing motor rated capacity	
6.0	<u>SPECIFIC REQUIREMENTS</u>	
6.1	<u>ENCLOSURE</u>	
6.1.1	All indoor motor enclosures shall conform to the degree of protection IP-55 unless otherwise specified and outdoor motor enclosure shall confirm to degree of IPW-55.Motor for outdoor or semi-outdoor service shall be of weather-proof construction.	
6.1.2	For hazardous area approved type of increased safety enclosure shall be furnished.	
6.2	<u>COOLING</u>	
6.2.1	The motor shall be self ventilated type, either totally enclosed fan cooled (TEFC) or closed air circuit air- cooled (CACA).	
6.2.2	In case water cooling is required for very large motors, prior approval of the customer is to be obtained before proceeding ahead with design & manufacture.	
6.3	<u>WINDING AND INSULATION</u>	
6.3.1	All insulated winding shall be of copper.	
6.3.2	All motors shall have class F insulation but limited to class B temperature rise.	
6.3.3	Windings shall be impregnated to make them non-hygroscopic and oil resistant.	

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 MAHAGENCO <small>Maharashtra State Power Generation Co. Ltd</small>	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: IV-A
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 10
REV: R0	ELECTRICAL EQUIPMENT & ACCESSORIES	Page 370 of 440

6.4 TROPICAL PROTECTION

6.4.1 All motors shall have fungus protection involving special treatment of insulation and metal against fungus, insects and corrosion.

6.4.2 All fittings and hardware shall be corrosion resistant.

6.5 BEARINGS

6.5.1 Motor shall be provided with antifriction bearings, unless sleeve bearings are required by the motor application.

6.5.2 Vertical shaft motors shall be provided with thrust and guide bearings. Thrust bearing of tilting pad type is preferred.

6.5.3 Bearings shall be provided with seals to prevent leakage of lubricant or entrance of foreign matters like dirt, water etc. into the bearing area.

6.5.4 Sleeve bearings shall be split type, ring oiled, with permanently aligned, close running shaft sleeves.

6.5.5 Grease lubricated bearings shall be prelubricated and shall have provisions for in-service positive lubrication with drains to guard against over lubrication.


6.5.6 Oiled bearing shall have an integral self cooled oil reservoir with oil ring inspection ports, oil sight glass with oil level marked for standstill and running conditions and oil fill and drain plugs.

6.5.7 Forced lubricated or water cooled bearing shall not be used without prior approval of Owner.


6.5.8 Lubricant shall not deteriorate under all service conditions. The lubricant shall be limited to normally available types with IOC equivalent.

6.5.9 Bearings shall be insulated as required to prevent shaft current and resultant bearing damage.

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 MAHAGENCO <small>Maharashtra State Power Generation Co. Ltd</small>	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: IV-A
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 10
REV: R0	ELECTRICAL EQUIPMENT & ACCESSORIES	Page 371 of 440
6.6	<u>NOISE & VIBRATION</u>	
6.6.1	The noise level shall be as per statutory acceptance (IS/IEC).	
6.6.2	The peak amplitude of the vibration shall be within IS/IEC specified limits.	
6.7	<u>MOTOR TERMINAL BOX</u>	
6.7.1	Motor terminal box shall be phase segregated (PSTB) type and located in accordance with Indian Standards clearing the motor base- plate/ foundation.	
6.7.2	Terminal box shall be capable of being turned 360 Deg. in steps of 180 Deg. For HT motors and 90 Deg. for LT motors unless otherwise approved.	
6.7.3	The terminal box shall be split type with removable cover with access to connections and shall have the same degree of protection as motor.	
6.7.4	The terminal box shall have sufficient space inside for termination/connection of XLPE insulated armoured aluminium cables.	
6.7.5	Terminals shall be stud or lead wire type, substantially constructed and thoroughly insulated from the frame.	
6.7.6	The terminals shall be clearly identified by phase markings, with corresponding direction of rotation marked on the non-driving end of the motor.	
6.7.7	The terminal box shall be capable of withstanding maximum system fault current for duration of 0.25 sec.	
6.7.8	For 11kV and 3.3kV motor, the terminal box shall be phase-segregated type. The neutral leads shall be brought out in a separate terminal box (not necessarily phase segregated type) with shorting links for star connection.	
6.7.9	Motor terminal box shall be furnished with suitable cable lugs and double compression brass glands to match with cable used.	
6.7.10	The gland plate for single core cable shall be non-magnetic type.	

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 MAHAGENCO <small>Maharashtra State Power Generation Co. Ltd.</small>	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: IV-A
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 10
REV: R0	ELECTRICAL EQUIPMENT & ACCESSORIES	Page 372 of 440

6.7.11 Due to any reason, if the terminal box is found to be not suitable for the approved cable size for either HT/LT motors, then the bidder shall arrange necessary adopter box to facilitate the termination of cables. The adopter box shall be of the same short circuit rating and specifications as the main terminal box. The adopter box shall be located as near as possible to the main terminal box. The interconnecting cabling between adopter box and main terminal box along with providing suitable cable glands and termination kits as applicable shall also be done by the bidder.

6.8 GROUNDING

6.8.1 The frame of each motor shall be provided with two separate and distinct grounding pads complete with tapped hole, GS bolts and washer

6.8.2 The grounding connection shall be suitable for accommodation of ground conductors as follows :

Motor above 90 kW : 75 x 10 mm GS Flat

Motor above 30 kW up to 90 kW : 50 x 6 mm GS Flat

Motor above 5 kW up to 30 kW : 25 x 6 mm GS Flat

Motor up to 5 kW : 8 SWG GS Wire

6.8.3 The cable terminal box shall have a separate grounding pad


6.9 RATING PLATE

In addition to the minimum information required by IS, the following information shall be shown on motor rating plate:

(a) Temperature rise in Deg.C under rated condition and method of measurement.

(b) Degree of protection.

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 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: IV-A
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 10
REV: R0	ELECTRICAL EQUIPMENT & ACCESSORIES	Page 373 of 440

(c) Bearing identification no. and recommended lubricant.

(d) Location of insulated bearings.

6.10 CONSTRUCTION

6.10.1 Stator Core

The Stator Core Lamination shall be made of high-grade silicon/magnetic steel sheet varnished on both sides and pressed to form rigid core.

6.10.2 Rotor

The rotor construction shall be such that in case of dislodging of the rotor bar from the end ring, it should not come out and hit the stator core/stator winding and damage.

7.0 ACCESSORIES

7.1 GENERAL

Accessories shall be furnished, as listed below, or if otherwise required by driven equipment specification or application

7.2 SPACE HEATER


7.2.1 Motor of rating 30 kW and above shall be provided with space heaters, suitably located for easy removal or replacement.

7.2.2 The space heater shall be rated 240 V, 1 phase 50 Hz and sized to maintain the motor internal temperature above dew point when the motor is idle.


7.3 TEMPERATURE DETECTORS

7.3.1 All 11kV and 3.3kV motors shall be provided with twelve (12) nos. Simplex type winding temperature detectors, four (4) nos. per phase.


CONSULTANT : PROCON ENGINEERS

 MAHAGENCO <small>Maharashtra State Power Generation Co. Ltd</small>	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: IV-A
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 10
REV: R0	ELECTRICAL EQUIPMENT & ACCESSORIES	Page 374 of 440
7.3.2	11kV and 3.3kV motor bearing shall be provided with duplex type temperature detectors.	
7.3.3	The temperature detector mentioned above shall be resistance type, 3 wire, platinum wound, 100 Ohms at 0°C.	
7.3.4	Leads of all simplex type motor winding RTDS and motor bearing RTDS shall be wired up to respective switchgear metering & protection compartment. From which one set of RTDS will be connected to numerical protection relay and another set shall be kept free for DCS connectivity.	
7.3.5	Five numbers of Temperature detectors / thermisters shall be provided for L.T. Motors above 90 kW (3 nos. Winding temperatures & 2 nos. bearing temperatures).	
7.4	<u>INDICATOR/SWITCH</u>	
7.4.1	Dial type local indicator with alarm contacts shall be provided for the following :	
	(a) 11kV and 3.3kV motor bearing temperature	
	(b) Hot and cold air temperature of the closed air circuit for CACA and CACW motor	
7.4.2	Flow switches shall be provided for monitoring cooling water flow of CACW motor and oil flow of forced lubrication bearing, if used.	
7.4.3	Alarm switch contact rating shall be minimum 0.5 A at 220V D.C. and 5A at 240V A.C.	
7.5	<u>CURRENT TRANSFORMER FOR DIFFERENTIAL PROTECTION</u>	
7.5.1	Motor 1000 KW and above shall be provided with three differential current transformers mounted over the neutral leads within the enclosure. Loose 3 nos. CT for mounting on switchgear side shall be in bidder's scope.	

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 MAHAGENCO <small>Maharashtra State Power Generation Co. Ltd</small>	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: IV-A
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 10
REV: R0	ELECTRICAL EQUIPMENT & ACCESSORIES	Page 375 of 440
7.5.2	The arrangement shall be such as to permit easy access for C.T. testing and replacement. Current transformer characteristics shall match Owner's requirements to be intimated later.	
7.6	<u>ACCESSORY TERMINAL BOX</u>	
7.6.1	All accessory equipment such as space heater, temperature detector, current transformers etc., shall be wired to and terminated in terminal boxes, separate from and independent of motor (power) terminal box.	
7.6.2	Accessory terminal box shall be complete with double compression brass glands and pressure type terminals to suit cable connections.	
7.7	<u>DRAIN PLUG</u>	
	Motor shall have drain plugs so located that they will drain the water, resulting from the condensation or other causes from all pockets of the motor casing.	
7.8	<u>LIFTING PROVISIONS</u>	
	Motor weighing 25 Kg. or more shall be provided with eyebolt or other adequate provision of lifting.	
7.9	<u>DOWEL PINS</u>	
	The motor shall be designed to permit easy access for drilling holes through motor feet or mounting flange for installation of dowel pins after assembling the motor and driven equipment.	
7.10	<u>PAINTING</u>	
	Motor including fan shall be painted with corrosion proof paints of colour shade (RAL-7032).	
8.0	<u>TESTS</u>	
8.1	<u>ROUTINE AND TYPE TEST:</u>	

CONSULTANT : PROCON ENGINEERS

 MAHAGENCO <small>Maharashtra State Power Generation Co. Ltd</small>	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: IV-A
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 10
REV: R0	ELECTRICAL EQUIPMENT & ACCESSORIES	Page 376 of 440

Tests are to be conducted for HT and LT motors 60kW and above in presence of Mahagenco representative and contractor as per IS: 325 and required copies of test certificates are to be furnished for approval and despatch clearance. In addition, following tests shall have to be carried out on the motors in presence of MAHAGENCO representative & contractor on LT & HT motors. For Motors below 60kW type and routine test conducted as per IS325 shall be witnessed by contractor and test certificate shall be submitted for review of Mahagenco & Dispatch clearance

8.1.1 FOR HT MOTORS:

- (a) Impulse test by 1.2 / 50 micro sec. On sample coil of Stator winding insulation as type test as per IEC-671/IS 14422,1995 test voltages as under

Voltage rating of motor	Impulse Test Voltage
3.3 kV	: 18 kV peak
11 kV	: 49 kV peak


- (b) Tan delta, charging current and dielectric loss measurements on each phase of motor stator winding as routine test
- (c) Polarization Index Test as per IS:7816 as routine test
- (d) Tan delta measurement on coils
- (e) Surge withstand test for inter turn insulation.
- (f) Test to diagnose rotor bar failure during manufacture.

Tests indicated at (d), (e), (f) shall be carried out during manufacture of the coils and shall be furnished for verification .


8.1.2 FOR HT & LT MOTORS:

- (a) Test for suitability of IP55/ IPW– 55 as per IS 4691 as type test. Type test certificate for first numeral shall be acceptable in lieu to test,


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	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 10
REV: R0	ELECTRICAL EQUIPMENT & ACCESSORIES	Page 377 of 440
<p>provided the test motor is identical to motor being supplied. Second numeral test shall be carried out on one motor of each type and rating.</p> <p>(b) Fault Withstand Test for main terminal box as type test. Type test certificate shall be acceptable, if the test is conducted on exactly identical terminal box within last three years.</p> <p>(c) Test for noise level as routine test.</p> <p>(d) Test for vibration as routine test.</p> <p>(e) Overspeed test as type test.</p> <p>8.2 <u>TEST WITNESS:</u></p> <p>Test shall be performed in presence of Owner/Purchaser’s representative so desired by the Owner/Purchaser. The Contractor shall give at least fifteen (15) days advance notice of the date when the tests are to be carried out.</p>		


CONSULTANT : PROCON ENGINEERS

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	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 10
REV: R0	ELECTRICAL EQUIPMENT & ACCESSORIES	Page 378 of 440

CONSULTANT : PROCON ENGINEERS

 MAHAGENCO Maharashtra State Power Generation Co. Ltd	MAHARASHTRA STATE POWER GENERATION CO. LTD.		Volume: IV-A
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1		Section – 10
REV: R0	ELECTRICAL EQUIPMENT & ACCESSORIES		Page 379 of 440
<u>AC & DC MOTOR</u>			
SR. NO.	ITEM	UNIT	
1.0	<u>AUXILIARY POWER SUPPLY</u>		
1.1	<u>H.T. SUPPLY</u>		
	11kV, 3Ø, 3W, 50 Hz non-effectively earthed		Motors rated 1000 kW and above
	Fault level 44 kA symm		
	3.3kV, 3Ø, 3W, 50 Hz, non-effectively earthed		Motors above 160 kW and below 1000kW
	Fault level 40 kA symm		
1.2	<u>L.T. SUPPLY</u>		
	415V, 3Ø, 3W, 50 Hz effectively earthed		Motors below and including 160kW
	Fault level 50 kA symm		
	240V, 1Ø, 2W, 50 Hz effectively earthed		Lighting, space heating, A.C. control & protective devices
1.3	<u>D.C. SUPPLY</u>		
	220V, 2W, unearthed		D.C. alarm, control & protective devices
	Fault level 25* kA.		
	Indicative only, the actual value will be decided by the Bidder, after substantiating the same by calculation		
2.0	<u>RANGE OF VARIATION</u>		

CONSULTANT : PROCON ENGINEERS

 MAHAGENCO <small>Maharashtra State Power Generation Co. Ltd</small>	MAHARASHTRA STATE POWER GENERATION CO. LTD.		Volume: IV-A
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1		Section – 10
REV: R0	ELECTRICAL EQUIPMENT & ACCESSORIES		Page 380 of 440
SR. NO.	ITEM	UNIT	
2.1	<u>A.C. SUPPLY:</u>		
	Voltage		± 10%
	Frequency		± 5%
	Combined Voltage & frequency		± 10% (absolute sum)
	During starting of large motor, the voltage may drop to 80% of the rated voltage for a period of 60 seconds. All electrical equipment while running shall successfully ride over such period without affecting system performance		
2.2	<u>D.C. SUPPLY</u>		
	Voltage		198 to 240 Volt

CONSULTANT : PROCON ENGINEERS



Design Calculations For LT Cable Selection & Sizing

1 x 660MW BHUSAWAL T.P.S UNIT-6

CONSTRUCTIONAL DETAILS OF CABLES SELECTED

(A) LT POWER & CONTROL CABLES

S.NO.	PARTICULARS	DETAILS	
		LT POWER CABLES	LT CONTROL CABLES
1	REFERENCE STANDARD	IS: 7098 -PART -1	IS -1554 PART -1
2	SYSTEM	415 V AC , 240 V AC & 220V DC	220V DC & 110 V AC
3	VOLTAGE GRADE	1.1 KV	1.1 KV
4	CONDUCTOR		
4.1	MATERIAL	STRANDED COMPACTED PLAIN ALUMINIUM CONDUCTOR OF H2 GRADE CLASS 2 / STRANDED HIGH CONDUCTIVITY ANNEALED PLAIN COPPER.	STRANDED, NON COMPACTED, HIGH CONDUCTIVITY ANNEALED PLAIN COPPER
4.2	REFERENCE STANDARD	IS 8130	IS 8130
4.3	SHAPE	CIRCULAR/ SHAPED	CIRCULAR
4.4	MINIMUM SIZE	ALUMINIUM- 16 SQ.MM. COPPER- 2.5 SQ. MM.	2.5 SQ.MM.
4.5	MAXIMUM CONDUCTOR TEMPERATURE WHEN CARRYING CONTINUOUSLY CURRENT	90°C	70°C
4.6	MAXIMUM CONDUCTOR TEMPERATURE AT THE TERMINATION OF SHORT CIRCUIT CURRENT	250°C	160°C
5	NO. OF CORES	1C,2C,3C,3.5C,4C	AS PER CLAUSE 4.2.1
6	INSULATION	EXTRUDED XLPE	EXTRUDED HRPVC, TYPE-C
6.1	REFERENCE STANDARD	IS: 7098 -PART -1	IS -5831 & IS-1554 PART-I
7	CORE IDENTIFICATION	BY COLOR CODING AS PER IS: 7098 -PART -1	i) CONTROL CABLES UPTO 5 CORE- COLOR CODING AS PER IS 1554 (Part-1) (ii) CONTROL CABLES ABOVE 5 CORES- BY NUMBERING AS PER IS 1554 (Part-1). INSULATION TO HAVE BLACK COLOR.
8	INNER SHEATH	EXTRUDED HRPVC FRLS TYPE -ST2 FOR MULTI CORE CABLES. SINGLE CORE SHALL HAVE NO INNER SHEATH.	EXTRUDED HRPVC TYPE -ST2 FRLS FOR MULTI CORE CABLES. SINGLE CORE SHALL HAVE NO INNER SHEATH.
8.1	REFERENCE STANDARD	IS: 5831 & IS-7098 PART-I	IS: 5831 & IS-1554 PART I
9	ARMOUR	NON-MAGNETIC HARD DRAWN ALUMINIUM ROUND WIRE ARMOUR OF H4 GRADE FOR SINGLE CORE CABLES AND GS ROUND STEEL WIRE ARMOUR FOR MULTI- CORE CABLES	GS ROUND STEEL WIRE ARMOUR FOR TWIN & MULTICORE CABLES
9.1	REFERENCE STANDARD	IS:3975 & IS 7098 PART I	IS 3975 & IS-1554 PART I
10	OUTER SHEATH	EXTRUDED FRLSH HRPVC TYPE ST2	EXTRUDED FRLSH HRPVC TYPE ST2
10.1	REFERENCE STANDARD	IS: 5831 & IS-7098 PART-I	IS: 5831
11	MARKING	(i) CABLE SIZE (CROSS SECTION AREA AND NO. OF CORES, VOLTAGE GRADE, WORD 'FRLS', REF. IS, TYPE OF CABLE, TYPE OF INSULATION/ SHEATH, MANUFACTURER'S NAME AND/OR TRADE NAME, YEAR OF MANUFACTURE-AT EVERY 5M (BY EMBOSSING), 'BHEL-PEM' and 'CUSTOMER' Name @5m (by embossing), (ii) PROGRESSIVE SEQUENTIAL MARKING OF LENGTH OF CABLE IN METERS- AT EVERY 1M (BY EMBOSSING/PRINTING)	
12	CABLE DRUMS		
12.1	TYPE OF DRUM	WOODEN (HEAVY CONSTRUCTION) AS PER IS 10418	
12.2	STANDARD DRUM LENGTH	500M FOR LARGER SIZES / 1000M FOR SMALLER SIZES (±) 5% (AS SPECIFIED IN BOQ)	
12.3	PAINTING	ENTIRE SURFACE TO BE PAINTED. ALL FERROUS PARTS USED SHALL BE TREATED WITH SUITABLE RUST PREVENTIVE FINISH OR COATING TO AVOID RUSTING DURING TRANSIT OR STORAGE. WOODEN CABLE DRUMS SHALL BE TREATED BY IMMERSING IN COPPER-NITRATE SOLUTION. DRUM NUMBER SHALL BE INDICATED ON EACH DRUM.	
12.4	OUTERMOST LAYER	TO BE COVERED WITH WATERPROOF POLYETHYLENE	
12.5	CONSTRUCTION	ALL WOODEN PARTS FROM SEASONED WOOD AND FERROUS PARTS SHALL BE TREATED WITH SUITABLE RUST PREVENTIVE FINISH OR COATING. WOODEN DRUM SHALL BE TREATED BY IMMERSING IN COPPER NITRATE SOLUTION.	



Design Calculations For LT Cable Selection & Sizing

1 x 660MW BHUSAWAL T.P.S UNIT-6

12.6	PARTICULAR INFORMATION ON DRUM	<p>BOTH THE END OF CABLES SHALL BE PROPERLY SEALED WITH HEAT SHRINKABLE SEAL. THE CABLE DRUMS SHALL CARRY THE FOLLOWING DETAILS IN PRINTED FORM:</p> <p>A) MSPGCL B) MANUFACTURER'S NAME OR TRADE MAKE C) TYPE OF CABLE & VOLTAGE GRADE D) YEAR OF MANUFACTURE E) TYPE OF INSULATION E.G. XLPE/HRPVC/IE2 F) NO. OF CORE AND SIZES OF CABLES G) CABLE CODE E.G. FRLS/FS H) SINGLE LENGTH OF CABLE ON DRUM I) DIRECTION OF ROTATION, BY ARROW J) APPROX GROSS MASS</p>
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(B) SCREENED CONTROL CABLES

S.NO.	PARTICULARS	DETAILS
1	VOLTAGE GRADE	1100V
2	TYPE OF CABLES	TYPE F (INDIVIDUAL & OVERALL SCREENED) & TYPE G (OVERALL SCREENED)
3	CODES AND STANDARD	IS-1554 PART-1, IS-5831, IS-8130, IS-694, SEN-4241475, IEC-60332 (I).
3(i)	CONDUCTOR	
(a)	CROSS SECTION AREA	0.5 sq.mm
(b)	CONDUCTOR MATERIAL	STRANDED, TINNED ANNEALED HIGH CONDUCTIVITY COPPER
(c)	CONDUCTOR GRADE	ELECTROLYTIC
(d)	NO. & DIA OF STRANDS	7 X 0.3 mm
(e)	NO. OF PAIRS	0.5 sq.mm. - 2P, 4P, 8P, 12P, 24P
(f)	REFERENCE STANDARD	IS-8130
(ii)	INSULATION	
(a)	MATERIAL	EXTRUDED HR PVC TYPE-C AS PER IS-5831
(b)	THICKNESS IN mm	0.6 (NOMINAL) AS PER IS-694
(c)	VOLUME RESISTIVITY (MIN) IN ohm-cm	i. 1×10^{13} Ohm-cm at 27 deg.C / room temp. (Min). ii. 1×10^{10} Ohm-cm at 85 deg.C (Min.)
(d)	VOLTAGE RATING	1100V
(e)	REFERENCE STANDARD	IS-1554 PART-1 & IS-5831
(f)	OD OF COND. INCLUDING INSULATION	AS PER MANUFACTURER'S CALCULATIONS / STD. PRACTICE
(iii)	PAIRING & TWISTING	
(a)	MAX. LAY OF PAIRS (mm)	60
(b)	CONDUCTOR /PAIR IDENTIFICATION	AS PER ATTACHED ANNEXURE D
4	SHIELDING	
(a)	TYPE OF SHIELDING	AL-MYLAR TAPE
(b)	INDIVIDUAL PAIR SHIELDING	TO BE PROVIDED FOR TYPE-F CABLE ONLY
(c)	OVERALL SHIELDING	TO BE PROVIDED FOR BOTH TYPE-F & TYPE-G CABLES
(d)	MINIMUM THICKNESS OF INDIVIDUAL PAIR SHIELDING	28 MICRONS
(e)	MINIMUM THICKNESS OF OVERALL CABLE ASSEMBLY SHIELDING	60 MICRONS
(f)	SHIELDING COVERAGE	100% WITH AT LEAST 25% OVERLAP
5	DRAIN WIRE (To be provided separately for individual pair shield and overall shield.)	
	Material	Multi stranded Annealed tinned copper drain wire.
	Size (No. of strands/ Dia. of each strand)	0.5 sq. mm. (7/0.3 mm.)
6	FILLERS (if applicable)	
(a)	TYPE	NON -HYGROSCOPIC WITH FRLS PROPERTY (AS REQUIRED FOR MAINTAINING CABLE CIRCULARITY)
7	INNER SHEATH	
(a)	MATERIAL	EXTRUDED HR PVC TYPE ST-2 AS PER IS-5831
(b)	THICKNESS	AS PER IS-1554 PART-1
(c)	Whether FR-LSH Applicable	YES
(d)	COLOUR	BLACK
(e)	REFERENCE STANDARD	IS-1554 PART-1 & IS-5831
8	RIP CORD	NON-METALLIC RIP CORD UNDER THE INNER SHEATH
9	ARMOUR	GALVANISED STEEL ROUND WIRE / STRIP AS PER IS-3975 & IS-1554 PART-1



Design Calculations For LT Cable Selection & Sizing

1 x 660MW BHUSAWAL T.P.S UNIT-6

10	OUTER SHEATH		
(a)	MATERIAL	EXTRUDED HR PVC TYPE ST-2 AS PER IS-5831	
(b)	THICKNESS	AS PER IS-1554 PART-1	
(c)	Whether FR-LSH Applicable	YES	
(d)	COLOUR	GREY	
(e)	REFERENCE STANDARD	IS-1554 PART-1 & IS-5831	
(f)	MARKING	(i) CABLE SIZE (CROSS SECTION AREA AND NO. OF CORES, VOLTAGE GRADE, WORD 'FRLS', REF. IS, TYPE OF CABLE, TYPE OF INSULATION/ SHEATH, MANUFACTURER'S NAME AND/OR TRADE NAME, YEAR OF MANUFACTURE-AT EVERY 5M (BY EMBOSSING), 'BHEL-PEM' and 'CUSTOMER' Name @5m (by embossing), (ii) PROGRESSIVE SEQUENTIAL MARKING OF LENGTH OF CABLE IN METERS- AT EVERY 1M (BY EMBOSSING/PRINTING)	
11	TECHNICAL PARAMETERS (C & I) AT 20 DEG C	0.5 sqmm (IS & OS) Type F	0.5 sqmm (OS) Type G
(a)	MUTUAL CAPACITANCE (MAX.) AT 0.8 KHz, nF / Km	120	100
(b)	CONDUCTOR LOOP RESISTANCE (MAX.), Ohm / Km	78	78
(c)	INSULATION RESISTANCE (MIN.), M Ohm / Km	100	100
(d)	CROSS TALK ATTENUATION (MIN.) AT 0.8KHz, dB / Km	60	60
(e)	CHARACTERISTIC IMPEDANCE (MAX.) AT 1KHz, Ohm	320	340
(f)	ATTENUATION (MAX.) AT 1KHz, dB / Km	1.2	1.2
12	FR-LSH CHARACTERISTICS		
(b)	SMOKE DENSITY RATING	Max. 60% (As per ASTM D 2843): Area under coverage.	
(c)	ACID GAS EMISSION	Max. 20% by weight (As per IEC-60754-1)	
(d)	OXYGEN INDEX	Min 29 at room temperature (As per ASTM D 2863)	
(e)	TEMPERATURE INDEX	Min. 250 deg.C at oxygen index value of 21 (As per ASTM D 2863)	
13	FLAMMABILITY TEST	(1) AS PER IEC-332-1 (2) Swedish Chimney test SEN-SS-424-1475-F3	
14	TEST VOLTAGE & DURATION (High Voltage Test)		
(a)	Core to core	1.5 kV for 1 minute	
(b)	Core to shield	1 kV for 1 minute	
15	CABLE DRUM DETAILS		
(a)	Material Type	Wooden, as per IS 10418	
(b)	Standard drum length	1000 metres: upto and including 12 Pairs. 500 metres: above 12 pairs.	
(c)	Tolerance on drum length	±5%	
(d)	Painting	ENTIRE SURFACE TO BE PAINTED. ALL FERROUS PARTS USED SHALL BE TREATED WITH SUITABLE RUST PREVENTIVE FINISH OR COATING TO AVOID RUSTING DURING TRANSIT OR STORAGE. WOODEN CABLE DRUMS SHALL BE TREATED BY IMMERSING IN COPPER-NITRATE SOLUTION. DRUM NUMBER SHALL BE INDICATED ON EACH DRUM.	
(e)	Outermost layer	TO BE COVERED WITH WATERPROOF POLYETHYLENE	
(f)	Construction	ALL WOODEN PARTS FROM SEASONED WOOD AND FERROUS PARTS SHALL BE TREATED WITH SUITABLE RUST PREVENTIVE FINISH OR COATING. WOODEN DRUM SHALL BE TREATED BY IMMERSING IN COPPER NITRATE SOLUTION.	



TITLE

**LV MOTORS
DATA SHEET-A****1X660 MW BHUSAWAL TPP**

SPECIFICATION NO.

VOLUME II B

SECTION D

REV NO. 00 DATE 23.01.2019

SHEET 1 OF 1

- 1.0 Design ambient temperature : 50 °C
- 2.0 Maximum acceptable kW rating of LV motor : 160KW
- 3.0 Installation (Indoors/ Outdoors) : As required
- 4.0 Details of supply system
- a) Rated voltage (with variation) : 415V ± 10%
 - b) Rated frequency (with variation) : 50 Hz (+5% and -5%)
 - c) Combined voltage & freq. variation : 10% (sum of absolute values)
 - d) System fault level at rated voltage : 50 kA for 1 sec
 - e) Short time rating for terminal boxes
 - o 90 kW and upto 160kW : 50 KA for 1 sec.
(Breaker controlled)
 - o Below 90 kW : 50 KA protected by fuse for 0.2 sec
(SFU + Contactor controlled)
 - f) LV System grounding : Effectively grounded
- 5.0 Class of insulation : Class 'F', with temp rise limited to class B.
- 6.0 Minimum voltage for starting : 80% of rated voltage
(As percentage of rated voltage)
- 7.0 Power cables data : Shall be given during Detailed engg
- 8.0 Earth Conductor Size & Material : Shall be given during Detailed engg
- 9.0 Space heater supply : 240 V, 1ϕ, 50 Hz
- 10.0 Rating up to which Single phase motor : Acceptable below 0.20 kW
- 11.0 Additional tests : As per QP and customer motor spec
- 12.0 Flame-proof motor
- a) Enclosure suitable (As per IS:2148) : As per requirement
 - b) Classification of Hazardous area : As per requirement
(As per IS: 5572 part-I)
- 13.0 Makes : As per ANNEXURE-I
- 14.0 Paint shade : RAL 7032
- 15.0 Degree of Protection of enclosure (motors): INDOOR IP-55
OUTDOOR IPW-55
- 16.0 Energy efficiency : IE3 as per IS:12615: 2011

❖ **Also detail Customer spec. for Motors to be referred as enclosed with spec.**


ANNEXURE-I


SUB-VENDOR LIST

The list of approved make of the LT Motors are as mentioned below:

S.No.	LIST OF LT MOTORS
1.	BHARAT BIJLEE LTD.
2.	CROMPTON GREAVES
3.	ASEA BROWN BOVERI
4.	KIRLOSKAR ELECTRIC CO LTD.
5.	NGEF
6.	SIEMENS
7.	MARATHON
8.	GE-POWER
9.	RAJINDRA ELECT INDUSTRIES
10.	LAXMI HYDRAULICS PVT. LTD

However, the final list of makes for the LT Motors is subjected to BHEL/Customer approval, during contract stage, without any commercial implications.

		QUALITY PLAN SHEET 1 OF 2			CUSTOMER : MAHAGENCO BIDDER/ : VENDOR		PROJECT 1X660 MW BHUSAWAL TPP TITLE QUALITY PLAN NUMBER PED-506-00-Q-006, REV-01		SPECIFICATION : NUMBER : SPECIFICATION TITLE			
		SYSTEM			ITEM AC ELECT. MOTORS BELOW 55KW (LV)		SECTION		VOLUME III			
SL. NO.	COMPONENT/OPERATION	CHARACTERISTICS CHECK	CAT.	TYPE/METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS
									P	W	V	
1	2	3	4	5	6	7	8	9	10			11
1.0	ASSEMBLY	1.WORKMANSHIP	MA	VISUAL	100%	MANUF'S SPEC	MANUF'S SPEC	-DO-	2	-	-	
		2.DIMENSIONS	MA	-DO-	-DO-	MFG. DRG./ MFG. SPEC.	MFG. DRG./ MFG. SPEC.	-DO-	2	-	-	
		3.CORRECTNESS COMPLETENESS TERMINATIONS/ MARKING/COLOUR CODE	MA	VISUAL	100%	MFG.SPEC./ RELEVANT IS	MFG.SPEC. RELEVANT IS	-DO-	2	-	-	
2.0	PAINTING	1.SHADE	MA	VISUAL	SAMPLE	MANUFR'S SPEC/BHEL SPEC./RELEVANT STANDARD	BHEL SPEC. SAME AS COL.7	LOG BOOK	2	-	-	
3.0	TESTS	1.ROUTINE TEST INCLUDING SPECIAL TEST AS PER BHEL SPEC.	MA	-DO-	100%	IS-325/ BHEL SPEC./ DATA SHEET	SAME AS COL.7	TEST REPORT	2	1	-	NOTE -1 & NOTE-3
		2.OVERALL DIMENSIONS & ORIENTATION	MA	MEASUREMENT & VISUAL	100%	APPROVED DRG/DATA SHEET	APPROVED DRG/DATA SHEET & RELEVANT IS	INSPN. REPORT	2	1	-	NOTE -1 & NOTE-3
BHEL			PARTICULARS			BIDDER/VENDOR						
			NAME									
			SIGNATURE									

		QUALITY PLAN			CUSTOMER : MAHAGENCO			PROJECT 1X660 MW BHUSAWAL TPP			SPECIFICATION :		
					BIDDER/ :			TITLE			NUMBER :		
SHEET 2 OF 2		VENDOR			SYSTEM			QUALITY PLAN			SPECIFICATION :		
TITLE :		NUMBER PED-506-00-Q-006, REV-01			ITEM AC ELECT. MOTORS BELOW 55KW (LV)			SECTION			VOLUME III		
SL. NO.	COMPONENT/OPERATION	CHARACTERISTICS CHECK	CAT.	TYPE/METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS	
									P	W	V		
1	2	3	4	5	6	7	8	9	10			11	
		3.NAMEPLATE DETAILS	MA	VISUAL	100%	IS-325 & DATA SHEET	IS-325 & DATA SHEET	INSPN. REPORT	2	1	-		
<p>NOTES:</p> <p>1 ROUTINE TESTS ON 100% MOTORS SHALL BE DONE BY THE VENDOR. HOWEVER, BHEL SHALL WITNESS ROUTINE TESTS ON RANDOM SAMPLES. THE SAMPLING PLAN SHALL BE MUTUALLY AGREED UPON</p> <p>2 WHERE EVER CUSTOMER IS INVOLVED IN INSPECTION, (1) SHALL MEAN BHEL AND CUSTOMERS BOTH TOGETHER.</p> <p>3 FOR EXHAUST/VENTILATION FAN MOTORS OF RATING UPTO 1.5KW , ONLY ROUTINE TEST CERTIFICATES SHALL BE FURNISHED FOR SCRUTINY.</p> <p><u>Legends for Inspection agency</u></p> <p>1. BHEL/CUSTOMER 2. VENDOR (MOTOR MANUFACTURER) 3. SUB-VENDOR (RAW MATERIAL/COMPONENTS SUPPLIER)</p> <p>P. PERFORM W. WITNESS V. VERIFY</p>													
BHEL			PARTICULARS			BIDDER/VENDOR							
			NAME										
			SIGNATURE										
			DATE						BIDDER'S/VENDORS COMPANY SEAL				



QUALITY PLAN

SHEET 1 OF 9

CUSTOMER :
MAHAGENCO

BIDDER/ :
VENDOR

SYSTEM

PROJECT TITLE
1X660 MW BHUSAWAL TPP

QUALITY PLAN
NUMBER PED-506-00-Q-007, REV-03

ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)

SPECIFICATION :
NUMBER :

SPECIFICATION :
TITLE

SECTION VOLUME III

1	2	3	4	5	6	7	8	9	10			11
									P	W	V	
1.0	RAW MATERIAL & BOUGHT OUT CONTROL											
1.1	SHEET STEEL, PLATES, SECTION, EYEBOLTS	1.SURFACE CONDITION	MA	VISUAL	100%	-	FREE FROM BLINKS, CRACKS, WAVINESS ETC	LOG BOOK	3	-	-	
		2.DIMENSIONS	MA	MEASUREMENT	SAMPLE	MANFR'S DRG./SPEC	MANFR'S DRG./SPEC	-DO-	3	-	-	
		3.PROOF LOAD TEST (EYE BOLT)	MA	MECH. TEST	-DO-	-DO-	-DO-	INSPEC. REPORT	3	-	2	
1.2	HARDWARES	1.SURFACE CONDITION	MA	VISUAL	100%		FREE FROM CRACKS, UN-EVENNESS ETC.	-DO-	3	-	-	
		2.PROPERTY CLASS	MA	VISUAL	SAMPLES	MANFR'S DRG./SPEC BOOK	RELEVANT IS/SPEC.	SUPPLIERS TC & LOG	3	-	2	PROPERTY CLASS MARKING SHALL BE CHECKED BY THE VENDOR
1.3	CASTING	1.SURFACE CONDITION	MA	VISUAL	100%		FREE FROM CRACKS, BLOW HOLES ETC.	LOG BOOK	3	-	2	
		2.CHEM. & PHY. PROP.	MA	CHEM & MECH TEST	1/HEAT NO.	MANFR'S DRG./SPEC	RELEVANT IS/	SUPPLIER'S TC	3	-	2	HEAT NO. SHALL BE VERIFIED
		3.DIMENSIONS	MA	MEASUREMENT	100%	MANFR'S DRG.	MANFR'S DRG.	LOG BOOK	3	-	2	
1.4	PAINT & VARNISH	1.MAKE, SHADE, SHELF LIFE & TYPE	MA	VISUAL	100% CONTINUOUS	MANFR'S DRG./SPEC	MANFR'S DRG./SPEC	LOG BOOK	3	-	2	
BHEL			PARTICULARS			BIDDER/VENDOR						
			NAME									
			SIGNATURE									
			DATE						BIDDER'S/VENDORS COMPANY SEAL			



QUALITY PLAN

CUSTOMER :
MAHAGENCO

PROJECT 1X660 MW BHUSAWAL TPP
TITLE

SPECIFICATION :
NUMBER :

BIDDER/
VENDOR

QUALITY PLAN
NUMBER PED-506-00-Q-007, REV-03

SPECIFICATION
TITLE

SHEET 2 OF 9

SYSTEM

ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)

SECTION

VOLUME III

SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS
									P	W	V	
1	2	3	4	5	6	7	8	9	10			11
1.5	SHAFT (FORGED OR ROLLED)	1. SURFACE COND.	MA	VISUAL	100%	-	FREE FROM VISUAL DEFECTS	-DO-	3	-	-	VENDOR'S APPROVAL IDENTIFICATION SHALL BE MAINTAINED
		2. CHEM. & PHYSICAL PROPERTIES	MA	CHEM. & PHYSICAL TESTS	1/HEAT NO. OR HEAT TREATMENT BATCH NO	MFG. DRG. SPEC.	RELEVANT IS	SUPPLIER'S TC	3	-	2	
		3. DIMENSIONS	MA	MEASUREMENT	100%	-DO-	MANUFR'S DRG.	LOG BOOK	3	-	2	
		4. INTERNAL FLAWS	CR	UT	-DO-	ASTM-A388	MANUFR'S SPEC. BHEL SPEC.	-DO-	3	2	1	FOR DIA OF 55 MM & ABOVE
1.6	SPACE HEATERS, CONNECTORS, TERMINAL BLOCKS, CABLES, CABLE LUGS, CARBON BRUSH TEMP. DETECTORS, RTD, BTD'S	1. MAKE & RATING	MA	VISUAL	-DO-	MANUFR'S DRG. SPEC.	MANUFR'S DRG. SPEC.	-DO-	3	-	2	
		2. PHYSICAL COND.	MA	-DO-	-DO-	-	NO PHYS. DAMAGE, NO ELECTRICAL DISCONTINUITY	-DO-	3	-	2	
		3. DIMENSIONS (WHEREVER APPLICABLE)	MA	MEASUREMENT	SAMPLE	MANUFR'S DRG./ SPEC.	MANUFR'S DRG. / SPEC.	-DO-	3	-	2	
		4. PERFORMANCE/ CALIBRATION	MA	TEST	100%	-DO-	-DO-	INSP. REPORT	3	-	2	
BHEL			PARTICULARS		BIDDER/VENDOR							
			NAME									
			SIGNATURE									
			DATE					BIDDER'S/VENDORS COMPANY SEAL				



QUALITY PLAN


SHEET 3 OF 9

CUSTOMER :
MAHAGENCO
BIDDER/
VENDOR
SYSTEM

PROJECT 1X660 MW BHUSAWAL TPP
TITLE
QUALITY PLAN
NUMBER PED-506-00-Q-007, REV-03
ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)

SPECIFICATION :
NUMBER :
SPECIFICATION :
TITLE
SECTION VOLUME II

SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS
									P	W	V	
1	2	3	4	5	6	7	8	9	10			11
1.7	OTHER INSULATING MATERIALS LIKE SLEEVES, BINDINGS CORDS, PAPERS, PRESS BOARDS ETC.	1. SURFACE COND. ETC. 2. OTHER CHARACTERISTICS	MA MA	VISUAL TEST	100% SAMPLE	- MANUF'S SPEC.	NO VISUAL DEFECTS MANUF'S SPEC.	INSPT. REPORT LOG BOOK AND OR SUPPLIER'S TC	3 3	- -	2 2	
1.8	SHEET STAMPING (PUNCHED)	1. SURFACE COND. 2. DIMENSIONS INCLUDING BURS HEIGHT 3. ACCEPTANCE TESTS	MA MA MA	VISUAL MEASUREMENT ELECT. & MECH TESTS	100% SAMPLE -DO-	- MANUFR'S DRG. . MANUF'S SPEC./ RELEVANT IS	NO VISUAL DEFECTS (FREE FROM BURS) MANUFR'S DRG. RELEVANT IS	LOG BOOK -DO- SUPPLIER'S TC	3 3 3	- -	- 2 2	FOR MV MOTOR INSULATION/VARNISH THICKNESS SHALL BE MORE THAN THE BURS HEIGHT
1.9	CONDUCTORS	1. SURFACE FINISH 2. ELECT. PROP. & MECH. PROP	MA MA	VISUAL ELECT. & MECH. TEST	100% SAMPLES	- RELEVANT IS/ BS OR OTHER STANDARDS	FREE FROM VISUAL DEFECTS RELEVANT IS/ BS OR OTHER STANDARDS	LOG BOOK SUPPLIERS TC & VENDOR'S INSPN. REPORTS	3* 3	- -	2* 2	* MOTOR MANUFACTURER TO CONDUCT VISUAL CHECK FOR SURFACE FINISH ON RANDOM BASIS (10% SAMPLE) AT HIS WORKS AND MAINTAIN RECORD FOR VERIFICATION BY BHEL/CUSTOMER.
BHEL			PARTICULARS			BIDDER/VENDOR						
			NAME									
			SIGNATURE									
			DATE						BIDDER'S/VENDORS COMPANY SEAL			

		QUALITY PLAN			CUSTOMER : MAHAGENCO		PROJECT 1X660 MW BHUSAWAL TPP		SPECIFICATION : NUMBER :			
		SHEET 4 OF 9			BIDDER/ VENDOR		TITLE		SPECIFICATION : TITLE			
		SYSTEM			ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)		SECTION		VOLUME III			
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS
1	2	3	4	5	6	7	8	9	P	W	V	11
1.10	BEARINGS	3.DIMENSIONS	MA	MEASUREMENT	-DO-	-DO-	-DO-	Log Book	3	-	2	
		1.MAKE & TYPE	MA	VISUAL	100%	MANFR'S DRG./ APPROVED DATASHEET	MANFR'S DRG./ APPROVED DATASHEET	-DO-	3	-	2	
		2.DIMENSIONS	MA	MEASUREMENT	SAMPLE	BHEL DATA SHEET	BHEL DATA SHEET BEARING MANUF'S CATALOGUES	-DO-	3	-	2	
		3.SURFACE FINISH	MA	VISUAL	100%	-	FREE FROM VISUAL DEFECTS	-DO-	3	-	2	
1.11	SLIP RING (WHEREVER APPLICABLE)	1.SURFACE COND.	MA	VISUAL	100%	-	-DO-	-DO-	3	-	-	
		2.DIMENSIONS	MA	MEASUREMENT	SAMPLE	MANUF'S DRG	MANUF'S DRG	-DO-	3	-	-	
		3.TEMP.WITH-STAND CAPACITY	MA	ELECT.TEST	-DO-	MANUF'S SPEC./ BHEL SPEC.	MANUF'S SPEC./ BHEL SPEC.	-DO-	3	-	2	
		4.HV/IR	MA	-DO-	100%	-DO-	-DO-	-DO-	3	-	2	
1.12	OIL SEALS & GASKETS	1.MATERIAL OF GASKET	MA	VISUAL	100%	MANUF'S DRG/SPECS	MANUF'S DRG./ SPECS.	-DO-	3	-	-	
		2.SURFACE COND.	MA	VISUAL	100%	-	FREE FROM VISUAL DEFECTS	-DO-	3	-	-	
		3.DIMENSIONS	MA	MEASUREMENT	SAMPLE	MANUF'S DRG	MANUF'S DRG	-DO-	3	-	-	
BHEL			PARTICULARS		BIDDER/VENDOR							
			NAME									
			SIGNATURE									
			DATE					BIDDER'S/VENDORS COMPANY SEAL				



QUALITY PLAN

SHEET 5 OF 9

CUSTOMER :
MAHAGENCO

BIDDER/ VENDOR :
SYSTEM

PROJECT TITLE
1X660 MW BHUSAWAL TPP

QUALITY PLAN
NUMBER PED-506-00-Q-007, REV-03

ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)

SPECIFICATION :
NUMBER :


SPECIFICATION :
TITLE

SECTION VOLUME III

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



QUALITY PLAN		CUSTOMER : MAHAGENCO			PROJECT 1X660 MW BHUSAWAL TPP			SPECIFICATION : NUMBER :					
SHEET 6 OF 9		BIDDER/ : VENDOR			QUALITY PLAN NUMBER PED-506-00-Q-007, REV-03			SPECIFICATION : TITLE					
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	SECTION			REMARKS	
									P	W	V		
1	2	3	4	5	6	7	8	9	10			11	
2.4	SHEET STACKING	1.COMPLETENESS	MA	MEASUREMENT	SAMPLE	MANUFR'S SPEC.	MANUFR'S SPEC.	Log Book	2	-	-	(FOR MOTORS OF 2MW AND ABOVE) * ON 10% RANDOM SAMPLE	
		2.COMPRESSION & TIGHTENING	MA	MEASUREMENT	100%	-DO-	-DO-	Log Book	2	-	-		
		3.CORE LOSS & HOTSPOT	MA	ELECT.TEST	-DO-	-DO-	-DO-	Log Book	2	1*	1		
2.5	WINDING	1.COMPLETENESS	CR	VISUAL	100%	MANUFR'S SPEC./BHEL SPEC.	MANUFR'S SPEC./BHEL SPEC.	Log Book	2	-	-		
		2.CLEANLINESS	CR	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	-		
		3.IR-HV-IR	CR	ELECT. TEST	-DO-	-DO-	-DO-	Log Book	2	-	1		
		4.RESISTANCE	CR	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	1		
		5.INTERTURN INSULATION	CR	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	-		
		6.SURGE WITH STAND AND TAN. DELTA TEST	CR	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	1		FOR MV MOTOR
2.6	IMPREGNATION	1.VISCOSITY	MA	PHY. TEST	AT STARTING	-DO-	-DO-	Log Book	2	-	-		
		2.TEMP. PRESSURE VACCUM	MA	PROCESS CHECK	CONTINUOUS	-DO-	-DO-	Log Book	2	-	-		
		3.NO. OF DIPS	MA	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	1	THREE DIPS TO BE GIVEN	
BHEL			PARTICULARS		BIDDER/VENDOR								
			NAME										
			SIGNATURE										
			DATE								BIDDER'S/VENDORS COMPANY SEAL		

		QUALITY PLAN			CUSTOMER : MAHAGENCO		PROJECT 1X660 MW BHUSAWAL TPP		SPECIFICATION : NUMBER :			
SHEET 7 OF 9		SYSTEM			BIDDER/ VENDOR		QUALITY PLAN NUMBER PED-506-00-Q-007, REV-03		SPECIFICATION : TITLE			
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS
1	2	3	4	5	6	7	8	9	P	W	V	11
2.7	COMPLETE STATOR ASSEMBLY	4.DURATION 1.COMPACTNESS & CLEANLINESS	MA	-DO- VISUAL	-DO- 100%	-DO- -DO-	-DO- -DO-	Log Book Log Book	2	-	1	VERIFICATION FOR MV MOTOR ONLY
2.8	BRAZING/COMPRESSION JOINT	1.COMPLETENESS 2.SOUNDNESS	CR	-DO- MALLETT TEST & UT	-DO- -DO-	-DO- -DO-	-DO- -DO-	Log Book Log Book	2	-	1	
2.9	COMPLETE ROTOR ASSEMBLY	3.HV 1.RESIDUAL UNBALANCE	MA	ELECT. TEST DYN. BALANCE	-DO- -DO-	-DO- MFG SPEC./ ISO 1940	-DO- MFG. DWG.	Log Book	2	-	1	
		2.SOUNDNESS OF DIE CASTING	CR	ELECT. (GROWLER TEST)	-DO-	MFG. SPEC.	MFG. SPEC.	Log Book	2	-	1	
2.10	ASSEMBLY	1.ALIGNMENT	MA	MEAS.	-DO-	-DO-	-DO-	Log Book	2	-	-	
		2.WORKMANSHIP	MA	VISUAL	-DO-	-DO-	-DO-	Log Book	2	-	-	
		3.AXIAL PLAY	MA	MEAS.	-DO-	-DO-	-DO-	Log Book	2	-	1	
		4.DIMENSIONS	MA	-DO-	-DO-	MFG.DRG./ MFG SPEC.	MFG. DRG/ RELEVANT IS	Log Book	2	-	-	
		5.CORRECTNESS, COMPLETENESS TERMINATIONS/ MARKING/ COLOUR CODE	MA	VISUAL	100%	MFG SPEC. RELEVANT IS	MFG SPEC. RELEVANT IS	Log Book	2	-	-	
		6. RTD, BTD & SPACE HEATER MOUNTING.	MA	VISUAL	100%	MFG SPEC. RELEVANT IS	MFG SPEC. RELEVANT IS	Log Book	2	-	1	
BHEL			PARTICULARS		BIDDER/VENDOR							
			NAME									
			SIGNATURE									
			DATE				BIDDER'S/VENDORS COMPANY SEAL					



QUALITY PLAN		CUSTOMER : MAHAGENCO			PROJECT : 1X660 MW BHUSAWAL TPP			SPECIFICATION : NUMBER :				
SHEET 8 OF 9		BIDDER/ : VENDOR			QUALITY PLAN NUMBER PED-506-00-Q-007, REV-03			SPECIFICATION : TITLE				
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	SECTION			REMARKS
									P	W	V	
1	2	3	4	5	6	7	8	9	10			11
3.0	TESTS	1.TYPE TESTS INCLUDING SPECIAL TESTS AS PER BHEL SPEC CLAUSE 8.1.2	MA	ELECT.TEST	1/TYPE/SIZE	IS-325/ BHEL SPEC./ DATA SHEET	IS-325/ BHEL SPEC./ DATA SHEET	TEST REPORT	2	1	1	
		2.ROUTINE TESTS INCLUDING SPECIAL TEST AS PER BHEL SPEC.	MA	-DO-	100%	-DO-	-DO-	-DO-	2	1 ^s	1	§ NOTE - 2
		3.VIBRATION & NOISE LEVEL	MA	-DO-	100%	IS-12075 & IS-12065	IS-12075 & IS-12065	-DO-	2	1 ^s	1	§ NOTE - 2
		4.OVERALL DIMENSIONS AND ORIENTATION	MA	MEASUREMENT & VISUAL	100%	APPROVED DRG/DATA SHEET	APPROVED DRG/DATA SHEET & RELEVANT IS	INSPC. REPORT	2	1	-	
		5.DEGREE OF PROTECTION	MA	ELECT. & MECH. TEST	1/TYPE/ SIZE	RELEVANT IS	BHEL SPEC. AND DATA SHEET	TC	2	1*	1	* REFER NOTE-3
		6. MEASUREMENT OF RESISTANCE OF RTD & BTD	MA	-DO-	100%	-DO-	-DO-	-DO-	2	1 ^s	1	§ NOTE - 2
		7. MEASUREMENT OF RESISTANCE, IR OF SPACE HEATER	MA	-DO-	100%	-DO-	-DO-	-DO-	2	1 ^s	1	§ NOTE - 2
		8. NAMEPLATE DETAILS	MA	VISUAL	100%	IS-325 & DATA SHEET	IS-325 & DATA SHEET	INSPC. REPORT	2	1 ^s	1	§ NOTE - 2
		9.EXPLOSION FLAME PROOF NESS (IF SPECIFIED)	MA	EXPLOSION FLAME PROOF TEST	1/TYPE	IS-3682 IS-8239 IS-8240	IS-3682 IS-8239 IS-8240	TC	2	-	1	TC FROM AN INDEPENDENT LABORATORY ON SIMILAR TYPE, SIZE AND DESIGN OF MOTOR.
		10. PAINT SHADE, THICKNESS & FINISH	MA	VISUAL & MEASUREMENT BY ELKOMETER	SAMPLE	BHEL SPEC. & DATA SHEET	BHEL SPEC. & DATA SHEET	TC	2	1 ^s	1	SAMPLING PLAN TO BE DECIDED BY INSPECTION AGENCY § NOTE - 2
BHEL			PARTICULARS		BIDDER/VENDOR							
			NAME									
			SIGNATURE									
			DATE					BIDDER'S/VENDORS COMPANY SEAL				





QUALITY PLAN

SHEET 9 OF 9

CUSTOMER :
MAHAGENCO

BIDDER/
VENDOR

SYSTEM

PROJECT 1X660 MW BHUSAWAL TPP
TITLE

QUALITY PLAN
NUMBER PED-506-00-Q-007, REV-03

ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)

SPECIFICATION :
NUMBER :

SPECIFICATION :
TITLE

SECTION VOLUME III

SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS
									P	W	V	
1	2	3	4	5	6	7	8	9	10			11

NOTES:

- 1 DEPENDING UPON THE SIZE AND CRITICALLY, WITNESSING BY BHEL SHALL BE DECIDED.
- 2 ROUTINE TESTS ON 100% MOTORS SHALL BE DONE BY THE VENDOR. HOWEVER, BHEL SHALL WITNESS ROUTINE TESTS ON RANDOM SAMPLES. THE SAMPLING PLAN SHALL BE MUTUALLY AGREED UPON.
- 3 IN CASE TEST CERTIFICATES FOR THESE TESTS ON SIMILAR TYPE, SIZE AND DESIGN OF MOTOR FROM INDEPENDENT LABORATORY ARE AVAILABLE, THESE TEST MAY NOT BE REPEATED FOR FIRST NUMERAL OF IP-XX. SECOND NUMERAL TEST SHALL BE CARRIED OUT ON ONE MOTOR OF EACH TYPE & RATING.
- 4 WHEREVER CUSTOMER IS INVOLVED IN INSPECTION, AGENCY (1) SHALL MEAN BHEL AND CUSTOMERS BOTH TOGETHER.

Legends for Inspection agency

1. BHEL/CUSTOMER
2. VENDOR (MOTOR MANUFACTURER)
3. SUB-VENDOR (RAW MATERIAL/COMPONENTS SUPPLIER)

- P. PERFORM
W. WITNESS
V. VERIFY

BHEL	PARTICULARS	BIDDER/VENDOR	
	NAME		
	SIGNATURE		
	DATE		BIDDER'S/VENDORS COMPANY SEAL



1X660 MW BHUSAWAL TPS UNIT-6
TECHNICAL SPECIFICATION
FOR
ELEVATORS

SPECIFICATION NO.: PE-TS-415-502-A001

SECTION: I

SUB SECTION: IC

REV: 01

DATE: SEP'22

Page: 1 of 1

SECTION – I
SPECIFIC TECHNICAL REQUIREMENTS

IC – Data Sheet A



**1X660 MW BHUSAWAL TPS UNIT-6
TECHNICAL SPECIFICATION
FOR
ELEVATORS**

SPECIFICATION NO.: PE-TS-415-502-A001
SECTION: I
SUB SECTION: IC
REV. 01 DATE: SEP'22
SHEET 1 OF 7

S. No.	DESCRIPTION	DETAILS
A	LIFT PARTICULARS	FGD CONTROL BUILDING
1.	Elevator Location	As per scope of supply ref cl. No. 2.0.1, Section IA of Technical Specification.
2.	Type of Elevator	
3.	Rated Load on Elevator	
4.	Quantity	
5.	Rated Speed of Lift	
6.	Total Travel	
7.	Nos. of floors to be served	
8.	Design, construction, installation, codes including car size, door size, shaft size, size of platform and car entrance	As per IS: 14665 (all relevant parts) (latest edition).
9.	CAR	
9.1	Size	As per IS: 14665
9.2	Car frame	Structural Steel and bolted construction with renewable guide shoes or guide shoes with renewable lining or set of roller guides.
9.3	Car enclosure & panels	SS-304, bright finish, 1.5 mm thick sheet of hairline finish.
9.3.1	Other features / facilities in car enclosure	
9.3.1.1	Isolating cushion between car and car frame	Type of cushion shall be rubber pad or spring as per manufacturer's standard.
9.3.1.2	Lighting & fan	One cabin fan, LED along with fittings for lux level: 100. LED lighting with a 5A socket shall be provided at every 3 meters interval in lift well/ hoist way. Light and fan in the Car enclosure shall be separate switch control.
9.3.1.3	Ventilation fan in the car as per IS-14665	Shall be provided for adequate ventilation of the car by elevator supplier. Ventilation fan in car shall be provided with manual and automatic switch through selector.
9.3.1.4	Telephone facility in the lift car	Internal telephone wiring and hands free telephone shall be provided in the car. Plant Telephone Communication system shall be extended up to the Elevator car through EPABX in machine room.
9.3.1.5	Automatic rescue device (ARD) with battery drive	Provided. Modern advanced electronic drive system of "Rescuing passenger trapped in an elevator" shall be provided.
9.3.1.6	Hand rails on 3 sides in car	Mirror finish stainless steel.
9.3.1.7	False ceiling	SS-304



**1X660 MW BHUSAWAL TPS UNIT-6
TECHNICAL SPECIFICATION
FOR
ELEVATORS**

SPECIFICATION NO.: PE-TS-415-502-A001
SECTION: I
SUB SECTION: IC
REV. 01 DATE: SEP'22
SHEET 2 OF 7

9.3.1.8	Cabin accessories	<ul style="list-style-type: none"> i. Car control station ii. Switches with braille characters iii. Intercom iv. LED Light fixture and fittings v. Alarm vi. PA system speakers vii. Emergency Stop switch viii. Attendant transfer switch key ix. One (01) No. 5/15A, 240 V plug socket outlet for hand lamp with switch on top of lift car.
9.3.1.9	Safety shoes complete with accessories shall be provided.	Yes
9.4	Car platform/ Flooring of cabin	As per scope of supply ref cl. No. 2.0.1, Section IA of Technical Specification.
9.5	Car roof	Car roof shall be covered with sheet metal and shall be provided with LED light fitting & a three pin plug One (01) No. 5/15A, 240 V plug socket outlet for hand lamp with switch of industrial type on top of lift car.
9.6	Leveling accuracy	As per IS: 14665
9.7	Overload sensing device and warning indicator	Every passenger lift shall be provided with an overload device (overload warning indicator), which will prevent the lift from starting in case the lift car is loaded to 110 % of the rated capacity of the lift or more. Lift shall remain stationary with door open. Audio and visual warning device shall be provided to alert the passengers in case of overload.
9.8	Car operating panel	
9.8.1	Type of construction	Partial Height car operating panel (COP), Removable type from Car with SS face plate.
9.8.2	Push button	Luminous push buttons with IP 54.
9.8.3	Other accessories of car operating panel	Car operating panel with luminous buttons, car position indication in car (both visual and audio), two-position key operated switch to indicate, "with attendant" & "without attendant", direction arrows, overload warning indicator, battery operated alarm bell, emergency light with suitable battery-battery charger, fan and controls, emergency stop switch, buzzer, emergency call button, telephone hand set with suitable battery charger & controls.



**1X660 MW BHUSAWAL TPS UNIT-6
TECHNICAL SPECIFICATION
FOR
ELEVATORS**

SPECIFICATION NO.: PE-TS-415-502-A001
SECTION: I
SUB SECTION: IC
REV. 01 DATE: SEP'22
SHEET 3 OF 7

9.8.4	Push button and call registered tell -tale lights at each landing	
9.8.4.1	Type of construction	Box type with SS face plate
9.8.4.2	Push Buttons	Luminous push buttons with IP 54
9.8.4.3	Description	One (1) push button for each landing, Two (2) push buttons, one for upward movement and the other for downward movement at each intermediate landing and one (1) push button at each terminal landing shall be provided in order to call the car.
		Push buttons shall be fixed in the car holding the doors open for any length of the time required.
9.8.5	Car position indicator	Digital car position indicator at all floors & tell-tale lights at all floors shall be provided.
9.8.5.1	Type of construction	Box type with stainless steel face plate.
9.8.5.2	Type of display	7 segment LED display (Text size of 6mm height as per IS-14665 is to be considered for LED display plate). Scrolling indicator in the car.
10.	Car, Landing door	
10.1	Type of door	Centre opening, automatic horizontal sliding type. Stainless steel construction. Landing door shall be fire rated for Min. Two (02) hours.
10.2	Door Size	As per IS: 14665.
10.3	Method of operation	Power operated with automatic door opening and closing devices. Door operation shall be automatic. Infrared light curtain type electronic door protection system for opening / closing of car & landing doors and shall be provided for safe operation of door and so that in case there is any obstruction in its path while the door is closing, car & landing door shall return to open position.
10.4	Door Hangers and Tracks	Provided.
10.5	MOC for Car door, landing door & Finishing	SS 304 with hairline finishing.
11.	Buffers	Spring type for car and counterweight on structural framework (no RCC buffer pedestal)
12.	Load Plate	Load plate giving rated payload (in kg and number of passengers) of elevator shall be fitted in car at conspicuous



**1X660 MW BHUSAWAL TPS UNIT-6
TECHNICAL SPECIFICATION
FOR
ELEVATORS**

SPECIFICATION NO.: PE-TS-415-502-A001
SECTION: I
SUB SECTION: IC
REV. 01 DATE: SEP'22
SHEET 4 OF 7

		position as per manufacturer's standard.
13.	Counter weight and counter weight frame.	
13.1	Counter weights frame	Fabricated Steel Construction
13.2	Counter weight fillers	Cast Iron.
14.	Guide rails complete with supporting brackets for the car and counter weights.	Provided. Shall be of rigid steel, continuous through entire length, provided with steel bracings & stiffeners.
14.1	Guide rails lubrication	Provided.
15.	Limit switches	
15.1	Location	Bottom & top terminal
15.2	Number of Limit Switches	As per requirement
15.3	Type	Electromechanical
15.4	Operation	Cam Operated
16.	Apron / Facia Plate provided as per IS 14665	Yes
17.	Motor control panel	Motor control panel shall house VVVF AC drives
18.	Method of control	AC VVVF (Variable Voltage Variable Frequency) Control with automatic level adjustment. The controls shall be variable voltage and variable frequency type and shall provide smooth and constant acceleration and retardation under all conditions of operation. Suitable control shall be provided in the machine room.
19.	Position of Machine Room	Directly above the lift shaft.
20.	Operation	<ul style="list-style-type: none"> • Selective simplex & duplex collective (as applicable), automatic operation with and without attendant through illuminated push button station located inside the lift car, with provision for locking control in "auto" or "Attendant" position. Key type lock switch shall be provided. • The operation of the elevators shall be through push button station located inside the lift car. Suitable interlock shall be provided so that the elevators shall not move unless the doors are properly closed. The landing doors of any floors shall not open when the elevator is not on that floor. • An electric contact for the car door shall be provided which shall prevent



**1X660 MW BHUSAWAL TPS UNIT-6
TECHNICAL SPECIFICATION
FOR
ELEVATORS**

SPECIFICATION NO.: PE-TS-415-502-A001
SECTION: I
SUB SECTION: IC
REV. 01 DATE: SEP'22
SHEET 5 OF 7

		elevator movement away from the landing unless the door is in the closed position. The mechanical interlock with auxiliary's door closing device shall be provided so that elevator can be operated only after the interlock circuit is established.
21.	Reverse phase relay and other protective devices	Required
22.	Car Safety & Governor	
	a) Stopping distance	As per IS:14665
	b) Type and mode of operation of Over speed Governor device	Centrifugal action
	c) Tripping speed and design code conforming to	As per IS 14665
	d) Location	At machine room
	e) Safety device	Shall be installed on sides of car
23.	Power supply:	As per elevator requirement.
	a) Power b) Lighting & fan	Only two (3 phase) supply feeders per elevator shall be provided one feeder shall be dedicated to elevator motor and other 3 phase supply feeder shall be provided by BHEL for air conditioner, machine room and shaft lighting and maintenance / installation requirement. Power supply mains shall be lockable as per requirements of IS: 1860. Industrial fluorescent luminaries with 2X40W fluorescent lamps with reflector shall be provided for Elevator Machine room. The lux level shall be 100 lux. Four (4) numbers of bulk head luminaries with 2 x 18 W CFS lamp and wire guard shall be provided in the elevator pit.
24.	Motor details	
	(a) Type	The motors will be AC squirrel cage induction type suitable for operation at 415V (+10% to -10% variation), 3 phase, 4 wire, 50 Hz (+5% to -5% variation) supply. The motors will be provided with Class-F insulation with temperature rise limited to class-B. The motors will generally conform to IS-325 and suitable for AC Variable Voltage Variable Frequency (VVVF) application.
	(b) Type of Duty	Elevator Duty suitable for inverter application.



**1X660 MW BHUSAWAL TPS UNIT-6
TECHNICAL SPECIFICATION
FOR
ELEVATORS**

SPECIFICATION NO.: PE-TS-415-502-A001
SECTION: I
SUB SECTION: IC
REV. 01 DATE: SEP'22
SHEET 6 OF 7

	(c) Motor Duty	S4/ suitable for operating with elevator duty motor.
	(d) Applicable standard	IS:325
	(e) Direction of rotation	Both Clockwise & Anticlockwise
	(f) Class of Insulation	Class F insulation with temperature rise limited to class-B.
	(g) Method of Starting	AC Variable Voltage Variable Frequency
	(h) Type of enclosures	IP55
25.	Door Motor	
	a) Equipment driven by Motor	Door (car and landing)
	b) Direction of rotation	Bidirectional
	c) Type of enclosures	IP54
26.	Cables & Wiring	<p>a. All the cables except trailing cables shall be as per IS 1554-1 or IS 7098-1. The PVC outer sheath of these cables shall be flame retardant, low smoke (FRLS) type.</p> <p>b. Trailing cable: The circular trailing cables shall be either in accordance with IS 4289 Part-I (elastomer insulated) or IS 4289 Part II (PVC insulated). The flat type trailing cables if offered shall be in accordance with IEC 60227-6.</p> <p>All wiring/ cabling between the equipments in the lift machine room and that between the machine room and equipments in the lift well and at the landings shall be wired in HDP conduits/ galvanized steel conduits to be supplied by the elevator supplier. Alternatively armored cables may be used.</p>
27.	Earthing	The elevator structures and all equipment including metal conduits shall be effectively earthed with earth conductors provided in the machine room as per IS 3043.
28.	Metallic Wire Mesh between Car & Counter Weight	Provided
29.	Fire Man Switch	Provided
30.	Sound Reducing Material	Isolation Rubber / other arrangement in the Machine shall be provided
31.	Announcement of floor level	Provided.
32.	Hall Lantern and Car Arrival Chimes	Hall lantern and car arrival chimes shall be provided for facilitating movement of



**1X660 MW BHUSAWAL TPS UNIT-6
TECHNICAL SPECIFICATION
FOR
ELEVATORS**

SPECIFICATION NO.: PE-TS-415-502-A001
SECTION: I
SUB SECTION: IC
REV. 01 DATE: SEP'22
SHEET 7 OF 7

		visually & hearing impaired persons.
33.	Other requirement	Suitable arrangement shall be provided to intimate unit control room during emergency in the form of audio visual alarm.
34.	Trailing cables	As per clause no.26 above.
35.	Protection class	Protection class for main control panel and other equipment shall be IP-54.
36.	AC for Machine room	Split air conditioner of 2T capacity shall be provided for each elevator.
37.	Fire extinguisher	½ Kg CO2 fire extinguisher in elevator car with suitable fixing arrangement.
38.	Maintenance Tool Kit	With each lift the vendor shall supply a maintenance tool kit which shall be kept in machine room.
39.	Braking Device	
38.1	Type of operation	Automatic
38.2	Type of brakes	DC Electro Magnetic
40.	Ropes	
39.1	Conforming to code	IS-2365
39.2	Wire Finish/Material Grade	Steel wire rope as per IS 14665
41.	Sheaves and Pulleys	Shall be provided.



1X660 MW BHUSAWAL TPS UNIT-6
TECHNICAL SPECIFICATION
FOR
ELEVATORS

SPECIFICATION NO.: PE-TS-415-502-A001

SECTION: II

SUB SECTION: IIA

REV: 01


DATE: SEP'22

Page: 1 of 1

SECTION – II

STANDARD TECHNICAL REQUIREMENTS

IIA – Standard Technical Requirement (Mechanical)

	TITLE	SPEC. NO. PE-TS-415-502-A001
	TECHNICAL SPECIFICATION of VVVF drive	for SECTION: II
	Elevator	SUB SECTION - IIA
	DATE: SEP'22	SUB SECTION
	SHEET	1 OF 5

1.0 General

- a) This part of the specification describes the general requirements for the Variable Voltage Variable frequency Drives, herein referred to as AC Drives, for use with standard IEC design AC squirrel cage induction motors. The nominal values, the standard documents and the drive's minimum performance are defined in this part. **To avoid any mismatch between the motor and its control equipment, the AC Drive shall be capable of auto adjustment by automatic measurement of the motor parameters with/without motor rotation.**

- b) Inverter construction and related devices:

Construction shall be divided in 3 broad sections. Section one converts AC Supply into DC supply. Section 2 Converts and controls DC supply into AC Supply with regulation. Section 3 shall be used for braking action of the motor and Dynamic Braking Unit (DBU) can be inbuilt or external depending upon the drive capacity. VVVF can be used in open loop (without external speed feed back) like in Travel motions or close loop (With external speed feed back) like in Hoist motions. Like all other electronic / electric devices VVVF drives are also protected by MCB / MCCB / Fuses. VVVF drives are sensitive to temperature and hence drive internal as well as external cooling fans are provided.

- c) Programming of VVVF Drives.

VVVF drives shall be programmable and for that purpose detachable digital Operator display unit shall be supplied along with the VVVF having required buttons for setting the user constant, functions etc. The VVVF drive is to be fine tuned by matching the motor parameters and setting the parameters on full load.

- d) VVVF drives shall be connected with power supply and these drives generate their own low voltage control supply. Potential free contacts shall be connected to this control supply and few programmable control terminals. Starting / stopping / set speeds operations of VVVF drive shall be achieved by above control connection.
- e) VVVF shall give smooth control over acceleration and deceleration making the motion jerk free and using Variable voltage variable frequency limits the inrush current to the squirrel cage motors. VVVF provides controlled torque to the motor due to which elevator operations are jerk free.

1.1 Experience

The Frequency Converter Manufacturer shall have adequate experience in frequency converter manufacturing and have adequate business volume in order to provide credibility in his commitments and a capability of long term support.

1.2 Local support

The Supplier shall have a permanent representative office with a trained and skilled support staff, in the country where the goods are delivered, in order to prove his commitment for local support and to provide a channel for communication.



TITLE

**TECHNICAL SPECIFICATION of VVVF drive
Elevator**

SPEC. NO. PE-TS-415-502-A001

for SECTION: II

SUB SECTION - IIA

DATE: SEP'22

SUB SECTION

SHEET

2 OF 5

The engineers employed by the Supplier's regional office shall be certified by the Manufacturer and provide start-up service including physical inspection of the drive, connected wiring and final adjustments, to ensure that the AC Drive meets the required performance.

The Supplier shall be able to give basic drives training to the Customer's engineers, preferably on the site. The training shall, as a minimum, include system concepts and basic troubleshooting.

2.0 Basic requirements for the AC Drives

2.1 General requirements

The AC Drive shall comply with National (country of origin) and International standards and the recommendations for electrical industrial control devices (IEC, EN, UL, NFC, and VDE).

The AC Drive shall be of the most modern design, yet user friendly and be simple to install commission and maintain. The AC Drive shall be able to start and control the speed of a standard squirrel cage induction AC motor. The AC Drives shall be: CE marked, conforming to European Low Voltage (73/23/CEE and 93/68/CEE) and EMC (89/336/CEE) Directives, UL/CSA marked according to UL 508C.

The AC Drives have to be built to comply with the IEC standards.

The AC Drive shall be a digitally controlled drive, using, at least, the Pulse Width Modulation (PWM) with flux vector control open loop (for travel) and closed loop (for hoist). It shall have diodes / thyristors in rectifier and IGBT's in the inverter section in their entire power range, and it shall have the following minimum specifications.

Rated Input Voltages	380V to 480V (-10% to +10% variation), three-phase
Rated Input Frequency	50Hz +3 % to - 5%
Output Voltage	0 – Input voltage, three-phase
Output Frequency Range	0 to 400 Hz
Acceleration / Deceleration Time	0.01 – 999s, adjustable, linear, with S, with U or customised shapes
Overload capability (Constant Torque)	150% of nominal current for 1min.
Operating ambient Temperature	-10°C up to 50°C (shall be de-rated suitably if not rated at 50°C)



TITLE

**TECHNICAL SPECIFICATION of VVVF drive
Elevator**

SPEC. NO. PE-TS-415-502-A001

for SECTION: II

SUB SECTION - IIA

DATE: SEP'22

SUB SECTION

SHEET

3 OF 5

Storage ambient Temperature	-25°C up to 70 °C
Maximum operating altitude	1000 m without de-rating, 1000...3000 (shall be de-rated suitably)
Max. Relative Humidity	95 %, without condensation and dripping water.
Main Protections	Over current, short circuit between phase, short circuit between phase and ground, input phase loss, output phase loss, motor overload, over speed, over voltage, under voltage, drive over temperature

The AC Drive shall be able to give a 100 % output current continuously in the above specified conditions. In order to ensure that the drive can provide the required output current in the specified ambient conditions, the Manufacturer shall inform the required de-rating, if the ambient temperature given in the project-specific specification is higher than rated ambient of the drive or if the installation altitude is more than 1000 m above the sea level. The de-rating factor shall be specified so that neither the lifetime of the AC Drive nor the unit's performance, overload capability included, nor the reliability of the AC Drive shall suffer.

Suitable encoder shall be provided for main hoist motion.

3.0 User interface

3.1 General

The user interface shall be identical throughout the power range and type to avoid confusion amongst the users and need for training in several different units.

3.2 Inputs and outputs

A. At least, the following standard Inputs and Outputs shall be provided, to be used in interface with the control system:

Analogue Inputs	:	1 x Programmable differential voltage input $\pm 10V$, 1 x Programmable current input 0(4) - 20mA 1 x Programmable voltage input 0 – 10V
Analogue Output	:	1 x Programmable analogue outputs 0(4) - 20mA or 0 – 10V
Logic inputs	:	6 x Programmable logic Inputs isolated from the mains
Relay Outputs	:	2 x Programmable Digital outputs with a changeover dry contact

All the control terminals shall be clearly marked.



TITLE

TECHNICAL SPECIFICATION of VVVF drive
Elevator

SPEC. NO. PE-TS-415-502-A001

for SECTION: II

SUB SECTION - IIA

DATE: SEP'22

SUB SECTION

SHEET

4 OF 5

B. At least, it shall be possible to assigned the following functions to the I/Os:

Analogue input	Analogue outputs
Speed reference Summing reference	Motor current Motor frequency Motor torque Motor power
Logic input	Relay or logic outputs (open collector)
Forward Reverse Jog Preset speeds Reference switching Ramp switching Parameter sets selection Fast stop Freewheel stop + speed - speed External fault	Ready Drive running High speed attained Drive fault Frequency threshold attained Motor thermal state attained Torque or current limitation attained Brake control

3.4 Programming terminal

- A. The AC drive shall have a keypad /display for programming and controlling purposes. An IP54 or IP65 remote mounting shall be possible at a distance of 10m.
- B. Password protection shall be provided to avoid unauthorized tampering with the set parameters.
- C. The programming terminal shall be able to display the commercial reference of the AC drive and of the options, the software version, the serial number
- D. Direct keypad entry shall be provided to observe the following actual parameters. Any one of the following parameters or actual values shall be selected to be always displayed:
- i) Input Voltage
 - ii) Input Frequency
 - iii) Output Frequency
 - iv) Output Power
 - v) Output Current
 - vi) Motor Speed



TITLE

TECHNICAL SPECIFICATION of VVVF drive
Elevator

SPEC. NO. PE-TS-415-502-A001

for SECTION: II

SUB SECTION - IIA

DATE: SEP'22

SUB SECTION

SHEET

5 OF 5

The following parameters shall always be displayed during normal operation:-

i) Drive Status

The following drive control functions at least shall be available from the keypad:-

- i) Run
- ii) Stop
- iii) Local / Remote selection.
- iv) Forward/Reverse (if function enabled)
- v) Accelerate
- vi) Decelerate
- vii) Parameter setting

3.5 Application programming

The AC Drive shall be designed for both simple and the most complicated applications, yet it shall be user friendly. It shall be possible to reset the parameter settings back to the original factory settings through the keypad.

3.6 PC Tools

The AC Drive Supplier shall have Windows based PC software available for monitoring and controlling the AC Drives, and the software shall be offered as an option. The software shall be supplied with the necessary hardware and a provision for connecting a PC with the AC Drives. It shall be possible to set and modify parameters, control the drive, read actual values and make trend analysis using the software.

4.0 Software features

A. Restart

In the event of a fault trip due to over voltage, over current or loss of analogue signal, the AC DRIVE shall be programmable to attempt an automatic restart. For safety reasons, the maximum number of attempts shall be within a selectable time. If the fault does not clear after the attempts, the drive shall lock out.

B. Brake logic control

The AC Drive shall have a built-in function to control a mechanical brake in order to move the load in a smooth and safe way. The brake logic control shall be adapted to the different movements: hoisting, travel, orientation.

5. Preferred makes:

As per sub vendor list – Annexure-I

ANNEXURE-VII

Check List for Operation & Maintenance Manual

Project name :
 Project number :
 Package Name :
 PO reference :
 Document number :
 Revision number :

Sl.no. & Sections	Description	Tick (√)if included in Manual			Remarks
		Yes	No	Not Applicable	
1.	Cover page				
1.1	Project Name				
1.2	Customer/consultant Name				
1.3	Name of Package				
1.4	Supplier details with phone, FAX ,email address , Emergency Contact number				
1.5	Name and sign of prepared by , checked by & approved by				
1.6	Revision history with approval Details				
2.0	Index				
2.1	showing the sections & related page nos All the pages should be numbered section wise				
3.0	Description of Plant/System				
3.1	Description /write up of operating principle of system equipment/ associated sub-systems & accessories/controls system , operating conditions, performance parameters under normal , start up and special cases				
3.2	Equipment list and basic parameter with Tag numbers				
3.3	Data sheets approved by Customer/for information and catalogues provided by original manufacturer				
3.4	Associated other packages and Interface /terminal points				
3.5	P&ID & Process Diagrams				
3.6	GA Layout drawings, As-built drawings , Actual photograph of items/system (Drawings of A2 & bigger sizes are to be attached in the last)				
3.7	Single line/wiring diagrams				
3.8	Control philosophy /control write-ups				

4.0	Commissioning Activities (if not covered in separate document i.e. erection manual, commissioning manual)				
4.1	Pre-Commissioning Checks				
4.2	handling of items at site				
4.3	Storage at site				
4.4	Unpacking & Installation procedure				
5.0	Operation Guidelines for plant personal/user/operator				
5.1	Interlock & Protection logic along with the limiting values of protection settings for the equipment along with brief philosophy behind the logic, drawings etc. to be provided.				
5.2	Start up, normal operation and shut down procedure for equipments along with the associated systems in step by step mode. Valve sequence chart, step list, interlocks etc. with Equipment isolating procedures to be mentioned.				
5.3	Do's & Don't of the equipments.				
5.4	Safety precautions to be taken during normal operation. Safety symbols, Emergency instructions on total power failure condition/lubrication failure/any other condition				
5.5	Parameters to be monitored with normal values and limiting values				
5.6	Trouble shooting with causes and remedial measures				
5.7	Routine operational checks, recommended logs & records				
5.8	Changeover schedule if more than one auxiliary for the same purpose is given				
5.9	Painting requirement and schedule				
5.10	Inspection, repair , Testing and calibration procedures				
6.0	Maintenance guidelines for plant personal				
6.1	List of Special Tools and Tackles required for Overhaul/Trouble shooting including special testing equipment required for calibration etc.				
6.2	Stepwise dismantling and re-assembly procedure clearly specifying the tools to be used, checks to be made, records to be maintained, clearances etc. to be mentioned. Tolerances for fitment of various components to be given.				
6.3	Preventive Maintenance & Overhauling schedules linked with running hours/calendar period along with checks to be given				

6.4	Long term maintenance schedules especially for structural, foundations etc.				
6.5	Consumable list along with the estimated quantity required during commissioning, normal running and during maintenance like Preventive Maintenances and Overhaul. Storage/handling requirement of consumables/self-life.				
6.6	List of lubricants with their Indian equivalent, Lubrication Schedule, Quantity required for each equipment for complete replacement is to be given				
6.7	List of vendors & Sub-vendors with their latest addresses, service centres ,Telephone Nos., Fax Nos., Mobile Nos., e-mail IDs etc.				
6.8	List of mandatory and recommended spare parts list				
6.9	Tentative Lead time required for ordering of spares from the equipment supplier				
6.10	Guarantee and warranty clauses				
7.0	Statutory and other specific requirements considerations.				
8.0	List of reference documents				
9.0	Binding as per requirement				

SITE STORAGE AND PRESERVATION GUIDELINES FOR MECHNANICAL BOPs

(Doc No: PE-DC-SSG-A001 REV.00)



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

CONTENT

- 1 SCOPE OF THE DOCUMENT
- 2 PURPOSE OF STORAGE & PRESERVATION
- 3 MEASURES TO BE TAKEN FOR STORAGE AND PRESERVATION
 - a) GENERAL STORAGE REQUIREMENTS
 - b) GENERAL PRESERVATION REQUIREMENTS
 - c) GENERAL INSPECTION REQUIREMENTS
- 4 TYPE OF STORAGE FOR VARIOUS EQUIPMENT
5. CONCLUSION
6. STACKING ARRANGEMENT FOR PLATES AND STRUCTURAL STEEL

1. SCOPE OF THE DOCUMENT

This guideline is prepared in intent to provide proper site storage and preservation of the Mechanical, Electrical and C & I items / equipment supplied under various bought out packages/items. This storage procedure shall be followed at different power plant sites by concerned agency for storage and preservation from the date of equipment received at site until the same are erected and handed over to the customer.

2. PURPOSE OF STORAGE & PRESERVATION

Many of the items may be required to be kept in stores for long period. It shall therefore be essential that proper methods of storage and preservation be applied so that items do not deteriorate, loose some of their properties and become unusable due to atmospheric conditions and biological elements.

3. MEASURES TO BE TAKEN FOR STORAGE, HANDLING & PRESERVATION

a) GENERAL STORAGE REQUIREMENTS

1. To the extent feasible, materials should be stored near the point of erection. The storage areas should have adequate unloading and handling facilities with adequate passage space for movement of material handling equipment such as cranes, fork lift trucks, etc. The storage of materials shall be properly planned to minimise time loss during retrieval of items required for erection.
2. The outdoor storage areas as well as semi-closed stores shall be provided with adequate drainage facilities to prevent water logging. Adequacy of these facilities shall be checked prior to monsoon.
3. The storage sheds shall be built in conformity with fire safety requirements. The stores shall be provided with adequate lights and fire extinguishers. 'No smoking' signs shall be placed at strategic locations. Safety precautions shall be strictly enforced.
4. Adequate lighting facility shall be provided in storage areas and storage sheds and security personnel positioned to ensure enforcement of security measures to prevent theft and loss of materials.
5. Adequate number of competent stores personnel and security staff shall be deployed to efficiently store and maintain the equipment / material.
7. The equipment shall be stored in an orderly manner, preserving their identification slips, tags and instruction booklets, etc., required during erection. The storage of materials shall be equipment-wise. Loose parts shall be stored in sheds on racks,

preserving the identification marks and tags in good condition. The group codes shall be displayed on the racks

6. At no time shall any materials be stored directly on ground. All materials shall be stored minimum 200 mm above the ground preferably on wooden sleepers

b) GENERAL PRESERVATION REQUIREMENTS

1. All special measures to prevent corrosion shall be taken like keeping material in dry condition, avoiding the equipment coming in contact with corrosive fluid like water, acid etc.
2. Materials which carry protective coating shall not be wrapped in paper, cloth, etc., as these are liable to absorb and retain moisture. The material shall be inspected and in case of signs of wear or damages to protective coating, that portion shall be cleaned with approved solution and coated with an approved protective paint. Complete record of all such observations and protective measures taken shall be maintained.
3. Generally equipment supplied at site are properly greased or rust protective oil is applied on machined/ fabricated components. However periodic inspection shall be carried out to ensure that protection offered is intact.
4. While handling the equipment, no dragging on the ground is permitted. Avoid using wire rope for lifting coated components. Use polyester slings (if possible) otherwise protective material (e.g. clothes, wood block etc.) should be used while handling the components with rope / slings
5. For Equipment supplied with finished paint, touch paint shall be done in case any surface paint gets peeled off during handling. Otherwise such surfaces shall necessarily be wrapped with polythene to avoid any corrosion. Further for equipment wherein finish coat is to be applied at site, site to ensure that equipment is received with primer coat applied.
6. It shall be ensured by periodic inspection that plastic inserts are intact in tapped holes, wherever applicable.
7. Pipes shall be blown with air periodically and it shall be ensured that there is no obstruction.
8. Silica gel or approved equivalent moisture absorbing material in small cotton bags shall be placed and tied at various points on the equipment, wherever necessary.
9. Heavy rotating parts in assembled conditions shall be periodically rotated to prevent corrosion/jamming due to prolonged storage.

10. All the electrical equipment such as motors, generators, etc. shall be tested for insulation resistance at least once in three months and a record of such measured insulation values shall be maintained.
11. Following preservatives/preservation methods can be used depending upon type of equipment
 - a. Rust preventive fluid (RPF)
 - b. Rust protective paints
 - c. Tarpaulin covers, in case of outdoor storage
 - d. De-oxy aluminate for weld-ments

c) GENERAL INSPECTION REQUIREMENTS

1. Period inspection of materials with specific reference to –
 - Ingress of moisture and corrosion damages.
 - Damage to protective coating.
 - Open ends in pipes, vessels and equipment -
 - In case any open ends are noticed, same shall be capped.
2. Any damages to equipment / materials.
 - In case of any damages, these shall be promptly notified and in all cases, the repairs / rectification shall be carried out.
 - Any items found damaged or not suitable as per project requirements shall be removed from site. If required to store temporarily, they shall be clearly marked and stored separately to prevent any inadvertent use.

4. TYPE OF STORAGE FOR VARIOUS EQUIPMENT

The types of storage are broadly classified under the following heads:

i **Closed storage with dry and dust free atmosphere. (C)**

The closed shed can be constructed by using cold-rolled / tubular components for structure and corrugated asbestos sheets / galvanised iron sheets for roofing. Brick walls / asbestos sheets can be used to cover all the sides. The floor of the shed can be finished with plain cement concrete suitably glazed. The shed shall be provided with proper ventilation and illumination.



ii **Semi-closed storage. (S)**

The semi closed shed can be constructed by using cold-rolled / tubular components for structure and corrugated / asbestos sheets for roofing. The floor shall be brick paved. If required a small portion of sides can be covered to protect components from rainwater splashing onto the components.





iii Open storage (O)

The open yard shall be levelled, well consolidated to achieve raised ground with the provision of feeder roads for crane approach along with access roads running all sides. One part of the open yard shall be stone pitched, levelled and consolidated with raised ground suitable for storing / stacking heavier and critical components with due space to handle them by cranes etc . Adequate number of sleepers, concrete block etc. to be provided to make raised platforms to stack critical materials.

A separate yard to be identified as “scrap yard” slightly away from main open yard to store wooden/steel scraps, which are to be disposed off. This is required to avoid mix up with regular components as well as to avoid fire hazard.

Some of the components, which are having both machined & un-machined surfaces and are bulky, shall be stored in open storage area on a raised ground and suitably covered with water proof / fire retardant tarpaulin.



The equipment listed below shall be stored and inspected as per requirement mentioned in the table below.

Sl. No.	Description of the equipment	Type of Storage	Check for	Remarks
Raw material /mechanical items like pipes, plates, structure sections etc.)				
1.	Steel pipes (lined/unlined)	S	Damage , paint, corrosion, rubber lining peeling	Provide end cap
2.	MS Plates	S	Damage, paint, corrosion	
3.	SS Plates	S	Damage	
4.	Non-metallic pipes	S	Damage, cracks	Provide end cap
5.	Stainless steel pipes	S	Damage ,	Provide end cap
6.	MS sections, beams	S	Damage, paint, corrosion	
7.	Cable trays	S	Damage, condition of preservations	
8.	Insulation sheets	S	Damage	
9.	Insulation	C	Damage, packing	
10.	Hangers Rods	S	Damage, paint, packing	
11.	Tubes	S	Damage, paint , packing	Provide end cap
12.	Hume pipes	O	Damage	
13.	Castings	O	Damage, paint, corrosion	
Fabricated mechanical items (pressure vessels, tanks etc.)				
14.	Pressure vessels (unlined)	O	Damage, paint, corrosion,	Covered nozzles
15.	Atmospheric storage tanks (unlined)	O	Damage, paint, corrosion	Covered nozzles

Sl. No.	Description of the equipment	Type of Storage	Check for	Remarks
16.	Pressure vessels (lined)	S	Damage, paint, corrosion, rubber lining	
17.	Atmospheric storage tanks(lined)	S	Damage, paint, corrosion, rubber lining	
18.	Support structures	O	Damage , paint, corrosion	
19.	Flanges	C	Damage , paint, corrosion	
20.	Fabricated pipes	S	Damage , paint, corrosion	Provide end cap
21.	Vessels internals	C	Damage , paint, corrosion ,packing	
22.	Grills	S	Damage , paint, corrosion	
23.	Angles	S	Damage , paint, corrosion	
24.	Bridge mechanism/clarifier mechanism	O	Damage , paint, corrosion	
25.	Cranes, rails	S	Damage , paint, corrosion	
26.	Stair cases	O	Damage , paint, corrosion	
27.	Ladders/handrails	O	Damage , paint, corrosion	
28.	Fabricated ducts	S	Damage , paint, corrosion	
29.	Isolation Gates	O	Damage , paint, corrosion	
30.	Fabricated boxes/panels	S	Damage , paint, corrosion	
Mechanical components like valves, fittings, cables glands, spares etc.)				
31.	Valves	S	Damage , packing	

Sl. No.	Description of the equipment	Type of Storage	Check for	Remarks
32.	Fittings	S	Damage , packing	Provide end cap
33.	Cable glands	C	Damage , packing	
34.	Tools & tackles	C	Damage , packing	
35.	Nut , bolts, washers,	C	Damage , packing	
36.	Gasket & Packings	C	Damage , packing	
37.	Copper tubes	C	Damage , packing, corrosion	Provide end cap
38.	SS tubing	C	Damage , packing	Provide end cap
Rotating assemblies (pumps, blowers, stirrers, fans, compressors etc.)				
39.	Pumps	S	Damage , packing, corrosion	Shaft rotation
40.	Blowers/Compressors	S	Damage , packing, corrosion	Shaft rotation
41.	Agitators/stirrers/radial launders	C	Damage , packing, corrosion	Shaft rotation
42.	Rollers for chlorine tonner mounting	C	Damage , packing, corrosion	
43.	Centrifuge	S	Damage , packing,	
44.	Gear box	C	Damage , packing, corrosion	
45.	Bearings	C	Damage , packing, corrosion	
46.	Fans	S	Damage , packing, corrosion	
47.	Dosing skids	S	Damage , packing, corrosion	
48.	Pump assemblies	S	Damage , packing, corrosion	
49.	Air washers(INTERNALS)	S	Damage , packing	
50.	Air conditioners (split)	C	Damage , packing	

Sl. No.	Description of the equipment	Type of Storage	Check for	Remarks
51.	Elevators(CONTAINERIZED)	O	Damage , packing, corrosion	
52.	Chillers/VA machines	S	Damage , packing	
53.	Air handling Unit/Package unit	S	Damage , packing	
54.	Chlorinators & Evaporators	C	Damage , packing	
55.	Ejectors	C	Damage , packing	
56.	Electrolyser	C	Damage , packing	
Miscellaneous items like chain pulley blocks, hoists etc.				
57.	Chain pulley blocks	S	Damage, Packing	
58.	Electric hoists	S	Damage, Packing	
59.	Fire extinguishers	C	Damage, expiry date	
60.	Fork Lift Truck	S	Damage, Packing	
61.	Hydraulic Mobile Crane	O	Damage, Packing	
62.	Mobile Pick Up & Carry Crane	O	Damage, Packing	
63.	Motor boats	O	Damage, Packing	
64.	Safety showers	S	Damage, Packing	
65.	Diffusers/dampers	S	Damage, Packing	
Chemicals and consumables (acid, alkali, paints, oils, reagents and special chemicals)				
66.	Hydro Chloric Acid (HCl)	Store in canes/ storage tank in dyke area	Date of production/ leakage/fumes	hazardous chemical
67.	Sulphuric acid (H ₂ SO ₄)	Store in canes/ storage tank in dyke area	Date of production/ leakage/fumes	hazardous chemical

Sl. No.	Description of the equipment	Type of Storage	Check for	Remarks
68.	Sodium hydroxide (NaOH)	Store in canes/ storage tank in dyke area	Date of production/ leakage/ fumes/ breather	hazardous chemical ,breather to be checked for air ingress
69.	Sodium hypo chlorite	To be stored under shed	Date of production/ leakage/ fumes	hazardous chemical ,self-life normally 15-30 days after which strength of chemical decays
70.	Ammonia	S	Date of production/ leakage/ fumes	Store in closed storage tanks, hazardous chemical
71.	CW treatment chemicals	S	Date of production , Self-life	Store in closed canes
72.	RO/UF cleaning chemicals	S	Date of production , Self-life	Store in closed canes
73.	Lime	C	Damage to packing , seepage	Prevent moisture, rain
74.	Alum bricks	C	Damage to packing	Prevent moisture, rain
75.	Poly electrolyte	S		Store in closed storage tanks
76.	Laboratory chemicals(powder)	C	Damage, Packing self- life	
77.	Laboratory chemicals(liquid)	C	Damage, Packing self- life	
78.	Lubrication oils	C	Leakage	
79.	Paints	S	Leakage ,air tightness	
80.	Sand	O	Damage of packing	No hooks
81.	Salt (NaCl)	C	Damage of packing, water ingress	Prevent moisture, rain
82.	Anthracite	S	Damage of packing	
83.	Activated carbon	S	Damage of packing	

Sl. No.	Description of the equipment	Type of Storage	Check for	Remarks
84.	Thermal insulation	S	Damage of packing	
85.	Cement	C	Damage of packing	Prevent moisture, rain
86.	Gravels	O	Damage of packing	
87.	ION exchange resins	C	Damage , packing	Refer manufacturer guidelines
88.	RO membranes	C	Damage , packing	Refer manufacturer guidelines
89.	UF membranes	C	Damage , packing	Refer manufacturer guidelines
90.	Cleaning chemicals	C	Damage , packing	Refer manufacturer guidelines
91.	Chemicals for analysers/calibration	C	Damage , packing	Refer manufacturer guidelines
Electrical and C & I items (motors, cables etc.)				
92.	Motors	C	Damage , packing	
93.	Cable drums	O	Damage	
94.	Control Panel /control desk, UPS ,JB	S	Damage, Packing	
95.	Instruments(gauges/analysers)	C	Damage	
Special items		As per Manufacturer's item, like Hydrogen cylinders, Ozonator, Analyser, Chlorine dioxide generators etc.		

5. CONCLUSION

Concerned storage agency at site should make sure that loss in equipment performance and wear & tear are minimised through proper storage and preservation. The above are broad guidelines and cover major equipment / materials. However specific storage practices shall be followed as per manufacturer recommendation. All the necessary measures even in addition to the ones mentioned above, if found necessary, should be taken to achieve the objective.

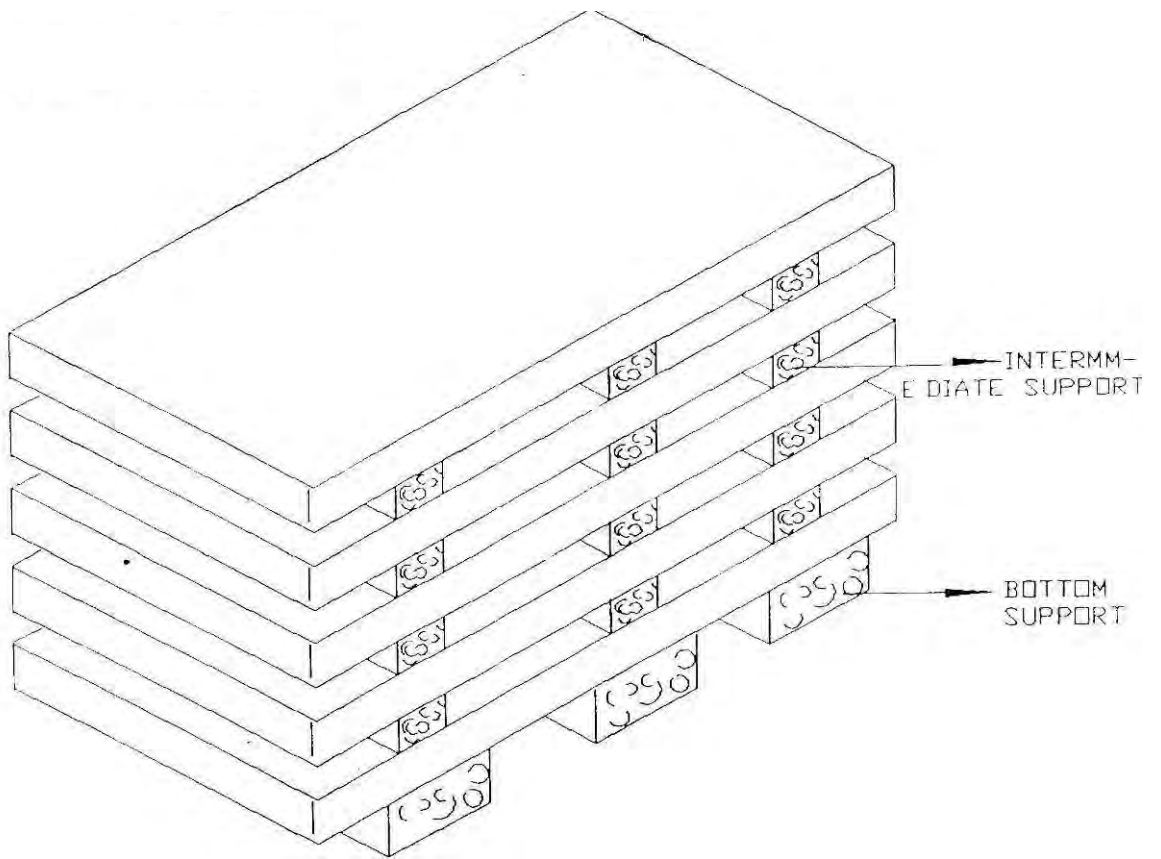


Figure - 1 - PLATE STACKING ARRANGEMENT

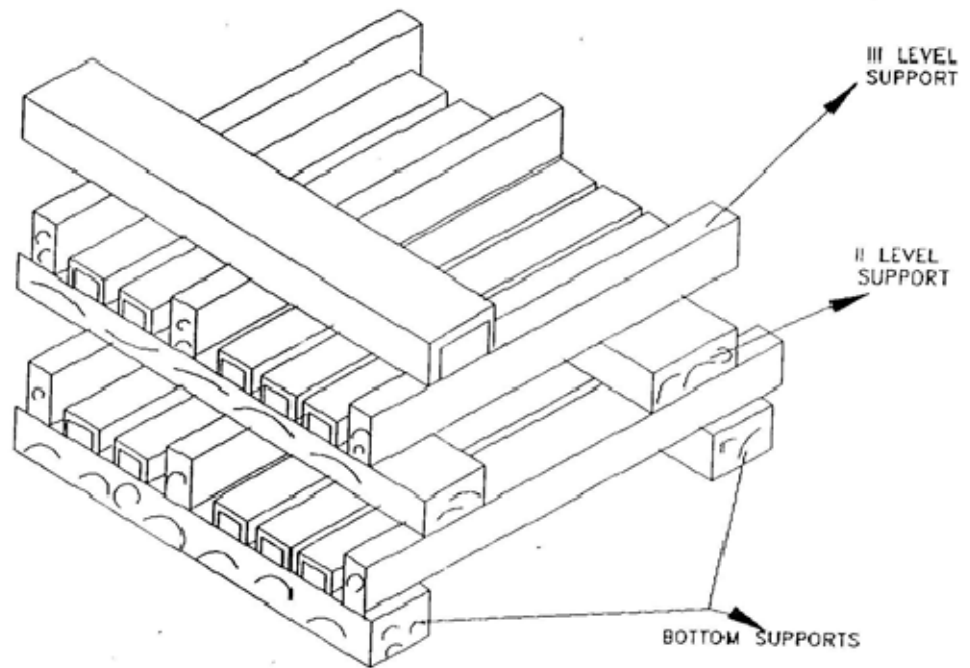


Figure - 2 - STRUCTURAL STEEL STACKING ARRANGEMENT



1X660 MW BHUSAWAL TPS UNIT-6
TECHNICAL SPECIFICATION
FOR
ELEVATORS

SPECIFICATION NO.: PE-TS-415-502-A001

SECTION: III

SUB SECTION: IIIA

REV: 01


DATE: SEP'22

Page: 1 of 1

SECTION – III

DOCUMENTS TO BE SUBMITTED BY THE BIDDER

IIIA – List of documents to be submitted with bid

	<u>1X660 MW BHUSAWAL TPS UNIT-6</u> <u>TECHNICAL SPECIFICATION</u> <u>FOR</u> <u>ELEVATORS</u>	SPECIFICATION NO.: PE-TS-415-502-A001	
		SECTION: III	
		SUB SECTION: IIIA	
		REV: 01	DATE: SEP'22
		Page: 1 of 1	

BIDDER HAS TO SUBMIT ONLY FOLLOWING DOCUMENTS ALONG WITH THE OFFER, FOR TECHNICAL EVALUATION OF THE BID:-

- 1) Schedule of technical deviations (if any).
OR
"No deviation certificate" – Clearly mentioning that bidder has considered 'No - Deviation' from the technical specification provided by BHEL.
- 2) Signed and stamped copy of compliance cum confirmation certificate.
- 3) Unpriced format, duly mentioned 'Quoted' against each Sl. No / clause no.
- 4) Signed and stamped copy of:
 - a) "Specific-Electrical Equipment Specification for elevator.
 - b) "Electrical Scope between BHEL and Vendor" sheet.
 - c) Compliance to /duly filled "Electrical Load Data" sheet.
- 5) Duly signed & stamped copy of civil assignment input drawings.

Note:

- 1) Any other standard document/ details furnished by the bidder i.e. Data sheet / GA Drawing/ QAP etc. shall not be taken in to consideration for evaluation.
- 2) Bidder to note that if the bidder does not submit the documents mentioned in Sl. No. 1.0 to 5.0 along with their offer then their offer is liable to be rejected.



1X660 MW BHUSAWAL TPS UNIT-6
TECHNICAL SPECIFICATION
FOR
ELEVATORS

SPECIFICATION NO.: PE-TS-415-502-A001

SECTION: III

SUB SECTION: IIIB

REV: 01

DATE: SEP'22

Page: 1 of 1

SECTION – III

DOCUMENTS TO BE SUBMITTED BY THE BIDDER

IIIB – Compliance cum Confirmation Certificate



1X660 MW BHUSAWAL TPS UNIT-6
TECHNICAL SPECIFICATION
FOR
ELEVATORS

SPECIFICATION NO.: PE-TS-415-502-A001

SECTION:III

SUB SECTION: IIIB

REV: 01


DATE: SEP'22

Page: 1 of 2

COMPLIANCE CUM CONFIRMATION CERTIFICATE

The bidder shall confirm compliance with following by signing/ stamping this compliance certificate (every sheet) and furnish same with the offer.

- a) The scope of supply, technical details, construction features, design parameters etc. shall be as per technical specification & there are no exclusions other than those mentioned under "exclusion" and those resolved as per 'Schedule of Deviations', if applicable, with regard to same.
- b) There are no other deviations w.r.t. specifications other than those furnished in the 'Schedule of Deviations'. Any other deviation, stated or implied, taken elsewhere in the offer stands withdrawn unless specifically brought out in the 'Schedule of Deviations'.
- c) Bidder shall submit QP in the event of order based on the guidelines given in the specification & QP enclosed therein. QP will be subject to BHEL/ CUSTOMER approval & customer hold points for inspection/ testing shall be marked in the QP at the contract stage. Inspection/ testing shall be witnessed as per same apart from review of various test certificates/ Inspection records etc. This shall be within the contracted price with no extra implications to BHEL after award of the contract.
- d) All drawings/ data-sheets / calculations etc. submitted along with the offer shall not be taken cognizance.
- e) The offered materials shall be either equivalent or superior to those specified in the specification & shall meet the specified / intended duty requirements. In case the material specified in the specifications is not compatible for intended duty requirements then same shall be resolved by the bidder with BHEL during the pre-bid discussions, otherwise BHEL / Customer's decision shall be binding on the bidder whenever the deficiency is pointed out. For components where materials are not specified, same shall be suitable for intended duty, all materials shall be subject to approval in the event of order.
- f) The commissioning spares shall be supplied on 'As Required Basis' & prices for same included in the base price itself.
- g) All sub vendors shall be subject to BHEL / CUSTOMER approval in the event of order.
- h) Guarantee for plant/equipment shall be as per relevant clause of GCC / SCC / Other Commercial Terms & Conditions.
- i) In the event of order, all the material required for completing the job at site shall be supplied by the bidder within the ordered price even if the same are additional to approved billing break up, approved drawing or approved Bill of quantities within the scope of work as tender specification. This clause will apply in case during site commissioning, additional requirements emerges due to customer and / or consultant's comments. No extra claims shall be put on this account.

	<u>1X660 MW BHUSAWAL TPS UNIT-6</u> <u>TECHNICAL SPECIFICATION</u> <u>FOR</u> <u>ELEVATORS</u>	SPECIFICATION NO.: PE-TS-415-502-A001	
		SECTION:III	
		SUB SECTION: IIIB	
		REV: 01	DATE: SEP'22
		Page: 2 of 2	

- j) Schedule of drawings submissions, comment incorporations & approval shall be as stipulated in the specifications. The successful bidder shall depute his design personnel to BHEL's / Customer's / Consultant's office for across the table resolution of issues and to get documents approved in the stipulated time.
- k) As built drawings shall be submitted as and when required during the project execution.
- l) The bidder has not tempered with this compliance cum confirmation certificate and if at any stage any tempering in the signed copy of this document is noticed then same shall be treated as breach of contract and suitable actions shall be taken against the bidder.
- m) Successful bidder shall furnish detailed erection manual for each of the equipment supplied under this contract at least 3 months before the scheduled erection of the concerned equipment / component or along with supply of concerned equipment / component whichever is earlier.
- n) Document approval by customer under Approval category or information category shall not absolve the vendor of their contractual obligations of completing the work as per specification requirement. Any deviation from specified requirement shall be reported by the vendor in writing and require written approval. Unless any change in specified requirement has been brought out by the vendor during detail engineering in writing while submitting the document to customer for approval, approved document (with implicit deviation) will not be cited as a reason for not following the specification requirement.
- o) In case vendor submits revised drawing after approval of the corresponding drawing, any delay in approval of revised drawing shall be to vendor's account and shall not be used as a reason for extension in contract completion.



1X660 MW BHUSAWAL TPS UNIT-6
TECHNICAL SPECIFICATION
FOR
ELEVATORS

SPECIFICATION NO.: PE-TS-415-502-A001

SECTION: III

SUB SECTION: IIIC

REV: 01

DATE: SEP'22

Page: 1 of 1

SECTION – III

DOCUMENTS TO BE SUBMITTED BY THE BIDDER

IIIC – Electrical Load data

LOAD TITLE	RATING (KW)		UNIT (U)/STN (S)	Nos.			VOLTAGE CODE**	FEEDER CODE**	EMER. LOAD (Y)	CONT.(C)/ INIT.(I)	STARTING TIME >5 SEC (Y)	LOCATION	BOARD NO.	CABLE		BLOCK CABLE DRG. No.	CONTROL CODE	REMARKS	LOAD No.
	NAME PLATE	MAX. CONT. DEMAND (MCR)		RUNNING	STANDBY									SIZE CODE	Nos				
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	

ELEVATOR FOR FGD CONTROL BUILDING

ELEVATOR MOTOR	16.5 KW		S	1	0	D	S	-	C		Elevator Machine room (FGD CONTROL BUILDING)	
2 T A/C FOR ELEVATOR M/C ROOM AND LIGHTING FOR ELEVATOR M/C ROOM & SHAFT AND MAINTENANCE AND INSTALLATION REQUIREMENT.	7 KW		S	1	0	D	S	-	C		Elevator Machine room (FGD CONTROL BUILDING)	

Note:

- 1) No other single phase or 3 phase supply shall be provided for elevator erection / operation etc.
- 2) Only two (3 phase) supply feeders per elevator shall be provided one feeder shall be dedicated to elevator motor and other 3 phase supply feeder shall be provided by BHEL for air conditioner, machine room and shaft lighting and maintenance / installation requirement. Elevator supplier/vendor to consider CT in their scope for stepping down the voltage as per their requirement.
- 3) Electrical load for Electric hoist is given by concerned DEALING ENGINEER of PEM- MAX- MH Section.
- 4) *Note for Elevator supplier/vendor: Feeder of indicated rating shall be provided by Electrical Contractor (i.e.BHEL). If motor rating is lesser than the provided feeder rating, Elevator supplier/vendor shall provide protection against over current.*

NOTES: 1. COLUMN 1 TO 12 & 18 SHALL BE FILLED BY THE REQUISITIONER (ORIGINATING AGENCY); REMAINING COLUMNS ARE TO BE FILLED UP BY PEM (ELECTRICAL)
2. ABBREVIATIONS : * VOLTAGE CODE (7):- (ac) A=11 KV, B=6.6 KV, C=3.3 KV, D=415 V, E=240 V (1 PH), F=110 V (DC): G=220 V, H=110 V, J=48 V, K=+24V, L=-24 V
: ** FEEDER CODE (8):- U=UNIDIRECTIONAL STARTER, B=BI-DIRECTIONAL STARTER, S=SUPPLY FEEDER, D=SUPPLY FEEDER (CONTACTOR CONTROLLED)

	LOAD DATA (ELECTRICAL)	JOB NO.	415	ORIGINATING AGENCY		PEM (ELECTRICAL)	
		PROJECT TITLE	1X660 MW BHUSAWAL TPS UNIT-6	NAME		DATA FILLED UP ON	
		SYSTEM / S	ELEVATOR	SIGN.		DATA ENTERED ON	
		DEPTT. / SECTION	MAUX / MF	SHEET 1 OF 1		REV. 01	DE'S SIGN. & DATE



1X660 MW BHUSAWAL TPS UNIT-6
TECHNICAL SPECIFICATION
FOR
ELEVATORS

SPECIFICATION NO.: PE-TS-415-502-A001

SECTION: III

SUB SECTION: IIID

REV: 01

DATE: SEP'22

Page: 1 of 1

SECTION – III

DOCUMENTS TO BE SUBMITTED BY THE BIDDER

IIID – Pre-bid Clarification Schedule

