TELANGANA STATE POWER GENERATION CORPORATION LTD.

1 X 800 MW KOTHAGUDEM TPP FGD

TECHNICAL SPECIFICATION
FOR
FGD CONTROL BUILDING ELEVATORS

SPECIFICATION NO.: PE-TS-439-502-A001

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

INDEX

SECTION – I

SPECIFIC TECHNICAL REQUIREMENTS

IA – Specific Technical Requirement (Mechanical)

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 **1 X 800 MW KOTHAGUDEM TPP FGD in Telangana 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.

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.

1.0 Introduction

Passenger elevator shall be provided for access to various operating floors / platforms in FGD Control building for 1 X 800 MW KOTHAGUDEM TPP FGD 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 1 X 800 MW KOTHAGUDEM TPP FGD 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	Five (05) including ground (0M, 3.7M, 8.7M, 12.4M, 18.4M)	18.4M	Passenger Elevator Conventional Type.	1 m/s	PVC tiles

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.

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 earthling.

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 statuary 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.

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 statuary 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.

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 the building.

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.

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.

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.

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

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 confirm 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.

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.

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.

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.

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.

CONTENT

VOLUME : IIIF

SECTION-IV

ELEVATORS

1.00.00 **CODES AND STANDARDS**

1.01.00 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 :

1.01.01 IS-14665 : Electric Traction Lifts.

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

1.01.03 State Elevator and Escalator Act

1.01.04 State Elevator and Escalator Rules

1.01.05 Indian Electricity Act.

1.01.06 Indian Electricity Rules

1.01.07 Any other acts/standards as applicable as mentioned in volume : II-A of this specification.

1.02.00 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.

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

1.04.00 Minimum acceptable degree of protections for various equipment are presented in Annexure-III.

1.05.00 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.

Stipulations in this section shall prevail in case of any contradiction between this section and other relevant sections/ volumes.

2.00.00 **SCOPE OF WORKS**

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.

2.01.00 **Scope of Supply**

2.01.01

a) One (1) goods elevator complete with all accessories shall be furnished for steam generator unit at the suitable locations so that the same can be used for the movement of materials 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.

b) One (1) passenger elevator complete with all accessories shall be furnished for steam generator unit at the suitable locations so that the same can be used for the movement of man 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.

c) One (1) passenger cum goods elevator complete with all accessories shall be furnished for crusher house at the suitable locations so that the same can be used for the movement of man & materials for the various equipments. The lift shall be connected to the crusher house structure and as such part of the lift load shall be transferred to the building column. The Bidder shall ensure that the crusher house columns are designed to take the loads due to the lift shafts and connecting platforms at different elevations.

d) One (1) passenger elevators shall be included in TG building at “C Row” near to control room upto D/A floor level. The landing for the elevator shall be provided for all the floors in TG building. This shall put into operation before commissioning activities start. These shall be connected to the power house/structural steelwork and as such part of their loads may be transferred to the main power house/ 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.

e) One (1) passenger elevator complete with all accessories shall be provided in the Service House Building to have access in various floors.

2.01.02 The above elevators shall be provided with the following accessories as applicable, for all the above elevators.

a) Elevator car complete with door, door hangers and tracks, push button station and operating panel, car position indicators, fan, telephone hooked upto EPABX of the plant and illumination fittings and other required accessories.

b) All required structural steel members and components to accommodate the elevator and accessories in the elevator shaft, steel guides for car and counter weight, necessary steel items associated with elevator such as machine supporting beams, bearing plates, supporting channels, sill supporting angles etc.

c) Counter weight, counter weight guard, sheaves and beams, ropes, hoist rope compensation, terminal buffers and guide rail lubricator device.

d) Complete drive machinery and accessories, electrical and control equipment including power and lighting distribution boards and switch fuse units for power and lighting. Necessary brakes and also automatic leveling device, terminal and final limit switches and all required protective devices including starters, switch fuse unit etc. Complete drive machinery shall include motors, starters, switchgears, fuses, switches, relays, junction boxes etc. as minimum requirement.

e) Hoist way doors and push button station with tell-tale lights at all the elevator landings.

f) Any other fittings and accessories required for the safe and efficient operation of the elevators.

g) All required foundation plates and/or base plates, inserts, anchor bolts, lifting lugs, eye bolts etc. wherever necessary.

h) Fireman's switch as per rules of fire lifts.

i) Earth leakage circuit breaker.

2.02.00 For detailed scope of services, Volume IIA of this specification shall be referred to.

3.00.00 OPERATION AND CONTROL PHILOSOPHY

3.01.00 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.

3.02.00 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 :

3.02.01 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.

3.02.02 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.

3.02.03 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 "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.

3.03.00 Besides the automatic mode of operations described in Clauses 3.02.00 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.

3.04.00 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.

3.05.00 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 will return to normal working.

4.00.00 PERFORMANCE REQUIREMENT

Performance requirement for the elevators shall be guided by the Attachments/Annexure enclosed with this section.

5.00.00 DESIGN AND CONSTRUCTION

Design and constructional requirement of all the elevators and components thereof shall be in line with Indian Standards specified in clause 1.00.00 above as applicable unless specified otherwise.

5.01.00 **Load and Speed**

The elevator shall lift a pay load as indicated against rated load of the applicable Annexure attached to this section 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.

5.02.00 **Travel and Landing**

Travel of the lift car, number and elevations of the landing levels shall be as indicated in Annexure attached to this section.

5.03.00 **Car**

5.03.01 Size

The dimensions of the lift car and car platform and door shall be as per IS-14665.

5.03.02 Car Frame

Lift car 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 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 frame.

5.03.03 Car Enclosure

Car shall be enclosed on all sides by means of car body and door. The sides of the car 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 inside enclosure shall be of stainless steel plate of grade SS:304 of bright finish.

Car of the elevators specified herein shall be equipped with decorated Stainless Steel hand rails on three sides. Car 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. Ventilation openings shall be provided in the enclosure walls as per requirement of IS-14665.To permit switching off of 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.

d) For vision panels and mirrors.

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

Telephone or paging facility shall be installed in the lift car. The Bidder shall provide suitable cabinets in the car to house hand sets. The Bidder shall also provide necessary wiring for telephone or paging connection from the car to a terminal box adjacent to the lift well.

The car panels shall be given final painting. The type and colour of the final painting shall be subject to the approval of the Owner/Consultant.

5.03.04 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 Annexure. The platform construction should be designed on the basis of rated loads evenly distributed.

Since, the car levelling devices will be used, substantial approns 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.

5.03.05 Car Roof

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

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.

5.04.00 **Car and Hoistway Doors**

5.04.01 Type of door

Type of car and hoistway 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 and hoistway doors shall be same and shall match that of the car.

5.04.02 Door Hangers and Tracks

Hangers and tracks for car door and each hoistway 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.

All required materials for landing entrance e.g. extruded aluminium or equivalent sills, strut angles, headers etc. shall be provided.

5.04.03 Door Operators

The door operation shall have power opening and power closing. Necessary electric type door operators shall be furnished. The car door and the hoistway door shall be mechanically connected and shall move simultaneously during opening and closing. The necessary door cushioning devices shall be furnished.

The car door and the hoistway 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.

5.05.00 **Car Self-leveling Device**

The elevator shall be equipped with automatic self-leveling devices, to bring the car to the floor landings. These self-leveling devices shall correct for overtravel and rope stretch.

5.06.00 **Car Operating Panel**

In the car, these shall be furnished, 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"; an emergency stop switch; a buzzar; an emergency call button connected to a bell to be provided by the Contractor at the bottom most landing of each elevator to serve as an emergency signal and also in the control room with an indication; 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.

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 shall be provided.

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

5.07.00 **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 is stopped at a floor. Up and down direction jewel lights shall also be provided.

5.08.00 **Push Button Station and Call-registered Tell-tale Lights at Hoistway**

5.08.01 The elevators as described in clause 3.00.00 above 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 landings 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 similar to that specified for car in clause 5.07.00 shall be provided above the entrance of all the landings.

5.08.02 The word "Fire Lift" shall be conspicuously displayed in radium paint on the lift landing doors of the elevators designated as fire lifts.

5.09.00 **Safety Shoe Device on Car Door**

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 and the hoistway door shall return to the open position. The doors shall remain open until the expiration of a pre-determined interval and then close automatically.

5.10.00 **Emergency Exit**

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.

5.11.00 **Terminal Buffers**

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.

5.12.00 **Load Plate**

A load plate giving the rated pay load of the elevator shall be fitted in the car in a conspicuous position. The rated load shall be given in kilograms and also in number of passengers.

5.13.00 **Counter-weights and Counter-weight Frames**

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 of the hoist-way.

5.14.00 **Guides for Car and Counter-weight**

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.

5.15.00 **Limit Switches**

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.

5.16.00 **Controller & Traction Machine**

5.16.01 The design ambient temperature for these equipment shall be taken as 50ºC. The insulation of motor shall be class "F" and temperature rise shall be limited to Class "B".

5.16.02 Complete details of controller and traction machine shall be furnished by the Bidder.

5.16.03 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.

5.16.04 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.

5.16.05 Necessary brakes shall be provided in the traction machine.

5.16.06 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.

5.17.00 **Lighting**

Lighting shall be provided in machine room, lift well and lift cabin.

Two (2) nos. 40 W 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.

5.18.00 **Grounding**

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. Necessary material for grounding shall be supplied by the Contractor.

5.19.00 **Other Electrical Items**

5.19.01 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.

5.19.02 All control cables shall have crimped type lugs and wire numbering ferrules at either ends.

5.19.03 For general technical requirements, Volume V of this specification shall be referred.

5.20.00 **Safety Gears**

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.

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.

5.21.00 **Overspeed Governor**

The elevator shall be equipped with overspeed 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.

5.22.00 **Brakes**

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.

5.23.00 **Rope**

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.

5.24.00 **Ringing of Stranded Lift**

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.

Alternative offer for bringing the stranded lift to the nearer floor by automatic winding arrangements may be given and price quoted separately.

5.25.00 **Lifting Attachments**

All equipment/component shall be equipped with suitable lifting attachments, e.g. lifting lugs, eye bolts etc. to facilitate erection and maintenance.

6.00.00 **INSPECTION AND TESTING**

6.01.00 The following specific test as applicable shall be carried out by the Contractor as minimum requirement for the elevators.

6.01.01 All materials used in manufacture of various components shall be of tested quality and shall conform to relevant standards/ specifications.

6.01.02 All welding shall be carried out as per welding procedures qualified as per ASME Section-IX or equivalent national / international standard. Welding procedures shall be forwarded for approval. Only qualified welders shall be employed for welding.

6.01.03 All NDT operators should be qualified as per ASNT-TC-IA.

6.01.04 Forged blanks grater than or equal to 40 mm thick and rounds grater than or equal to 50 mm dia shall be subjected to ultrasonic test to ensure free from internal defects.

6.01.05 All welds shall be subjected to dye-penetration test and visual examination.

6.01.06 All forged components shall be subjected to DPT/MPT after machining.

6.01.08 Buffer springs shall be subjected to load test as per relevant specifications. Material certificates for springs shall also be furnished.

6.01.09 Steel wire ropes shall be subjected to all the tests including material test as per relevant standard. Braking load test shall be carried out as per relevant national/international standards.

6.01.10 All components prior to assembly shall be checked for dimensions.

6.01.11 All rotating components shall be shop tested for dynamic balancing as per ISO-1940.

6.01.12 Car sling and car body in assembled condition shall be checked for position of all major components i.e. car sling inside depth, width, height and respective positions of all accessories within the same.

6.01.13 Induction Motor shall be subject to both type and routine tests in accordance with IS-325 and IS-4029. In addition, following tests shall also be carried out :

a) 20% overspeed test for 2 minutes.

b) Vibration measurement.

c) Measurement of noise level as type test.

d) Degree of protection test on motor enclosure and terminal box as per IS-4691 as type test.

6.01.14 Following items shall be tested as per relevant standard :

a) Trailing cable and copper conductors. PVC cables shall also be subjected to type, routine and acceptance tests.

b) Brake coil.

c) Relays contactors, instruments and controlling equipment.

6.01.15 The control panels, door operating panels, junction box & other metallic enclosures test shall conform to specific degree of protection.

6.01.16 Mechanical balance test and vibration levels of elevator and accessories shall be carried out.

6.01.17 Insulation, resistance test, high voltage withstand test of all wiring shall be carried out.

6.02.00 After installation of complete elevator, necessary trial run and performance tests shall be carried out by the Contractor in presence of Purchaser to

determine that equipment supplied is satisfactorily installed and commissioned.

The performance tests to be conducted shall interalia include but not limited to the following:

a) Car operates smoothly for full length of travel.

b) Car stops at each platform elevation under both loaded and unloaded conditions and alignment with floor level.

c) Car travels at specified speed when loaded at specified capacity.

d) Enclosure doors operate properly.

e) Mechanical and electrical equipment function as specified.

f) Input power at motor terminal at specified design capacity and speed

g) Working of all safety interlocks and safety features including emergency braking in case of freefall of the car

All performance tests shall be conducted by the Contractor and the procedure for conducting such tests shall be approved by Owner.

6.03.00 **Permits & Inspection**

Regarding Permits and Inspection, Bidder shall obtain and pay for necessary Municipal or State inspections and permits as required including license fees for installation and inspection of elevator equipment and also make such tests as called for by the regulations of such authorities in the presence of the Purchaser representative. Bidder shall be responsible to obtain license for operating the elevator at site. Checking and inspection by the statutory authorities and obtaining license shall be Bidder responsibilities.

7.00.00 **DRAWINGS, DATA, AND INFORMATION**

7.01.00 In addition to the Proposal Data Sheets in Volume-IX of this specification duly filled up, Bidder shall submit the following drawings/data/information for the elevator along with this offer.

7.01.01 Layout drawing showing principal dimensions of the elevator car in plan and the elevator car and shaft in elevation.

7.01.02 Layout drawing showing the location of various equipment in the elevator machine room.

7.01.03 Complete general arrangement drawing of the elevators and its support structure showing all landing levels and enclosures.

7.01.04 Electrical Control Schematics.

7.01.05 Write-up, description and illustrative pamphlets on various components of the elevator and its control, interlock and safety devices.

7.01.06 Foundation details and loading.

7.01.07 Load on elevator columns.

7.01.08 Layout of conduits, conductors, cables etc.

7.01.09 Other drawings, data sheets and literature as necessary.

7.02.00 Drawing, Data, Information to be furnished by the successful Bidder after award of contract.

7.02.01 All drawings, data and information as asked for in Clause No. 7.01.00 in finalised form for review and approval of Owner/Consultant.

7.02.02 Detailed layout drawings including foundation and structural design data for elevator shaft and elevator machine room. The data shall include braking load on guides, reaction of buffers on lift pits, reaction on support point on machine room, hoistway etc.

7.02.03 Details of block outs, embedments, inserts on RCC Works.

7.02.04 For Mandatory Spares, Spares required for erection and commissioning, Recommended Spares, Special Tools and Tackle, fixtures etc., as required for regular operation and maintenance of the equipment offered and supply of first charge of lubricating oil, inhibitor oil and also adequate quantity of the consumables, ~~please refer Technical Specification Volume II A.~~

7.02.05 Complete Electrical Control, schematic wiring diagram of power and control room.

7.02.06 Write-up explaining the sequence of operation of control circuits and elevator components when an operation button is pressed.

7.02.07 Performance and characteristics curves for motors.

7.02.08 Drawings of control panels, operating panels, position indicators, in car and hoistways, push button station and call registered tell-tale lights at hoistway. These include Electrical Control Diagram and detailed circuit diagrams and physical arrangement/location diagrams of various electrical components in the Controller in the machine room, in the hoistway, in the car, at the landing etc.

7.02.09 Detail of pit floor, landing and landing entrance, machine room floor etc.

7.02.10 Other drawings and data as necessary.

7.02.11 Reports on shop tests and test certificates.

7.02.12 Material and performance test certificates.

ANNEXURE-II

PASSENGER ELEVATORS FOR FGD CONTROL BUIDLING ~~STEAM GENERATOR, POWER HOUSE BUILDING & SERVICE BUILDING~~

1.	Type of service	Passenger type.
2.	Rated load on elevator	~~1080 Kg (minimum)~~
3.	Rated speed of lift	~~0.5 M/Sec.~~
4.	Minimum number of floors to be served	~~Steam Generator- To be decided by Bidder and shall be subjected to Purchaser's approval.~~ Power House Building- All floors in the TG building upto deaerator floor. Service Building- Various floor levels shall be finalized by APPDCL during detail engineering stage.
5.	Method of control	ACVVVF control with automatic level adjustment.
6.	Position of machine room	Directly above the lift shaft.
7.	Car enclosure construction, design and finish of car	S.S. sheet fabricated smooth finish spray painted to approved shade.
8.	Size of platform and car entrance	As per IS-14665
9.	Car and landing door	Horizontal Sliding door.
10.	Flooring	As per scope of supply ref cl. No. 2.0.1, Section IA of Technical Specification.
11.	Operation	Automatic simplex collective with and without attendant with provision for locking control in "Auto" or "Attendant" position. Key type lock switch shall be provided.
12.	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. Remote alarm and Public address system to be provided.
13.	Method of operation of car and landing doors	Power operated with automatic door opening and closing device.

As per scope of supply ref cl. No. 2.0.1, Section IA of Technical Specification.

14.	Lighting & fan	One cabin fan, two recessed fluorescent lamp fittings.
15.	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
16.	Other requirements	1. Plant Telephone Communication system shall be extended upto the elevator car through EPABX in M/C room.. 2. Suitable arrangement shall be provided to intimate unit control room during emergency in the form of audio-visual alarm. 3. Automatic rescue device. 4. If floor to floor distance between 2 floors is more than 10m, dummy landing should be provided in between these 2 floors. Dummy landing should have the connectivity with the staircase. 5. Hall Lantern & gong with scrolling indicator. 6. Scrolling indicator in car. 7. CFL lighting inside car 8. Overload sensing device & warning indicator. 9. Announcement of floor level.

ANNEXURE-III

DEGREE OF PROTECTION
FOR
VARIOUS EQUIPMENT

Sl. No.	Equipment	Degree of Protection
1	A.C. Motor	IP 54
2	Controller	IP 54
3	Hall Buttons Fixture	IP 54
4	Hall Position Indicator	IP 54
5	Car Operating Panel	IP 54
6	Car Position Indicator	IP 54
7	Safety Operating Switch (car)	IP 54
8	Junction/Inspection Box	IP 54
9	Lighting Fixture (for shaft & M/C room)	
	a) Tube Light	IP 21
	b) Bulk Head	IP 21
10	Brake	IP 21
11	Indoor Equipment (car light & fan junction box)	IP 54

SECTION-XIII

TECHNICAL SPECIFICATION

FOR

PROTECTIVE LINING AND PAINTING

C O N T E N T S

SECTION-XIII

TECHNICAL SPECIFICATION

FOR

PROTECTIVE LINING AND PAINTING

1.00.00 INTENT OF SPECIFICATION

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

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

2.00.00 CODES & STANDARDS

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

a) SSPC SP 10 / NACE 2 /	:	Near White Blast Cleaning
b) SSPC PA 2	:	Measurement of dry film Coating Thickness with magnetic gauges.
c) ASTM D 4541	:	Method for pull off strength using portable Adhesion Tester.
d) NACE RP 0274 – 2004	:	High-Voltage Electrical Inspection of Pipeline Coatings
e) NACE SP 0188 – 2006	:	Discontinuity (Holiday) Testing of New Protective Coatings on Conductive Substrates

f)	NACE RP 0169 – 2002	:	Control of External Corrosion on Underground or Submerged Metallic Piping Systems
g)	AWWA C 210 – 2007	:	Liquid-Epoxy Coating Systems for the Interior and Exterior of Steel Water Pipelines
h)	IS 3589:2001 Annexure B	:	Steel Pipes for Water and Sewage Specification.
i)	AWWA C222-2000	:	Polyurethane Coating for the Interior and Exterior of Steel Water Pipe and Fittings.
j)	IS 13213 : 2000	:	Polyurethane Full Gloss Enamel (Two pack)

3.00.00 GENERAL REQUIREMENTS

3.01.00 The steel surface preparation prior to actual commencement of coating shall conform to SSPC SP 10 / NACE 2 / Sa2½ (near white metal) with sand blasting.

3.02.00 The contractor shall submit a detailed written description in the form of a manual covering coating equipment, procedures, materials inspection test, and repair etc. to Owner/Consultant for approval.

3.03.00 The contractor shall also provide copies of test reports from NABL approved laboratory (like National Test House, Kolkata) in support of the paint/primer materials to be used shall conform to the specification requirement.

3.04.00 The contractor shall also provide certificates from paint/primer manufacturer mentioning the batch numbers, date of manufacture and shelf life etc. of the materials to be used. In addition to that Manufacturing Quality Plan (MQP) and Field Quality Plan (FQP) shall also be submitted prior to commencement of supply of material and field application.

3.05.00 Paint/coating application work at site shall be done either by paint manufacturer or by their authorized applicator. The authorized applicator shall have proper training & certification from manufacturer. Applicator shall possess all the necessary specialized equipment and manpower experienced in similar job.

3.06.00 Applied coating shall be tested for dry film thickness, holiday (electrical inspection for continuity) and adhesion as per relevant standard such as SSPC PA 2, NACE RP 0274 and ASTM D 4541.

3.07.00 If necessary, the material may be heated and applied by airless spray / plural component spray system.

3.08.00 Manufacturer's specific recommendation, if any, shall be followed during application of lining / paints.

3.09.00 In areas where there is danger of spotting automobiles or other finally finished equipment or building by wind borne particles from paint spraying, a Purchaser approved method shall be adopted.

3.10.00 The colour scheme of the entire Plant, covered under this specification shall be approved by the Purchaser in advance before application.

3.11.00 All indoor and outdoor piping, insulated as well as uninsulated will have approved colour bands painted on the pipes at conspicuous places throughout the system, as approved by Purchaser.

3.12.00 Inside surfaces of vessels / tanks shall be protected by anticorrosive paints or rubber lining as required / specified elsewhere in the specification. External surfaces of all vessels / tanks shall be protected by anti corrosive painting.

3.13.00 For vessels / tanks requiring lining and epoxy painting all inside surface shall be blast cleaned using non-siliceous abrasive after usual wire brushing.

3.14.00 Natural rubber lining shall be provided on the inside of vessels / tanks as required / specified elsewhere in the specification, in three layers resulting in a total thickness not less than 4.5 mm.

3.15.00 Surface hardness of rubber lining shall be 65 +/- 5 deg. A (shore).

3.16.00 After the lining is completed, the vessels / tanks shall not be subjected to any prolonged exposure to direct sunlight in course of its transportation, erection etc. They shall not be stored in direct sunlight. No further lining or burning shall be carried out on the vessel, after application of the lining.

3.17.00 All lining projecting outside of the vessel shall be protected adequately from mechanical damages during shipment, handling storage etc.

3.18.00 Suitable warnings, indicating the special care that must be taken with respect to these lined vessels shall be stenciled on their outside surface with the letters at least 12 mm high.

3.19.00 All insulated piping shall have aluminium sheet jacketing.

4.00.00 EQUIPMENT, MATERIAL AND SERVICES TO BE FURNISHED BY THE BIDDER

4.01.00 After erection at site, the outside surfaces of all equipment having a shop coat shall be given further priming coat and finished coats of paint as detailed in following clauses. However, if the painting system is such that the shop coat and primer coat to be applied at site are not compatible, then shop coat has to be removed from the surface of equipment before application of primer coat with prior blasting.

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

All uninsulated piping shall be finished with final paintings after use of proper wash primer and primer. Aluminium sheet jacketed piping need not be painted. Colour bands of Purchaser's approved shade shall however be applied on jacketed piping near walls or partitions, at all junctions, near valves and all other places as instructed by the Purchaser. All structures shall be painted with approved paint.

4.02.00 Surface Preparation

4.02.01 Unless mentioned otherwise, all rust and mill scale shall be removed by blasting to Sa 2-1/2 Swiss Standard before applying the primer.

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

4.02.03 The minimum degree of surface preparations for all equipment, piping, fittings, valves, structures etc. shall be "Near White" according to Steel Structure, Painting Council-SSPC-SP-10 before application of any primer/paint.

4.03.00 Painting

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

a) Surface preparation shall be done either manually or by any other approved method.

b) Primer Coat shall consist of one coat (minimum DFT of 50 microns) of chlorinated rubber based zinc phosphate.

c) Intermediate Coat (or Under Coat) shall consist of one coat (minimum DFT of 50 microns) of chlorinated rubber based paint pigmented with Titanium Dioxide.

d) Top Coat shall consist of one coat (minimum DFT of 50 microns) of chlorinated rubber paint of approved shade and colour with glossy finish.

e) Total DFT of paint system shall not be less than 150 microns.

4.03.02 Specification for application of paints for external surfaces protection of vessels / tanks / equipment / piping / fittings / valves etc to be installed **outdoor** shall be as follows :

a) Surface preparation shall be done by means of sand blasting, which shall conform to Sa 2-1/2 Swiss Standard.

b) Primer Coat shall consist of one coat (minimum DFT of 100 microns) of epoxy resin based zinc phosphate primer.

c) Intermediate Coat (or Under Coat) shall consist of one coat (minimum DFT of 100 microns) epoxy resin based paint pigmented with Titanium Dioxide.

d) Top Coat shall consist of one coat (minimum DFT of 75 microns) of epoxy paint of approved shade and colour with glossy finish. Additional one coat (minimum DFT of 25 microns) of Finish Coat of polyurethane shall be provided.

e) Total DFT of paint system shall not be less than 300 microns.

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

External surface of the pipe, fittings, specialties etc. handling raw water/clarified water/filter water shall be painted with one coat of two part chemically cured polyurethane primer of min 50 micron dry film thickness followed by three or maximum four coats of two part solvent less polyurethane to build up coating of dry film thickness of 2000 micron including primer coat.

4.03.04 Specification for application of paints for **internal surface protection of large diameter pipes** (sizes above 600 mm NB and above) if any, shall be as follows :

a) All Internal surfaces of steel pipes, fittings, specialties etc. buried underground or located within pipe trenches shall be given epoxy coating to protect them from (except for drinking water service, where the compatible painting shall be so selected to meet relevant quality standards) corrosion.

b) Internal surface of the pipe should be coated with one coat of two part epoxy primer with not less than 50 micron DFT (dry film thickness) followed by two part polyamide cured solvent less epoxy.

c) The minimum dry film thickness (DFT) of internal lining shall be 600 micron.

4.03.05 Specification for application of paints for protection of **internal surfaces of DM Water Storage Tank(s)** shall be as follows :

a) Primer - One coat of epoxy primer containing high level of Zinc Phosphate anticorrosive pigment. Total Dry Film Thickness (DFT) of primer shall not be less than 125 microns.

b) Finish Paint - Three (3) coats Polyamine HB Epoxy Paint. Total Dry Film Thickness (DFT) of finish paint shall not be less than 125 microns per coat.

c) Total thickness of primer and paint should not be less than 500 microns.

4.03.06 All motors, local push button stations, cable racks, structures used for supports etc. are to be painted with acid proof paint.

4.03.07 The following surfaces shall not be painted - stainless steel, galvanized steel, aluminum, copper, brass, bronze and other nonferrous materials.

4.03.08 No painting or filler shall be applied until all repairs, hydrostatic tests and final shop inspection are completed.

4.03.09 All machined surfaces shall have two (2) coats of water repellant grease after thorough cleaning.

5.00.00 COATING PROCEDURE AND APPLICATION

5.01.00 Surface Preparation :

Pipe shall be blast cleaned by sand. The cleanliness achieved prior to application shall be in accordance with the requirement of SSPC SP 10 / NACE 2 / Sa2½ of ISO 8501 (near white metal)

a) The blast pattern or profile depth shall be 40 to 100 micron and shall be measured by dial micrometer.

b) Before sand blasting is started or during blasting or coating, temperature of the pipe surface should be more than 3°C above dew point temperature. Blast cleaned surface should be primed within 4 hours and shall be protected from rainfall or surface moisture and shall not be allowed to flash rust. If the rust occurs, the surface again to be prepared by sand blasting or wire brushing.

5.02.00 Application of Epoxy Coating

a) Coating shall be applied when

i) When the pipe surface temperature shall be atleast 3°C above dew point temperature.
ii) The temperature of mixed coating material and the pipe at the time of application shall not be lower than 10°C or greater that 50°C.

b) Material preparation shall be in accordance with manufacturer's recommendations.

c) Application of epoxy coating system :

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

5.03.00 Application of PU Coating

a) PU coating shall be applied when the pipe surface temperature atleast 3°C above dew point temperature (when R.H is more than 85%).

b) Material preparation and application shall be done as per manufacturer recommendation.

6.00.00 TEST REQUIREMENTS :

6.01.00 Measurement of dry film thickness

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

6.01.01 Apparatus / Instrument:-

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

6.01.02 Procedures:-

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

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

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

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

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

6.02.00 Electrical Inspection (Holiday) Test

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

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

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

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

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

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

6.03.00 Adhesion Pull off Test :

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

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

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

6.03.02 Prepare the test surface :

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

6.03.03 Prepare Dolly (Test Pull Stub) :

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

6.03.04 Select an adhesive:

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

6.03.05 Attach the dolly to the surface.

a) Using a wooden stick, apply an even layer of adhesive to the entire contact surface area of the dolly.

b) Carefully remove the excessive adhesive by using a cotton swab. Allow the adhesive to fully cure before performing the adhesion test.

c) Attach the dolly to the coated surface and gently push downward to displace any excessive adhesive.

d) Push the dolly inward against the surface, then apply tape across the head of the dolly.

6.03.06 Adhesion Test Procedure

a) Attach the adhesion tester to the dolly by rotating the hand wheel counter clockwise to lower the jaw of the device.

b) Slide the jaw completely under the head of the dolly. Position the three legs of the instruments so that they are sitting flat on the coated surface.

c) Slide the dragging indicator pin on the black column to zero by pushing it downward.

d) Firmly hold the base of the instrument in one hand and rotate the handwheel clockwise to raise the jaw of the device that is attached to the head of the dolly. The dragging indicator pin will move upward on the black column as the force is increased and will hold the reading. Apply the tension using a moderate speed. Continue to increase the tension on the head of the dolly until (a) the minimum PSI/MPa/Kg/cm² required by project specification is exceeded and the test is discontinued, (b) the maximum PSI/MPa/Kg/cm² of adhesion tester has been achieved and dolly is still attached, (c) The force applied by the adhesion tester causes the dolly to dislodge.

e) Read the scale and record the adhesion value.

6.04.00 Coating Repair

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

6.04.01 Surface Preparation:

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

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

6.04.03 Coating Application :

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

6.04.04 Repair Inspection :

Repaired portion shall be electrically inspected using a holiday detector.

6.05.00 Welded Field Joints

6.05.01 Preparation :

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

6.05.02 Electrical Inspection :

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

7.00.00 INFORMATION/DATA REQUIRED

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

FUNCTIONAL/PERFORMANCE / DEMONSTRATION GUARANTEE (AS APPLICABLE)

TRIAL OPERATION, COMMISSIONING, PERFOMANCE/ 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	D	AGENCY VE	M	B	REMARKS
A. Boughtout Items :													
1	Raw materials, Round Hexagon & Structurals. Type : EN-8/EN-8D to EN-9,B and En-24	A: Chemical Composition	Major	Analysis	Sample	IS/BS : 970	IS/BS : 970	O.S.L/ T.C		V	V	V	
		B: Mechanical Properties	Major	Hardness	Sample	IS/BS : 970	IS/BS : 970	QA REG.		V	V	V	
		C: Dimensional Checks	Major	Measurement	100%	DRG.	DRG.	D.I.R/Q.C.R		V	w	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	Major	Analysis	Sample	IS-vendor DRG	AS PER DRG.	S.T.C	√	V	V	V	
		B: Mechanical Properties	Major	Hardness on traction sheave	Sample	vendor-DRG IS : 210	vendor-DRG IS : 210	S.T.C	√	V	V	V	
		C: Dimensional Checks	Major	Measurement	Sample	vendor-DRG	vendor-DRG	QA/FMT/02		-	W	-	
		D: Blow Holes	Major	Visual	100%	—	-	QA/REG		-	W	-	
4	Suppliers Item :												
	a. Manufactured Items	Dimensional Check	Major	Measurement	100%	vendor/DRG.	vendor/DRG.	D.I.R		-	W	-	
	b. Moldings Rubber Items (ABSORBER)	A: Dimensional Checks	Major	Measurement	100%	vendor-DRG.	vendor/DRG.	QA/FMT/02		-	W	-	
		B: Hardness	Major	Compression Test	Sample	vendor-DRG.	vendor-DRG.	QA/FMT/02		-	W	-	
	c. Springs (Buffer)	A: Dimensional Check	Major	Measurement	100%	vendor-DRG.	vendor-DRG.	QA/FMT/02		-	W	-	
		B: Spring Constant compression.	Major	Compression	Sample	vendor-DRG.	vendor-DRG.	S.T.C	√	V	V	V	
	d. Guide Rail.	A.Chemical Test.	Major	Analysis	Sample	vendor- DRG	vendor -DRG	S. T.C	√	V	V	V	
		B. Dimension check.	Major	Measurement	Sample	vendor-DRG.	vendor-DRG.	QA/FMT/02		V	W	V	
	e. Wire rope	A: Dimensional Check	Major	Measurement of O.D/ Const.	Sample	IS/2365 &	IS/2365 &	QA/FMT/02		-	W	-	
		B: Mechanical Properties.	Major	Measurement	Correlate S.T.C	IS : 2266	IS : 2266	S.T.C	√	V	V	V	

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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 ,	Major	Electrical	Sampling	IS - 694	IS - 694	S.T.C	√	V	V	V	
		b- Insulation resistance.	do	do	do	do	do	do	√	V	V	V	
5	Raw material for motor. (1) Enameled wire.												
		a) Dimension Check	Major	Measurement	Sample	vendor -STD	vendor -STD	D.I.R		V	W	V	
		b) High voltage test	Major	Elect.	One Sample each roll	IS:4800	IS:4800	D.I.R		V	W	V	
	(2) Copper base (Flat)	Chemical check	Major	Analysis	Sample	Cu=min 99.5%	Cu=min 99.5%	O.S.L / T.C		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	Major	Measurement	100%	vendor-DRG.	vendor-DRG.	QA/FMT/01		-	W	-	
		B: Crack detection Motor bodies	Major	D.P. Test	100%	vendor-STD.	vendor-STD.	-		-	W	-	
		C: Surface check	Major	Visual	100%	vendor-STD.	vendor-STD.	-		-	W	-	
2	Fabrication Shop :	Dimensional Checks of critical items	Major	Measurement	100%	vendor-DRG.	vendor-DRG.	Q.C.R		-	W	-	
		Welding	minor	Visual	Sampling	do	do	.		.	W	.	Welding by approved welder
C. Assembly Inspection.		A- Back lash of gears& Maching	Major	Measurement	100%	vendor	vendor	QA/FMT/11		V	W	-	
1	Winding gear.	contact.				INSP NORMS	INSP NORMS						
		B- Vibration .	Major	Measurement	100%	vendor	vendor	do		V	W	-	
						INSP NORMS	INSP NORMS						
		C- Noise level.	Major	Measurement	100%	vendor	vendor	do		V	W	-	
						INSP NORMS	INSP NORMS						
		D- Visual .	Oil leckage	Visual	100%	vendor	vendor	do		V	W	-	
						INSP NORMS	INSP NORMS						

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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	CHARATERISTICS	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.	Major	High Volt. Test	100%	I S :325-96 1.5 KV for 5 SEC	I S :325-96 1.5 KV for 5 SEC.	D.I.R QA/FMT/13		V	W	V	
		B-Insulation Resistance	Major	Measurement	100%	> 10 mega ohms	> 10 mega ohms	Test report		V	W	V	
		C-Motor testing for elect. Pmt.	Major	Elect.	100%	IS : 325	IS : 325	Test report		V	W	V	
		D-Vibration measurement & noise lev	Major	Measurement	100%	vendor - Norms	vendor -Norms	Test report		V	W	.	
3	Speed Governor Assembly :	Tripping speed Easy Run test	Major	Function Check	100%	I S : 9878 LCH -112	I S : 9878 LCH - 112	T.C IN Pant.		V	W	V	
4	Controller Assembly / VVVF Unit.	1. Visual Inspection	Major	Visual	100%	vendor Norms	vendor Norms	T.C		V	W	V	
		2. Electrical Checks (Routine Test).	do	Electrical	100%	do	do	do		V	W	V	
		3. Functional Checks	do	Function	100%	do	do	do		V	W	V	
		4. Pretreatment in seven tank for sheet & paint thickness.	Major	Measurement + Visual	Sampling	do	do	vendor - FMT.		V	W	V	

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CONTRACTOR SIGN AND SEAL.

NAME & SIGN OF APPROVING AUTHIRITY & SEAL.

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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	
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	

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ANNEXURES

ANNEXURE-I
LIST OF MAKES

SR. NO.	ITEM	SUPPLIERS	PLACE	REMARKS
1.	WIRE ROPES	USHA MARTIN	RANCHI	
		BHARAT WIRE ROPE	MUMBAI.	
2.	TRAILING CABLE	GEBAUR & 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	-	
		OEM	-	
6.	STAINLESS STEEL	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 TELEMECHANIQUE	-	

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.

ANNEXURE-II
List of Mandatory Spares for Elevators

NIL

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)		

ANNEXURE-IV

Drawing document submission schedule

S.N0.	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).

ANNEXURE-V

MDL FOR ELEVATOR

SL. NO.	BHEL DOC NO.	TITLE	APP. CAT
1	PE-V0-439-502-A103	GAD OF FGD CONTROL BUILDING ELEVATOR	A
2	PE-V0-439-502-A104	DATA SHEET FOR FGD CONTROL BUILDING ELEVATOR	A
3	PE-V0-439-502-A105	MQP OF FGD CONTROL BUILDING ELEVATOR	A
4	PE-V0-439-502-A106	O & M MANUAL FOR FGD CONTROL BUILDING ELEVATOR	I
5	PE-V0-439-502-A107	WIRING DIAGRAM & POWER DISTRIBUTION SCHEMATIC FOR FGD CONTROL BUILDING	I

A= APPROVAL
I= INFORMATION

CIVIL INPUT DETAILS

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

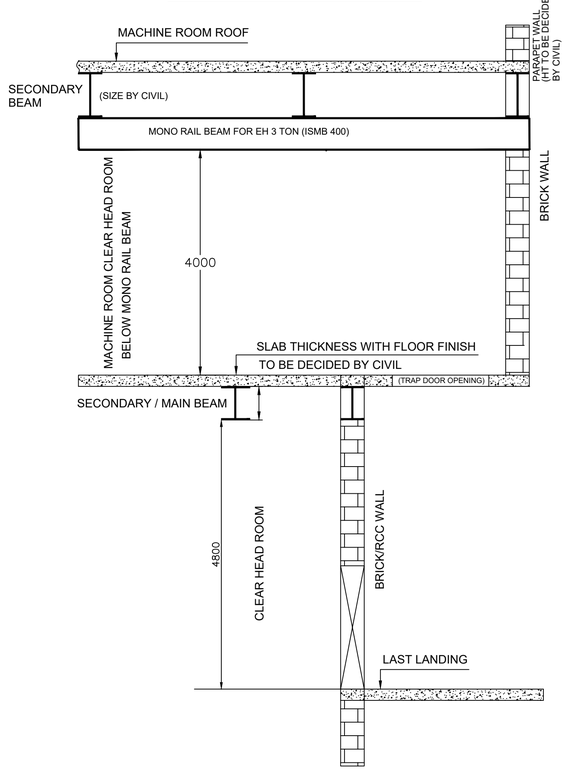
FIRST ANGLE PROJECTION

ALL DIMENSIONS ARE IN MM

DRAWING No.

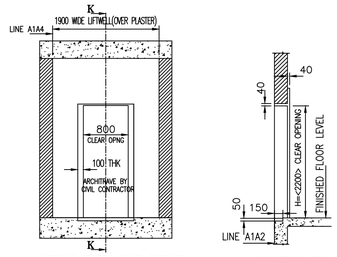
CUSTOMER'S DRAWING No.

ELEVATION ON MACHINE ROOM



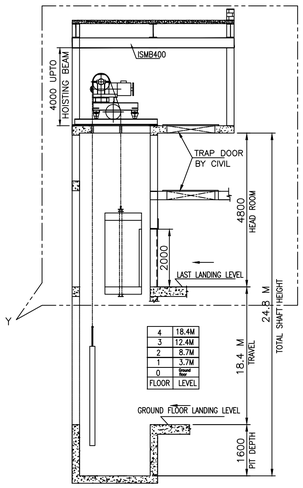
DETAIL–Y

STANDARD DETAILS OF SHAFT



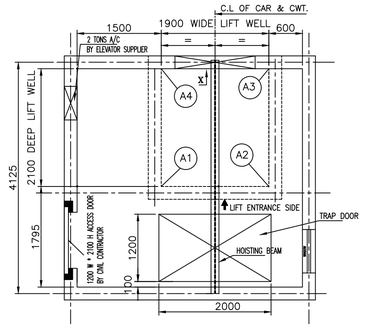
LANDING ENTRANCE DETAIL
(VIEW FROM LIFT WELL OUTSIDE)
(TYPICAL FOR ALL FLOORS)

SECTION–KK

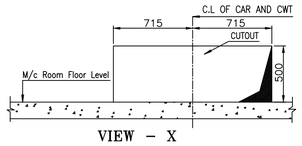


ELEVATIONAL DETAILS
(NOT FOR SCALE)

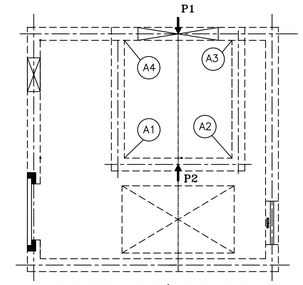
STANDARD DETAILS OF MACHINE ROOM



PLAN ON MACHINE ROOM

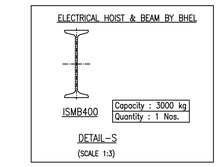


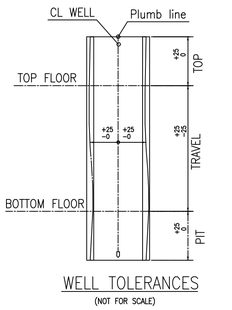
VIEW – X



LOAD POSITION ON M/C ROOM PLAN

Point	Dynamic Load (Kg)
P1	15000
P2	6000





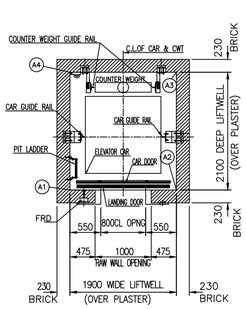
WELL TOLERANCES

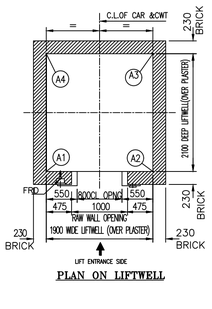
(NOT FOR SCALE)

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 BHEL 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 LANDING/S, ARE REQUIRED IN CASE TRAVEL BETWEEN TWO CONSECUTIVE LANDINGS IS MORE THAN 10 M, AS PER CODAL REQUIREMENT. HENCE, CORRESPONDING LANDING PLATFORMS & SUITABLE ACCESS LADDER/ STAIRS FOR DUMMY LANDING PLATFORMS ARE ALSO TO BE PROVIDE 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 MAINTAINENCE.	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

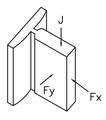
STANDARD DETAILS OF PIT





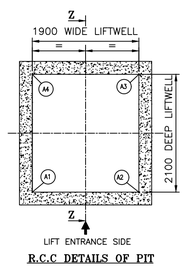
PLAN ON LIFTWELL

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

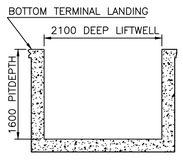


GUIDE RAIL FORCES

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



R.C.C DETAILS OF PIT



SECTION ZZ

CUSTOMER:	TELANGANA STATE POWER GENERATION CORP. LTD.
CONSULTANT:	----
PROJECT:	1 X 800 MW KOTHAGUDEM TPP FGD

BHARAT HEAVY ELECTRICALS LTD
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NOIDA

JOB NO.	439
STATUS	CONTRACT
DISTRIBUTION	

DEPT CODE	NAME	SIGN	DATE
DRN.			
DESN	BS		23.09.22
CHD	PKK		23.09.22
APPD	GB		23.09.22

REV.	DATE	ALTD	CHD	APPD

TITLE: ENGG. INPUTS DRAWING FOR 10 PASS. (680KG) ELEVATOR-FGD CONTROL BUILDING

DEPT. | SCALE | SIGN

DRAWING NO. PE-DG-439-502-A001

SHEET 01 OF 01 | REV. 00

SIZE–A0

COMPUTER FILE NAME:

SECTION – I

SPECIFIC TECHNICAL REQUIREMENTS

IB – Specific Technical Requirement (Electrical)

SECTION- C3

TECHNICAL SPECIFICATION
(Electrical Portion)

CONTENTS

SPECIFIC TECHNICAL REQUIREMENTS: ELECTRICAL

1.0 EQUIPMENT & SERVICES TO BE PROVIDED BY BIDDER:

a) Services and equipment as per "Electrical Scope between BHEL and Vendor".
b) Any item/work either supply of equipment or erection material which have not been specifically mentioned but are necessary to complete the work for trouble free and efficient operation of the plant shall be deemed to be included within the scope of this specification. The same shall be provided by the bidder without any extra charge.
c) Supply of mandatory spares as specified in the specifications of mechanical equipments.
d) Electrical load requirement for 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.

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

Refer "Electrical Scope between BHEL and Vendor".

3.0 DOCUMENTS TO BE SUBMITTED ALONG WITH BID

3.1 The electrical specification without any deviation from the technical/quality assurance requirements stipulated shall be deemed to be complied by the bidder in case bidder furnishes the overall compliance of package technical specification in the form of compliance certificate/No deviation certificate.

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

4.0 List of enclosures :

a) Electrical scope between BHEL & vendor (Annexure –I)
b) Technical specification for motors.
c) Datasheets & quality plan for motors.
d) Electrical Load data format (Annexure –II)
e) BHEL cable listing format (Annexure –III)
f) Electrical mandatory spares (As per spec.)

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

PACKAGE: ELEVATORS

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

PROJECT : 1X800 MW KOTHAGUDEM FGD

S. NO	DETAILS	SCOPE SUPPLY	SCOPE E&C	REMARKS
1	Isolating Switch	Vendor	Vendor	BHEL will provide two number 415 V(3ph, 3W) 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	1. Double compression Ni-Cr plated brass cable glands 2. Solder less crimping type heavy duty tinned copper lugs for power & control cables.
7	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.

LOAD TITLE	RATING (KW / A)		UNIT (U)/STN (S)	Nos.		VOLTAGE CODE*	FEEDER CODE**	EMER. LOAD (Y)	CONT.(C)/ INTT.(I)	STARTING TIME >5 SEC (Y)	LOCATION	BOARD NO.	CABLE		BLOCK CABLE DRG. No.	CONTROL CODE	REMARKS	LOAD No.	VERIFICATION FROM MOTOR DATASHEET (Y/N)	KKS NO
	NAME PLATE	MAX. CONT. DEMAND (MCR)		RUNNING	STANDBY								SIZE CODE	NOs						
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
ANNEXURE-II																				

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NOTES: 1. COLUMN 1 TO 12 & 18 SHALL BE FILLED BY THE REQUISITIONER (ORIGINATING AGENCY); REMAINING COLUMNS ARE TO BE FILLED UP BY PEM (ELECTRICAL)/ CUSTOMER

2. ABBREVIATIONS : * VOLTAGE CODE (7):- (ac) A=11 KV, B=6.6 KV, C=3.3 KV, D=415 V, E=240 V (1 PH), F=110 V (cc): G=220 V, H=110 V, J=48 V, K=+24V, L=-24 V

: ** FEEDER CODE (8):- U=UNIDIRECTIONAL STARTER, B=BI-DIRECTIONAL STARTER, S=SUPPLY FEEDER, D=SUPPLY FEEDER (CONTACTER CONTROLLED)

LOAD DATA (ELECTRICAL)					
JOB NO.	415	ORIGINATING AGENCY		PEM (ELECTRICAL)	
PROJECT TITLE	1X800 MW KOTHAGUDEM FGD	NAME		DATA FILLED UP ON	
SYSTEM	Elevators	SIGN.		DATA ENTERED ON	
DEPTT. / SECTION	MAUX	SHEET 1 OF 1	REV. 00	DE'S SIGN. & DATE	

1.0	Design ambient temperature	:	50 °C
2.0	Maximum acceptable kW rating of LV motor	:	<175 KW
3.0	Installation (Indoors/ Outdoors)	:	As required
4.0	Degree Of Protection	:	IP55 - Outdoor IP54 – Indoor
5.0	Details of supply system		
	a) Rated voltage (with variation)	:	415V ± 10%
	b) Rated frequency (with variation)	:	50 Hz (Variation: +3% TO –5%)
	c) Combined voltage & freq. variation	:	10% (sum of absolute values)
	d) System fault level at rated voltage	:	25 kA for 1 sec
	e) Short time rating for terminal box	:	25 kA for 0.25 sec
	f) LV System grounding	:	Solidly
6.0	Class of insulation	:	Class ‘F’,with temp rise limited to class B.
7.0	Minimum voltage for starting (As percentage of rated voltage)	:	85% of rated voltage
8.0	Power cables data	:	Shall be given during Detailed engg.
9.0	Earth Conductor Size & Material	:	Shall be given during Detailed engg.
10.0	Space heater supply (30KW & ABOVE)	:	240 V, 1Φ , 50 Hz
11.0	Rating up to which Single phase motor	:	Acceptable below 0.20 Kw
12.0	TYPE OF STARTER PROVIDED IN MCC	:	DOL
13.0	Locked rotor current		
	a) Limit as percentage of FLC	:	600%
	b) Permissible tolerance, if any	:	±20%
14.0	Additional tests	:	As per QP
15.0	Flame-proof motor		
	a) Enclosure suitable (As per IS:2148)	:	As per requirement
	b) Classification of Hazardous area (As per IS: 5572 part-I)	:	As per requirement
	c) Degree of protection	:	IP65
16.0	Makes	:	AS PER ANNUXURE-I
17.0	Terminal box	:	Suitable to rotate at 90 degrees
18.0	Paint shade	:	Shade 631 of IS-5

All LT motors shall be controlled as follows:
a) Up to 110kW: - Contactor operated.
b) 110Kw to 175kW shall have ACB.

19.0	Energy efficiency	:	IE3 as per IS:12615: (Latest Amendment)

S. No.	Description	Data to be filled by successful bidder
A.	**General**	
1	Manufacturer & country of origin	
2	Motor type	
3	Type of starting	
4	Name of the equipment driven by motor & Quantity	
5	Maximum Power requirement of driven equipment	
6	Rated speed of Driven Equipment	
7	Design ambient temperature	
B.	**Design and Performance Data**	
1	Frame size & type designation	
2	Type of duty	
3	Rated Voltage	
4	Permissible variation for	
5	a) Voltage	
6	b) Frequency	
7	c) Combined voltage & frequency	
8	Rated output at design ambient temp (by resistance method)	
9	Synchronous speed & Rated slip	
10	Minimum permissible starting voltage	
11	Starting time in sec with mechanism coupled	
12	a) At rated voltage	
13	b) At min starting voltage	
14	Locked rotor current as percentage of FLC (including IS tolerance)	
15	Torque	
	a) Starting	
	b) Maximum	
16	Permissible temp rise at rated output over ambient temp & method	
17	Noise level at 1.0 m (dB	
18	Amplitude of vibration	
19	Efficiency & P.F. at rated voltage & frequency	
	a) At 100% load	
	c) At 75% load	

S. No.	Description		Data to be filled by successful bidder
	c) At starting		
C.	**Constructional Features**		
1	Method of connection of motor driven equipment		
2	Applicable Standard		
3	DOP of Enclosure		
4	Method of cooling		
5	Class of insulation		
6	Main terminal box		
	a) Type		
	b) Power Cable details (Conductor, size, armour/unarmour)		
	c) Cable Gland & lugs details (Size, type & material)		
	d) Permissible Fault level (kArms & duration in sec)		
7	Space heater details (Voltage & watts)		
8	Flame proof motor details (if applicable)		
	a) Enclosure		
	b) suitability for hazardous area		
	i	Zone	O / I / II
	ii	Group	IIA / IIB / IIC
9	No. of Stator winding		
10	Winding connection		
11	Kind of rotor winding		
12	Kind of bearings		
13	Direction of rotation when viewed from NDE		
14	Paint Shade & type		
15	Net weight of motor		
16	Outline mounting drawing No (To be enclosed as annexure)		
D.	**Characteristic curves/ drawings** (To be enclosed for motors of rating ≥ 55KW)		
	a) Torque speed characteristic		
	b) Thermal withstand characteristic		
	c) Current vs time		
	d) Speed vs time		

CABLE SCHEDULE FORMAT

ANNEXURE III

UNITCABLENO	FROM	TO	PURPOSE	CABLE SCOPE (BHEL PEM/ VENDOR)	REMARKS	CABLESIZE	PATHCABLENO	TENTATIVE CABLE LENGTH

Explanatory notes for filling up cable list for routing through WinPath, the cable routing program (developed by Corporate R&D) being used in PEM.

1. For the purpose of clarity, it may please be noted that the information given in regard to the cables to be routed through WinPath as per the system elaborated below is called "Cable List", while the term "Cable Schedule" applies to the cable list with routing information added after routing has been carried out.
2. The cable list shall be entered as an MS Excel file in the format as per enclosed template EXT_CAB_SCH_FORMAT.XLS. No blank lines, special characters, header, footer, lines, etc. shall be introduced in the file. No changes shall be made in the title line (first line) of the template.
3. The field properties shall be as under:
    a. UNITCABLENO: A/N, up to sixteen (16) characters; each cable shall have its own unique, unduplicated cable number. In case this rule is violated, the cable cannot be taken up for routing.
    b. FROM: A/N, up to sixty (60) characters; the "From" end equipment/ device description and location to be specified here. Information in excess of 60 characters will be truncated after 60 characters.
    c. TO: A/N, up to sixty (60) characters; the "To" end equipment/ device description and location to be specified here. Information in excess of 60 characters will be truncated after 60 characters.
    d. PURPOSE: A/N, up to sixty (60) characters; the purpose (i.e. power cable/ indication/ measurement, etc.) to be specified here. Information in excess of 60 characters will be truncated after 60 characters.
    e. REMARKS: A/N, up to forty (40) characters; Any information pertinent to routing to be specified here (e.g., cable number of the cable redundant to the cable number being entered). Information in excess of 40 characters will be truncated after 40 characters.
    f. CABLESIZE: A/N, 7 characters exactly as per the codes indicated below shall be specified here. The program cannot route cables described in any other way/ format.
    g. PATHCABLENO: Field reserved for utilization by the program. User shall not enter any information here.
4. One list shall be prepared for each system/ equipment (i.e., separate and unique cable lists shall be prepared for each system).
5. The cables shall be described as per the scheme listed below:

A	NN	A	NNN
|	|	|	|
Cable Voltage Code (see B below)	No. of cores (e.g. 01,03,3H, 07)	Cable code (See C below)	Cable size (e.g. 035,185,2.5, 0.5)

(A) SYSTEM VOLTAGE CODES:
(ac) A = 11KV, B = 6.6KV, C = 3.3KV, D = 415V, E = 240V, F = 110V
(dc) G = 220V, H = 110V, J = 48V, K = +24V, L = -24V

(B) CABLE VOLTAGE CODES:
A = 11KV (Power cables)

Explanatory notes for filling up cable list for routing through WinPath, the cable routing program (developed by Corporate R&D) being used in PEM.

B = 6.6KV (Power cables)
C = 3.3KV (Power cables)
D = 1.1KV (LV & DC system power & control cables)
E = 0.6KV (0.5 sq. mm. Control cables)

(C) CABLE CODES

PVC Copper

A = Armoured FRLS	B = Armoured Non-FRLS
C = unarmoured FRLS	D = Unarmoured Non-FRLS

PVC Aluminium

E = Armoured FRLS	F = Armoured Non-FRLS
G = unarmoured FRLS	H = Unarmoured Non-FRLS

XLPE Copper

J = Armoured FRLS	K = Armoured Non-FRLS
L = unarmoured FRLS	M = Unarmoured Non-FRLS

XLPE Aluminium

N = Armoured FRLS	P = Armoured Non-FRLS
Q = unarmoured FRLS	R = Unarmoured Non-FRLS

S = FIRE SURVIVAL CABLES
T = TOUGH RUBBER SHEATH
U = OVERALL SCREENED
V = PAIRED OVERALL SCREENED
W = PAIRED INDIVIDUAL SCREENED
Y = COMPENSATING CABLES
I = PRE-FABRICATED CABLES
Z = JELLY FILLED CABLES

MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	STANDARD QUALITY PLAN		SPEC. NO :	DATE:
	CUSTOMER :		QP NO.: PE-QP-999-Q-006, REV-02	DATE: 17.04.2020
	PROJECT:		PO NO.:	DATE:
	ITEM: AC ELECT. MOTORS UPTO 55KW (LV (415V))	SYSTEM:	SECTION: II	SHEET 1 of 2

S. NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD		AGENCY			REMARKS
1	2	3	4	5	6		7	8	9	*	**			
					M	C/ N				D	M	C	N	
1.0	ASSEMBLY	1.WORKMANSHIP	MA	VISUAL	100%	-	MFG. SPEC.	MFG. SPEC.	LOG BOOK		P	-	-	
		2.DIMENSIONS	MA	VISUAL	100%	-	MFG. DRG./ MFG. SPEC.	MFG. DRG./ MFG. SPEC.	LOG BOOK		P	-	-	
		3.CORRECTNESS COMPLETENESS TERMINATIONS/ MARKING/ COLOUR CODE	MA	VISUAL	100%	-	MFG.SPEC./	MFG.SPEC.	LOG BOOK		P	-	-	
2.0	PAINTING	1.SHADE	MA	VISUAL	SAMPLE	-	MFG. SPEC/ APPROVED DATASHEET	MFG. SPEC/ APPROVED DATASHEET	LOG BOOK	✓	P	V	-	
3.0	TESTS	1.ROUTINE TEST INCLUDING SPECIAL TEST	MA	VISUAL	100%	-	IS-325 / IS-12615/ APPROVED DATA SHEET	IS-325 / IS-12615/ APPROVED DATA SHEET	TEST/ INSPN. REPORT	✓	P	V *	-	* NOTE -1
		2.OVERALL DIMENSIONS & ORIENTATION	MA	MEASUREMENT & VISUAL	100%	-	APPROVED DRG/ DATA SHEET	APPROVED DRG/ DATA SHEET	TEST/ INSPN. REPORT	✓	P	V *	-	* NOTE -1 & NOTE-2

BHEL					
ENGINEERING			QUALITY		
	Sign & Date	Name		Sign & Date	Name
Prepared by:		HEMA KUSHWAHA	Checked by:		KUNAL GANDHI
Reviewed by:		PRAVEEN DUTTA	Reviewed by:		RITESH KUMAR JAISWAL

BIDDER/ SUPPLIER	
Sign & Date	
Seal	

FOR CUSTOMER REVIEW & APPROVAL			
Doc No:			
	Sign & Date	Name	Seal
Reviewed by:			
Approved by:			

	MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	STANDARD QUALITY PLAN		SPEC. NO :	DATE:
		CUSTOMER :		QP NO.: PE-QP-999-Q-006, REV-02	DATE: 17.04.2020
		PROJECT:		PO NO.:	DATE:
		ITEM: AC ELECT. MOTORS UPTO 55KW (LV (415V))	SYSTEM:	SECTION: II	SHEET 2 of 2

		3.NAMEPLATE DETAILS	MA	VISUAL	100%	-	IS-325 / IS-12615 / APPROVED DATA SHEET	SAME AS COL. 7	TEST/ INSPN. REPORT	✓	P	V	-	
4.0	PACKING	SURFACE FINISH & COMPLETENESS	MA	VISUAL	100%	100%	AS PER MFG. STANDARD / (#)	AS PER MFG. STANDARD / (#).	INSPC. REPORT	✓	P	W	-	(#) REFER NOTE-8

NOTES:
1. Routine tests on 100% motors shall be done by the vendor. However, BHEL/ Customer shall witness routine tests on random samples. The sampling plan shall be mutually agreed upon.
2. For exhaust/ventilation fan motors of rating up to 1.5 KW, only routine test certificates shall be furnished for scrutiny.
3. In case test certificates for these tests on similar type, size and design of motor from independent laboratory are available, the same is valid for 5 years.
4. BHEL reserves the right to perform repeat test, if required.
5. After packing and prior to issue MDCC, photographs of items to be despatched shall be sent to BHEL for review.
6. In case of any changes in QP commented by customer at contract stage, same shall be carried out by bidder without any implication to BHEL/ Customer.
7. Project specific QP to be developed based on customer requirement.
8. For export job, BHEL technical specification for seaworthy packing to be followed.
9. Packing shall be suitable for storage at site in tropical climate conditions.
10. Latest revision/ year of issue of all the standards (IS/ ASME/ IEC etc.) indicated in QP shall be referred.

LEGENDS:

*RECORDS, INDENTIFIED WITH "TICK"(√) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION,
** **M**: SUPPLIER/ MANUFACTURER/ SUB-SUPPLIER, B: MAIN SUPPLIER/ BHEL/ THIRD PARTY INSPECTION AGENCY, **C**: CUSTOMER,
P: PERFORM, **W**: WITNESS, **V:** VERIFICATION, AS APPROPRIATE
MA: MAJOR, **MI**: MINOR**, CR:** CRITICAL
D: DOCUMENTATION

BHEL					
ENGINEERING			QUALITY		
	Sign & Date	Name		Sign & Date	Name
Prepared by:		HEMA KUSHWAHA	Checked by:		KUNAL GANDHI
Reviewed by:		PRAVEEN DUTTA	Reviewed by:		RITESH KUMAR JAISWAL

BIDDER/ SUPPLIER	
Sign & Date	
Seal	

FOR CUSTOMER REVIEW & APPROVAL			
Doc No:			
	Sign & Date	Name	Seal
Reviewed by:			
Approved by:			

VOLUME: V-A

SECTION-II

TECHNICAL SPECIFICATION FOR A.C. & D.C. MOTORS

CONTENT

VOLUME: V-A

SECTION-II

TECHNICAL SPECIFICATION FOR A.C. & D.C. MOTORS

1.00.00 **SCOPE**

1.01.00 This section covers the general requirements of the drive motors for power station auxiliary equipment.

1.02.00 Motors shall be furnished in accordance with both this general specification and the accompanying driven equipment specification.

1.03.00 In case of any discrepancy, the driven equipment specification shall govern.

2.00.00 **CODES & STANDARDS**

2.01.00 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.

2.02.00 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:

i) IS-325

ii) IS-12615

iii) IEC-60034

3.00.00 **SERVICE CONDITIONS**

3.01.00 The motors will be installed in hot, humid and tropical atmosphere highly polluted at places with coal dust and/or fly ash.

3.02.00 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.

3.03.00 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.

4.00.00 **TYPE AND RATING**

4.01.00 **A.C. Motors**

4.01.01 Motors shall be general purpose, constant speed, squirrel cage, three/single phase, induction type.

4.01.02 All motors shall be rated for continuous duty. They shall also be suitable for long period of inactivity.

4.01.03 LT motor & HT motor name-plate rating at 50°C shall have at least 15% margin and 10% margin respectively over the input power requirement of the driven equipment at rated duty point unless stated otherwise in driven equipment specification.

4.01.04 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.

4.01.05 Motors efficiency class shall be ~~IE1, IE2 as per latest version of IEC 60034~~ IE3 as per IS:12615: (Latest Amendment).

4.02.00 **D.C. Motors**

4.02.01 D.C. motor provided for emergency service shall be shunt/compound wound type.

4.02.02 Motor shall be sized for operation with fixed resistance starter for maximum reliability.

Starter panel complete with all accessories shall be included in the scope of supply.

5.00.00 **PERFORMANCE**

5.01.00 **Running Requirements**

5.01.01 Motor shall run continuously at rated output over the entire range of voltage and frequency variations as given in the annexure.

5.01.02 The motor shall be capable of operating satisfactorily at full load for 5 minutes without injurious heating with 75% rated voltage at motor terminals.

5.01.03 The motor shall be designed to withstand momentary overload of 60% of full load torque for 15 second without any damage.

5.02.00 **Starting Requirements**

Motor shall be designed for direct online starting at full voltage. Breakaway starting current as percentage of full load current for various motor rating shall not exceed the given below-

Motors up to 1500kW	-	600% subject to IS tolerance of plus 20%.
Motors above 1500kW	-	450% not subject to any positive tolerance.

5.02.01 The motor shall be capable of withstanding the stresses imposed if started at 110% rated voltage.

5.02.02 Motor shall start with rated load and accelerate to full speed with 80% rated voltage at motor terminals except mill motor. Mill motor shall start with rated load and accelerate to full speed at 85% of the rated voltage at the motor terminals.

5.02.03 a) Two hot starts in succession with motor initially at normal running temperature.

b) 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.

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

5.03.00 **Stress During Bus Transfer**

5.03.01 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.

5.03.02 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.

5.04.00 **Locked Rotor Withstand Time**

5.04.01 The locked rotor withstand time under hot condition at 110% rated voltage shall be more than motor starting time by at least 3 seconds for motors up to 20 seconds starting time and by 5 seconds for motor with more than 20 seconds starting time.

5.04.02 Starting time mentioned above is at minimum permissible voltage of 80% rated voltage.

5.04.03 Hot thermal withstand curve shall have a margin of at least 10% over the full load current of the motor to permit relay setting utilising motor rated capacity.

6.00.00 **SPECIFIC REQUIREMENTS**

6.01.00 **Enclosure**

6.01.01 All motor enclosures for outdoor, semi-outdoor & indoor application shall conform to the degree of protection IP-55 unless otherwise specified. Motor for outdoor or semi-outdoor service shall be of weather-proof construction with canopy.

6.01.02 For hazardous area approved type of increased safety enclosure shall be furnished.

6.02.00 **Cooling**

6.02.01 The motor shall be self ventilated type, either totally enclosed fan cooled IC 411(TEFC), totally enclosed tube ventilated IC 511(TETV) or closed air circuit air- cooled IC 611(CACA).

6.02.02 For large capacity motors not available with above type of cooling may be accepted with IC 81W or IC 91W, closed air circuit water cooled (CACW) subject to the approval of the owner.

6.03.00 **Winding and Insulation**

6.03.01 All insulated winding shall be of copper.

6.03.02 All motors shall have class F insulation but limited to class B temperature rise.

6.03.03 Windings shall be impregnated to make them non-hygroscopic and oil resistant.

6.04.00 **Tropical Protection**

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

6.04.02 All fittings and hardwares shall be corrosion resistant.

6.05.00 **Bearings**

6.05.01 Motor shall be provided with antifriction bearings, unless sleeve bearings are required by the motor application. Bearings shall be rated for minimum service life of 40,000Hrs.

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

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

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

6.05.05 Grease lubricated bearings shall be pre-lubricated and shall have provisions for in-service positive lubrication with drains to guard against over lubrication. LT motors 15kW and above shall be provided with external greasing arrangement.

6.05.06 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.

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

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

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

6.06.00 **Noise & Vibration**

6.06.01 All HT motors shall be provided with vibration pads for mounting of vibration detectors. Vibration monitoring devices shall be provided on DE and NDE side in x&y direction with remote DCS monitoring, alarm and tripping.

6.06.02 The maximum double amplitude vibrations for HT motors upto 1500 rpm shall be 25 microns and 15 microns upto 3000 rpm. For 415V motors, maximum double amplitude vibrations upto 1500 rpm shall be 40 microns and 15 microns upto 3000 rpm.

6.06.03 The noise level shall not exceed 85db (A) at 1.5 meters from the motor.

6.07.00 **Motor Terminal Box**

6.07.01 Motor terminal box shall be detachable type and located in accordance with Indian Standards clearing the motor base- plate/ foundation

6.07.02 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.

6.07.03 The terminal box shall be split type with removable cover with access to connections and shall have the same degree of protection as motor.

6.07.04 The terminal box shall have sufficient space inside for termination/connection of XLPE insulated armoured aluminium cables.

6.07.05 Terminals shall be stud or lead wire type, substantially constructed and thoroughly insulated from the frame.

6.07.06 The terminals shall be clearly identified by phase markings, with corresponding direction of rotation marked on the non-driving end of the motor.

6.07.07 The terminal box shall be capable of withstanding maximum system fault current for a duration of 0.25 sec.

6.07.08 For 11000V and 3300V 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.

6.07.09 Motor terminal box shall be furnished with suitable cable lugs and double compression brass glands to match with cable used.

6.07.10 The gland plate for single core cable shall be non-magnetic type.

6.07.11 Minimum clearances to be provided between phase to phase and phase to earth shall be as under-

Voltage Rating of Motor		Minimum Ph-Ph & Ph-Earth clearance
0.415 kV	:	25 mm
3.3 kV	:	65 mm
11.0 kV	:	140 mm

Note: In case it is not possible to maintain these clearances, the live parts shall be totally insulated from earth and other Phases. Adequate clearances shall be provided for cable connections.

6.08.00 **Grounding**

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

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

Rating			Conductor Size
Above	Up to		
-------	5.5 kW	:	8 SWG GI Wires.
5.5 kW	22 kW	:	25mm X 4mm GS Flat.
23 kW	55 kW	:	40mm X 6mm GS Flat.
56kW	174kW	:	50mm X 8mm GS Flat.
175kW	ABOVE	:	75mm X 10mm GS Flat.

6.08.03 The cable terminal box shall have a separate grounding pad.

6.09.00 **Minimum Cable Size for LT & HT Motors shall as be as follows-**

a) For 415V, 3-Ph, LT Motors-

Rating		:	Cable Size
Above	Up to		
-------	5.5 kW	:	1R X 3C X 6 Sq.mm
5.5 kW	11 kW	:	1R X 3C X 10 Sq.mm
11 kW	22 kW	:	1R X 3C X 35 Sq.mm
22 kW	37.5 kW	:	1R X 3C X 70 Sq.mm.
37.5kW	55 kW	:	1R X 3C X 150 Sq.mm
55 kW	75 kW	:	1R X 3C X 300 Sq.mm
75 kW	110kW	:	2R X 3C X 150 Sq.mm
110 kW	175kW	:	2R X 3C X 300 Sq.mm

b) For 3.3kV & 11kV, 3-Ph, HT Motors-

Rating		:	Cable Size
Above	Up to		

175 kW	1000 kW	:	1R X 3C X 240 Sq.mm
1000 kW	2000 kW	:	2R X 3C X 240 Sq.mm
2000 kW	4500 kW	:	2R X 3C X 300 Sq.mm
4501 kW	10,000 kW	:	9R X 1C X 1000 Sq.mm.

Note: During detail engineering if higher cable size is required same shall be provided.

6.10.00 **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.

c) Bearing identification no. and recommended lubricant.

d) Location of insulated bearings.

7.00.00 **ACCESSORIES**

7.01.00 **General**

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

7.02.00 **Space Heater**

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

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

7.02.03 Minimum Cable Size for space heater shall be as listed-

i) For LT motors: 2.5 sq.mm, 2-Core copper cable complying with IS-1554(Part-1).

ii) For HT motors: 6 sq.mm, 2 Core aluminium cable complying with IS-1554(Part-1).

7.03.00 **Temperature Detectors**

7.03.01 All 11000V and 3300V motors shall be provided with twelve (12) nos. simplex type winding temperature detectors, four (4) nos. per phase.

7.03.02 11000V and 3300V motor bearing shall be provided with duplex type temperature detectors.

7.03.03 The temperature detector mentioned above shall be resistance type, 3 wire, platinum wound, 100 Ohms at 0°C.

7.03.04 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 DDCMIS connectivity.

7.03.05 0.5 sq.mm annealed tinned copper conductor complying with IS-1554(Part-1). shall be used for RTD/BTD wiring.

7.04.00 **Indicator/Switch**

7.04.01 Dial type local indicator with alarm contacts shall be provided for the following:

a) 11000 V and 3300V motor bearing temperature.

b) Hot and cold air temperature of the closed air circuit for CACA and CACW motor.

7.04.02 Flow switches shall be provided for monitoring cooling water flow of CACW motor and oil flow of forced lubrication bearing, if used. CACW motor shall be provided with water leakage detector with remote alarm and tripping.

7.04.03 Alarm switch contact rating shall be minimum 2.0 A at 220V D.C. and 10A at 240V A.C.

7.05.00 **Current Transformer for Differential Protection**

7.05.01 Motor 1000 kW and above shall be provided with three differential current transformers mounted over the neutral leads within the enclosure.

7.05.02 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.

7.06.00 **Accessory Terminal Box**

7.06.01 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.

7.06.02 Accessory terminal box shall be complete with double compression brass glands and pressure type terminals to suit owner’s cable connections.

7.07.00 **Drain Plug**

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.

7.08.00 **Lifting Provisions**

Motor weighing 25 Kg. or more shall be provided with eyebolt or other adequate provision of lifting.

7.09.00 **Dowel Pins**

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.

7.10.00 **Painting**

For paint shade finish, refer Section-X of Volume: II-A : Lead Specification.

8.00.00 **TESTS**

Routine and Type Tests are to be conducted in presence of customer's representative as per IS:325 and in addition,any special test called for in the driven equipment specification shall be performed and required copies of test certificates are to be furnished for approval. In addition, following tests shall have to be carried out on the motors in presence of OWNER's representative on 3.3kV/11kV motors.

a. Impulse test by 1.2 / 50 micro sec. On sample coil of Stator winding insulation as type test as per IEC-60034, part -15 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. Test for suitability of IPW– 55(Weather proof) as per IS 4691 as type test. Type test certificate for first numeral shall be acceptable in lieu to test, 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.

e. 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.

f. Test for noise level as routine test.

g. Test for vibration as routine test.

h. Tan delta measurement on coils.

i. Surge withstand test for inter turn insulation.

j. Test to diagnose rotor bar failure during manufacture.

k. Over speed test as routine test.

l. Temperature rise test.

Temperature rise under normal condition above ambient temperature shall be limited to-

Specified Design Ambient temperature	Thermometer Method	Resistance Method
50 deg.C	60 deg.C	70 deg.C
45 deg.C	65 deg.C	75 deg.C
40 deg.C	70 deg.C	80 deg.C

Tests indicated at (h), (i), (j) shall be carried out during manufacture of the coils and shall be furnished for verification.

9.00.00 **DRAWINGS, DATA & MANUALS**

9.01.00 Drawings, Data & Manuals shall be submitted in triplicate with the bid and in quantities and procedures as specified in General Conditions of Contract and/or elsewhere in the specification for approval and subsequent distribution after the issue of 'Letter of Intent'.

9.02.00 **To be Submitted with the bid**

a) List of the motors

b) Individual motor data sheet as per format of the proposal data sheets.

c) Scheme & write-up on forced lubrication system, if any

d) Type test report

9.03.00 **To be submitted for Owner / Purchaser's Approval and Distribution**

All relevant drawings and data pertaining to the equipment like GTP, GA drawing, foundation plan, QAP, etc. shall be submitted by the Bidder for approval of Owner/Owner's consultant. Also refer clause no. 1.19.02(u) of Section-I of Volume – V-A: Technical Specifications for Electrical Equipment & Accessories.

ANNEXURE-A

DESIGN DATA

1.0 AUXILIARY POWER SUPPLY

Supply		Description	Consumer
H.V. Supply		11000 V, 3Ø, 3W, 50 Hz, Non-effectively earthed Fault level 44 kA symm. for 1 sec.	Motors 1500 kW & above
M.V. Supply		3300 V, 3Ø, 3W, 50 Hz, Non-effectively earthed Fault level 40 kA symm. for 1 sec.	Motors 175 kW and Up to less than 1500 kW.
L.V. Supply	(i)	415V, 3Ø, 3W, 50 Hz effectively earthed Fault level 50 kA symm. for 1 sec.	Motors above 0.2kW and below 175kW.
	(ii)	240V AC/415V AC 240V, 1Ø, 2W, 50 Hz effectively earthed	Motors upto 0.2kW. Lighting, Space heating , A.C supply for Control & protective devices.
D.C. Supply		220V, 2W, unearthed Fault level 25* kA. for 1 sec.	D.C. alarm, control & protective devices

* Indicative only, the actual value will be decided by the Bidder, after substantiating the same by calculation.

Note-

- 415V or 3.3 kV may be adopted by the bidder for the drives in the range of 160-210 kW.
- 3.3 kV AC supply for CHP conveyor motors of rating above 160 kW is to be used.
- The voltage rating of the drives indicated above is for basic guideline. Minor variations can be accepted on case to case basis based on techno-economic considerations of the various sub-systems.
- Voltage rating for special purpose motors viz, VFD and screw compressors, shall be as per manufacturer's standard. All the motors ratings on Stacker/ reclaimer shall be 415V ac supply only.

2.0 RANGE OF VARIATION

A.C. Supply :

Voltage	:	± 10%
Frequency	:	+3% to -5%
Combined Volt + 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.

D.C. Supply :

Voltage	:	187 to 242 Volt

SECTION-IV

**TECHNICAL SPECIFICATION
FOR
CABLES**

1.00.00 **SCOPE OF SUPPLY**

1.01.00 Power and Control Cables shall cover the requirement of entire Plant including the switchyard.

Other cables including special cables, if any, which may be necessary as per proven engineering practice for satisfactory and trouble free operation of the entire cable system of the plant shall also be within the scope of supply. These shall include all such cables for electrical integral with mechanical equipment systems and subsystems.

1.02.00 Cable shall be furnished in accordance with this specification and the following annexures :

a)	11kV & 3.3 kV Power cables	:	Annexure - A
b)	1100V Power Cables	:	Annexure – B
c)	Control Cables	:	Annexure – C
d)	Fire Survival Cables	:	Annexure – D
e)	Flexible Trailing cable	:	Annexure – E

1.03.00 All relevant drawings, data and instruction manuals

2.00.00 **CODES & STANDARDS**

2.01.00 All cable and materials shall be designed, manufactured and tested in accordance with the latest applicable Indian Standards (IS) and IEC except where modified and/or supplemented by this specification.

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

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

3.00.00 **DESIGN CRITERIA**

3.01.00 Cables will be generally laid on ladder type trays or drawn through rigid PVC/GI /HDPE pipe/conduits. Cable tunnels shall be avoided as far as possible, except at locations where overhead trays are not possible, with prior approval of the Owner.

3.02.00 For continuous operation at specified rating, maximum conductor temperature shall be limited to the permissible value as per relevant standard and/or this specification which one is more stringent.

3.03.00 The insulation and sheath materials shall be resistant to oil, acid and alkali and shall be tough enough to withstand mechanical stresses during handling.

3.04.00 Armouring shall be single round wire of galvanized steel for multicore cables and aluminum for single core cable for power and control cables. For fire survival control cable, the armouring over inner sheath shall consist of single layer of wire / round galvanised steel wire as per IS 3975 amended upto date. For Fire survival power cable, Single core cables to be used in A.C. system, the armouring over inner sheath shall consist of single layer of round copper wire, for multi-core cables to be used in A.C. system and single core cables in D.C. System, the armouring over inner sheath shall consist of single layer of round galvanised steel wire.

3.05.00 The outer sheath shall have flame retardant low smoke halogen evolution (FRLSH) characteristics or fire survival characteristics as applicable and shall meet the requirements of additional tests specified for the purpose.

3.06.00 Core identification for multicore cable shall be provided by colour coding.

3.07.00 HT cables shall be manufactured by triple extrusion dry cured (CCV) process using pressurized nitrogen.

4.00.00 **SPECIFIC REQUIREMENTS**

4.01.00 **General Description**

All Cables shall be furnished in strict compliance with ratings and requirements and sizes as given in Annexures to this Specification.

4.02.00 **Drum Length and Tolerance**

The cables shall be supplied in non-returnable packing steel drum for 11 kV & 3.3 kV power cables, wooden drums for 1100V power and control cables, each containing minimum 500 meters length of larger sizes of cable unless specifically asked for. For smaller sizes of cables, each drum shall contain 1000 meters length of cable. Allowable tolerance on individual drum length is $\pm$5%.

4.03.00 **Non-Standard Length**

Non-standard lengths upto 5% of the total ordered quantity may be accepted. However the Contractor will be required to obtain approval before packing the Cables on drums. Non-standard lengths shall not be less than 100 metres in any case.

4.04.00 **Cable identification**

Cable identification shall be provided by embossing on every meter on the outer sheath the following :

a) TSGENCO

b) Manufacturer's name or trade mark

c) Voltage grade

d) Year of manufacture

e) Type of insulation, e.g. XLPE/PVC/HR85/IE2 etc.

f) No. of core and size of cables.

g) Type of improved fire performance, e.g. FR/FRLSH/FS

h) IS number

4.05.00 **Packing**

4.05.01 Cables shall be supplied in non returnable drums. The drums shall be of heavy construction. All wooden parts shall be manufactured from seasoned wood. All ferrous parts used shall be treated with suitable rust preventive finish or coating to avoid rusting during transit or storage. Wooden cable drum shall be treated by immersing in copper-nitrate solution.

4.05.02 Cable shall be wound and packed on drums in such a manner that it will be properly sealed and firmly secured to the drum. The ends of each length shall be sealed before shipment.

4.05.03 The cable drums should carry the following details in printed form:

a) TSGENCO

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 size of cables

g) Cable code e.g. FRLSH/FS

h) Length of cable on drum

i) No. of length on drum, if more than one

j) Direction of rotation, by arrow

k) Approx. gross mass.

l) IS/IEC number and ISI mark

4.06.00 **Joints and Terminations**

Materials of construction for a joint/termination shall perfectly match with the dielectric chemical and physical characteristics of the associated cables. The material and design concepts shall incorporate a high degree of operating compatibility between the cable and joints. The protective outer covering (jacket) used on the joints/terminations shall have the same qualities as that of the cable outer sheath in terms of ambient/operating temperature withstand capability and resistance to hazardous environments and corrosive elements. Straight through joints and terminations for HT cables shall be heat shrinkable type.

4.07.00 **Selection Criteria**

4.07.01 a) HT and LT power cables shall be selected on the basis of current carrying capacity, short circuit rating and permissible voltage drop.

b) While sizing power cables, following aspects shall be reckoned:

i) Ground/Ambient Air temperature

ii) Depth of Laying.

iii) Power Cables touching each other.

c) Cables, for circuit breaker controlled feeders, shall withstand the short circuit current for the fault clearing time 0.16 Sec. for outgoing feeder, 0.5 Sec. for Tie feeder and 1.0 Sec. for Incomer.

d) HT cables shall be sized based on the following considerations:

Rated current of the equipment and ground/ambient temperature.

Touching/spacing of cable.

Laying on multi-tier racks, trench

Depth of laying.

The voltage drop of the cable , during motor starting condition , shall be limited to 15% and during full load running condition shall be limited to 3 % rated voltage. For BFP motor, the voltage drop during motor starting condition shall be limited to 20% and for Mill motor shall be limited to 10%. Other outgoing feeder / transformer feeder shall be limited to 3% rated voltage.

Short circuits withstand capability

e) For fuse/MCCB/Breaker protected circuits the conductor size shall depend upon full load current subject to voltage drop limited to 3% during running of all feeders and 15% during starting for motor feeders. In addition, transformer regulation shall also be considered for loads fed from 415V PMCC. Incase of other out going line feeder voltage drop shall be limited to 3%.

f) For loads fed from local panels, the total running voltage drop in cable from 415V PMCC to local panel and from local panel to individual motor shall be limited to 3% at full load motor current while the same during starting shall be limited to 15%.

g) As per national electric code (NEC) current rating capacity of motor feeder/cables should be 125% of full load current.

h) For welding receptacle, 3% running drop shall only be considered.

The minimum sizes of L.T cable to be chosen are as below:

AL - 16 mm^2 (3 core) & 16mm^2 (2 core) Cu - 2.5 mm^2

4.07.02 Apart from above, consideration shall also be given to limit the cable to some standard sizes instead of using too many types.

4.07.03 The standard cable sizes, amp capacities, derating factors. as given in IS/IEC will be generally followed.

4.07.04 a) For breaker protected circuits minimum size of the cable shall be as follows:

1100V Power Cable	:	240 Sq mm XLPE AL
3300V Power Cable	:	185 Sq mm XLPE AL
11000V Power Cable	:	240 Sq mm XLPE AL

b) For motor circuits the selection of size will be made ensuring that the cable shall withstand a short circuit fault directly following a second hot start.

4.07.05 For fuse/MCCB protected circuit, the conductor size will depend on full load current subject to voltage drop not exceeding 3%. For practical purposes, the minimum size chosen is as below :

a)	Aluminium	:	6 Sq mm.
b)	Copper	:	2.5 Sq mm.

4.07.06 All control cables shall be 2.5 Sq mm copper cable.

4.07.07 Multicore control cables will generally have spare conductor (s) in accordance with the following chart :

Conductors required	**Cables**
1 or 2	1-3/C
3 or 4	1-5/C
5 or 6	1-7/C
7 or 8	1-9/C

9 or 10	1-12/C
Above 10	Two or more of above cables

4.07.08 Separate cables for each type of following services/functions as applicable shall be used for each feeder. Same multicore cable using different services shall not be acceptable.

a) Power.

b) Control, interlock and indication.

c) Metering and measuring.

d) Alarm and annunciation.

e) C.T. Cables.

f) V.T. Cables.

4.08.00 **Cable Identification**

Cable identification shall be provided by embossing on the outer sheath the following :

a) Manufacturer's name or trade mark

b) Manufacturer's name or trade mark

c) Voltage grade

d) Year of manufacture

e) Type of insulation, e.g. XLPE, HRPVC & IE2 etc.

f) No. of core & size of cables

g) Type of outer sheath e.g. FRLSH, FS etc.

4.09.00 Selected sizes of power and control cables are given in Annexure-G.

4.10.00 Fire Survival Cables shall be used for important auxiliaries / area as recommended in Standard Technical Specification by CEA for the following services. The fire survival time of these cables shall not be less than 3 hours at 750 deg. C.

i. DC emergency lube oil pump

ii. DC hydrogen seal pump

iii. Turbine lube oil pump/barring gear

iv. DC emergency lighting for main building and service building

v. DC cables for battery to charger & DC distribution boards

vi. Jacking oil pump

vii. Emergency turbine trip in control room

viii. Boiler Turbine : Generator inter trip which include the interconnection between

- Boiler master fuel trip and turbine trip relays
- Generator trip relays & turbine trip relays
- Generator trip relays & generator breaker
- Generator trip relays & field breaker
- Generator trip relays & unit auxiliary transformer breaker
- Incomer cables for DG board, emergency board, DC lighting board etc.

5.00.00 **TESTS**

5.01.00 **Shop Tests**

The Cables shall be subject to shop tests in accordance relevant IS/IEC standards to prove the design and general qualities of the Cables as below:

5.01.01 Routine tests on each drum of cables.

5.01.02 Acceptance Tests on 1 drum out of every 10 drums chosen at random for acceptance of the lot for every size.

5.01.03 Type test on each type and size of cable, inclusive of measurement of armour DC resistance of power cables on one drum out of every 10 drums of cable.

5.02.00 **Additional Tests**

Following additional acceptance tests shall also be performed on each type of cables having outer sheath with improved fire performance (category C1, Type FR/ Category C2, Type FRLSH)

5.02.01 Oxygen index test (both C1 & C2)

The Oxygen index shall not be less than 29.

5.02.02 Temperature Index Test (both C1 & C2)

The measured value of temperature index shall be 21 at a temperature of 250°C for FRLS cables and 350°C for FS cables

5.02.03 Flame Retardance test on single cable and on bunched cables (both C1 & C2)

After the test, there should be no visible damages on the test specimen within 300mm from its upper end.

After burning has ceased, the cables should be wiped clean and the charred or affected portion should not have reached a height exceeding 2.5 meter above the bottom edge of the burner, measured at the front and rear of the cable assembly. 3 Hours fire rating test shall be carried out for FS cable as per IEC-331

5.02.04 Halogen acid gas evolution test (for Category C2)

The level of HCL evolved shall not exceed 20 per cent by weight. HCL evolved shall not be exceed 2% for FS cable.

5.02.05 Smoke density test (for Category C2)

The cables shall meet the requirements of light transmission of minimum 40% after the test. Minimum transmission shall be 80% for FS cable.

5.02.06 Test for specific optical density of smoke

The cables shall meet the requirements of IS/IEC.

5.02.07 Test for rodent & termite repulsion property

The test shall be carried out to note the presence of rodent and termite repelling chemical in PVC compound. Normal procedure is that a few chippings of the PVC compound are slowly ignited in a porcelain dish or crucible in a muffle furnace at about 600°C. The resulting ignited ash is boiled with a little ammonium acetate solution (10%). A drop of aqueous sodium sulphide solution is placed on a thick filter paper and it is allowed to soak. The spot is touched with a drop of above extract. A black spot indicates the presence of anti-termite & rodent compound.

Flammability test shall be carried on finished cables as per following standards-

a) Swedish Chimney test – SS: 424-14-75

b) IEEE std.383 – 1974 latest

c) IEC std. 332-1, 332-3 and IEC 331

6.00.00 DRAWINGS, DATA & MANUALS

6.01.00 Drawings, Data and Manuals shall be submitted with the bid and for approval/ reference and subsequent distribution after the issue of Letter of Intent in quantities and procedures as specified in General condition of contract and/or

6.02.00 **To be submitted with the Bid**

a) Manufacturer's catalogues giving cable construction details and characteristics.

b) Cable current ratings for different types of installation, inclusive of derating factors for ambient temperature, grouping etc.

c) Write-up on Manufacturer's recommended method of splicing, jointing, termination etc. of the cables.

d) Type test reports on 11 KV & 3.3 KV Power, LT FRLSH Power & control, FS power and control cables.

e) Filled-up proposal particulars.

6.03.00 To be submitted for Owner/Purchaser's Approval and Distribution

All relevant drawings and data pertaining to the equipment like GTP, QAP, etc. shall be submitted by the Bidder for the approval of Owner/Owner's consultant. Also refer clause no. 1.19.02(u) of Section-I of Volume – V-A: Technical Specifications for Electrical Equipment & Accessories.

ANNEXURE-A

RATINGS AND REQUIREMENTS
HV POWER CABLES (11 KV & 3.3 KV)

1.0 11000/11000V & 3300/3300V grade 90^0C continuous rating under normal condition and 250^0C rating under short circuit condition heavy duty XLPE power cable suitable for use in 11000V/3300V non-effectively earthed system conforming to following requirement and in line with IS-7098, IS-8130, IS-5831 & IS-3975, manufactured by Triple Extrusion Dry Cure (CCV) process using pressurized Nitrogen.

1.1	Conductor	:	Stranded and compacted aluminium conductor of grade H2 & class 2 for all sizes, generally conforming to IS: 8130.
1.2	Conductor Screen	:	Extruded semi-conducting compound.
1.3	Insulation	:	Extruded cross linked polyethylene (XLPE) conforming to IS: 7098 (Part-2)
1.4	Insulation Screen	:	Extruded semi-conducting compound with a layer of non-magnetic metallic tape. For single core armoured cables, the armouring shall constitute the metallic part of screening. The semi-conducting tape shall be easily strippable.
1.5	Core Identification	:	By coloured strips applied on (For three core cables) cores.
1.6	Inner Sheath	:	Extruded HRPVC/FRLS compound conforming to type ST2 of IS: 5831 for three core cables. Single core cables shall have inner sheath. Filler material shall also be of type ST2 PVC.
1.7	Armour	:	Galvanised single round steel wire armour for twin and multicore cables. Non-magnetic hard drawn aluminum single round wire conforming to H4 of IS-8130 latest for single core cables
1.8	Overall Sheath	:	Extruded FRLSH HRPVC compound conforming to type ST2 of IS: 5831.
1.9	Drum	:	Steel Drum

ANNEXURE-B

RATINGS AND REQUIREMENTS
LV POWER CABLES [1.1KV (XLPE TYPE)]

1.0 1100 V grade, 90ºC continuous rating under normal condition and 250°C under short circuit condition rating, XLPE heavy duty, power cable conforming to following requirement and in line with IS 7098 Part-I. IS 8130 & IS 5831 and IS 3975.

1.1	Conductor	:	Stranded and compacted plain aluminium of grade H2 and class 2 stranded, high conductivity annealed plain copper for cable sizes upto 2.5 mm^2 conforming to IS:8130.
1.2	Insulation	:	Extruded cross-linked polyethylene (XLPE) conforming to IS: 7098 (Part-1)
1.3	Core Identification	:	By color coding
1.4	Inner Sheath	:	Extruded HRPVC FRLS compound conforming to type ST2 of IS: 5831 for multicore cable. Single core cables shall have no inner sheath. Filler shall be of same material as of inner sheath i.e. ST2
1.5	Armour	:	Galvanized single round steel wire armour for twin and multicore cables. Non-magnetic hard drawn aluminum single round wire conforming to H4 of IS-8130 latest for single core cables
1.6	Overall Sheath	:	Extruded FRLSH HRPVC compound conforming to type ST2 of IS: 5831.
1.7	Drum	:	Conforming to IS-10418 (Wooden drum)

ANNEXURE-C

RATINGS AND REQUIREMENTS
CONTROL CABLES

1.0 1100 V grade 85ºC continuous rating under normal condition and 160°C under short circuit condition rating HRPVC Control cable (YWY) conforming to following requirement and in line with IS:1554, IS:8130, IS:5831 and IS:3975.

1.1	Conductor	:	Stranded, non-compacted & circular, high conductivity annealed plain copper, generally conforming to IS: 8130.
1.2	Insulation	:	Extruded HRPVC type-C compound conforming to IS: 5831. The minimum volume resistivity of insulation shall be 3.5 x 10^{14} ohm-cm at 27^{O}C and 3.5 x 10^{11} OHM-CM at 85^{O}C.
1.3	Core Identification	:	By color coding and numbering at interval of 100mm or less
1.4	Inner sheath	:	Extruded HRPVC compound conforming to type ST2 FRLS of IS: 5831 for multicore cables. Single core cables shall have no inner sheath. Filler shall be of same material as of inner sheath i.e. ST2.
1.5	Armour	:	Galvanised single round steel wire for twin and multicore cables.
1.6	Overall sheath	:	Extruded FRLSH HRPVC compound conforming to type ST2 of IS: 5831.
1.7	Drum	:	Conforming to IS: 10418 (Wooden drum)

ANNEXURE-D

RATINGS AND REQUIREMENTS
(1.1KV GRADE COPPER CONDUCTOR FS POWER CABLES)

1100 V, copper conductor, heat resisting insulation, extruded inner sheath of low smoke and very low halogen content fire resisting material, single layer of copper wire armour for single core/ single layer of round galvanised steel wire for multicore, outer sheath of low smoke and very low halogen content fire resistant material, suitable for minimum temperature of 750 deg.C for 3 hours. The cables shall be in compliance with IEC-60331, Part 11.

RATINGS AND REQUIREMENTS
(1.1KV GRADE COPPER CONDUCTOR FS CONTROL CABLES)

1100 V, copper conductor, heat resisting insulation, extruded inner sheath of low smoke and very low halogen content fire resisting material, single layer of copper wire armour for single core/ single layer of round galvanised steel wire for multicore, outer sheath of low smoke and very low halogen content fire resistant material, suitable for minimum temperature of 750 deg.C for 3 hours. The cables shall be in compliance with IEC-60331, Part 11.

ANNEXURE-E

RATINGS AND REQUIREMENTS
FLEXIBLE TRAILING CABLES

i) 3300 V Unearthed Grade

Flexible trailing cable, annealed plain copper conductor, Class-5 of IS-8130, insulated with EPR, conductor and insulation shielded with EPR, cores screened with ATC wire braiding, cores laid up, HD CSP inner sheathed, proof cotton taped and FRLS HD CSP sheathed overall, conforming to IS:9968. Alternatively PCP sheathing may be acceptable.

ii) 1100 V Grade

1100 V Grade trailing cable shall be plain copper of Class-5 of IS-8130, heat resistant elastomeric compound based on EPR insulation, inner sheath of heat resistant elastomeric compound PCP sheath, nylon cord reinforcement and heat resistant, oil resistant and flame retardant heavy duty elastomeric compound FRLS CSP outer sheath.

ANNEXURE-F

CABLE SIZES

Following sizes are given as a general guideline. Standard sizes as per IEC/IS shall be adopted.

Sl. No.	Cable Size	Conductor	Insulation
1.0	**H. T. CABLES (11kV)**		
1.1	1 core 1000 sq.mm	AL	XLPE (FRLS)
1.1	1 core 630 Sq.mm	AL	XLPE (FRLS)
1.2	3 core 400 Sq.mm	AL	XLPE (FRLS)
1.3	3 core 240 Sq.mm	AL	XLPE (FRLS)
1.4	1 core 70 Sq.mm	AL	XLPE (FRLS)
1.0	**H. T. CABLES (3.3kV)**		
1.1	1 core 630 Sq.mm	AL	XLPE (FRLS)
1.2	3 core 300 Sq.mm	AL	XLPE (FRLS)
1.3	3 core 240 Sq.mm	AL	XLPE (FRLS)
1.4	3 core 185 Sq.mm	AL	XLPE (FRLS)
1.5	1 core 70 Sq.mm	AL	XLPE (FRLS)
2.0	**L. T. POWER CABLES**		
2.1	3 core 2.5 Sq.mm	CU	XLPE (FRLS)
2.2	2 core 16 Sq.mm	AL	XLPE (FRLS)
2.3	3 core 16 Sq.mm	AL	XLPE (FRLS)
2.4	4 core 16 Sq.mm	AL	XLPE (FRLS)
2.5	2 core 35 Sq.mm	AL	XLPE (FRLS)
2.6	3 core 35 Sq.mm	AL	XLPE (FRLS)
2.7	4 core 35 Sq.mm	AL	XLPE (FRLS)
2.8	3 core 70 Sq.mm	AL	XLPE (FRLS)

Sl. No.	Cable Size	Conductor	Insulation
2.9	3.1/2 core 70 Sq.mm	AL	XLPE (FRLS)
2.10	3 core 95 Sq.mm	AL	XLPE (FRLS)
2.11	3.1/2 core 95 Sq.mm	AL	XLPE (FRLS)
2.12	3 core 185 Sq.mm	AL	XLPE (FRLS)
2.13	3.1/2 core 185 Sq.mm	AL	XLPE (FRLS)
2.14	3 core 240 Sq.mm	AL	XLPE (FRLS)
2.15	3.1/2 core 240 Sq.mm	AL	XLPE (FRLS)
2.16	3 core 300 Sq.mm	AL	XLPE (FRLS)
2.17	3.1/2 core 300 Sq.mm	AL	XLPE (FRLS)
2.18	1 core 630 Sq.mm	AL	XLPE (FRLS)
3.0	**CONTROL CABLE**		
3.1	2 core 2.5 Sq.mm	CU	HRPVC (FRLS)
3.2	3 core 2.5 Sq.mm	CU	HRPVC (FRLS)
3.3	5 core 2.5 Sq.mm	CU	HRPVC (FRLS)
3.4	7 core 2.5 Sq.mm	CU	HRPVC (FRLS)
3.5	9 core 2.5 Sq.mm	CU	HRPVC (FRLS)
3.6	12 core 2.5 Sq.mm	CU	HRPVC (FRLS)
3.7	20 core 2.5 Sq.mm	CU	HRPVC (FRLS)
4.0	**FS POWER CABLES**		
4.1	3 core 2.5 Sq.mm	CU	EPR
4.2	2 core 16 Sq.mm	CU	EPR
4.3	3 core 16 Sq.mm	CU	EPR
4.4	4 core 16 Sq.mm	CU	EPR
4.5	2 core 35 Sq.mm	CU	EPR

Sl. No.	Cable Size	Conductor	Insulation
4.6	3 core 35 Sq.mm	CU	EPR
4.7	4 core 35 Sq.mm	CU	EPR
4.8	3 core 95 Sq.mm	CU	EPR
4.9	3.1/2 core 95 Sq.mm	CU	EPR
5.0	**FS CONTROL CABLE**		
5.1	2 core 2.5 Sq.mm	CU	EPR
5.2	3 core 2.5 Sq.mm	CU	EPR
5.3	5 core 2.5 Sq.mm	CU	EPR
5.4	7 core 2.5 Sq.mm	CU	EPR
5.5	9 core 2.5 Sq.mm	CU	EPR
5.6	12 core 2.5 Sq.mm	CU	EPR

SECTION – I

SPECIFIC TECHNICAL REQUIREMENTS

IC – Data Sheet A

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

9.3.1.8	Cabin accessories	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, buzzar, emergency call button, telephone hand set with suitable battery charger & controls.

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

		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	• 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

		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: a) Power b) Lighting & fan	As per elevator requirement. 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.

	(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	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, armored cables may be used.
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

		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.

SECTION – II

STANDARD TECHNICAL REQUIREMENTS

IIA – Standard Technical Requirement (Mechanical)

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.

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)

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 ± 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.

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

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

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_2SO_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.

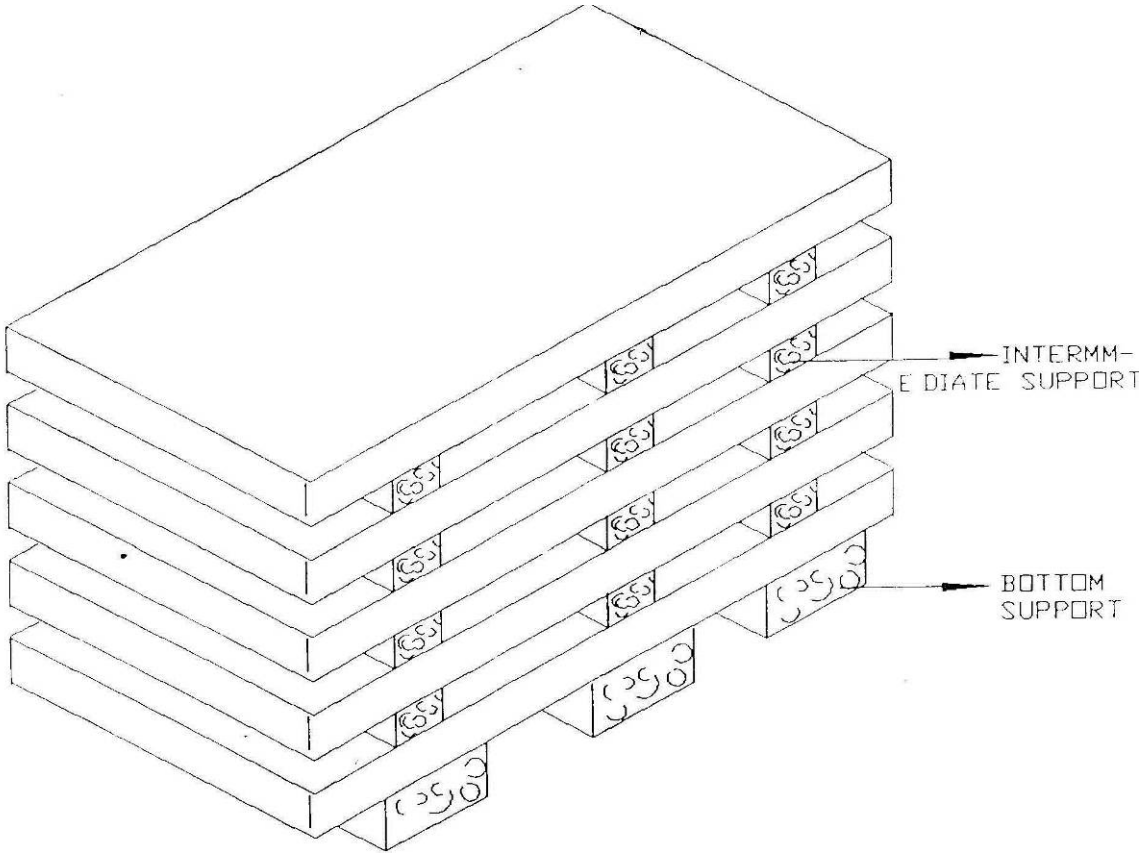

Figure – 1 – PLATE STACKING ARRANGEMENT

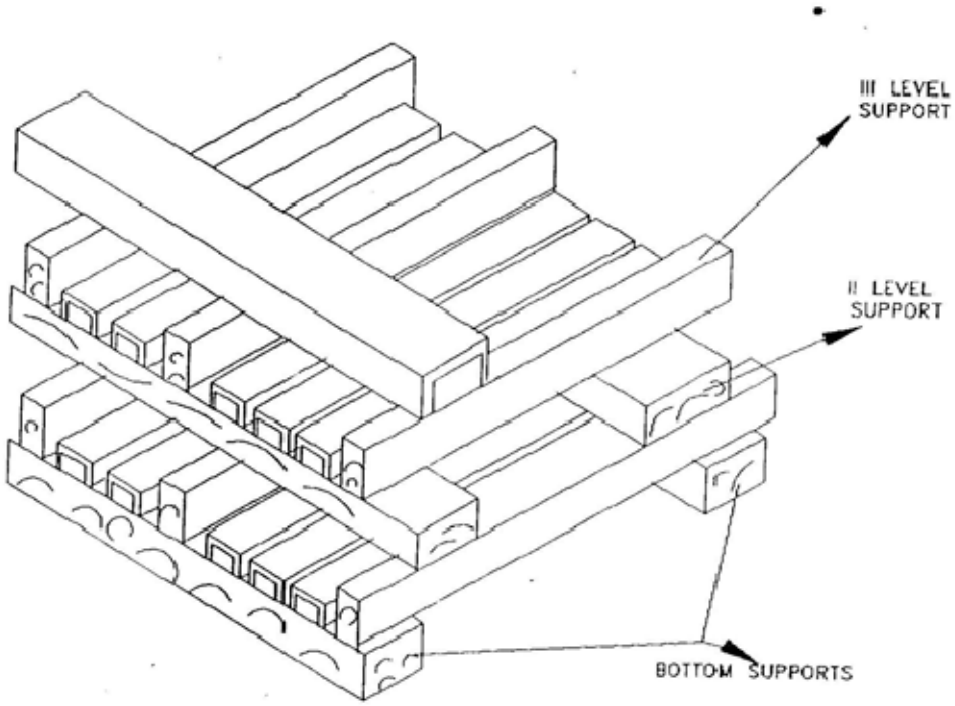

Figure – 2 – STRUCTURAL STEEL STACKING ARRANGEMENT

SECTION – III

DOCUMENTS TO BE SUBMITTED BY THE BIDDER

IIIA – List of documents to be submitted with bid

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.

SECTION – III

DOCUMENTS TO BE SUBMITTED BY THE BIDDER

IIIB – Compliance cum Confirmation Certificate

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.

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.

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)/ INTT.(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 (CONTACTER CONTROLLED)

भेल BHEL	LOAD DATA (ELECTRICAL)	JOB NO.	439	ORIGINATING AGENCY		PEM (ELECTRICAL)
		PROJECT TITLE	1X800 MW KOTHAGUDEM TPP FGD	NAME		DATA FILLED UP ON
		SYSTEM / S	ELEVATOR	SIGN.		DATA ENTERED ON
		DEPTT. / SECTION	MAUX / MP	SHEET 1 OF 1	REV. 01	DE'S SIGN. & DATE

SECTION – III

DOCUMENTS TO BE SUBMITTED BY THE BIDDER

IIID – Pre-bid Clarification Schedule

PRE-BID CLARIFICATION SCHEDULE

S. No.	Section/Clause /Page No.	Statement of the referred clause	Clarification Required

The bidder hereby certifies that above mentioned are the only clarifications required on the technical specification for the subject package.

SIGNATURE: _____

NAME: _____

DESIGNATION: _____

COMPANY: _____

DATE: _____

COMPANY SEAL