

**KARNATAKA POWER CORPORATION LIMITED
1x370 MW YELAHANKA COMBINED CYCLE POWER PLANT**

VOLUME IIB & III

**TECHNICAL SPECIFICATION
FOR
ELEVATOR**

SPECIFICATION NO.: PE-TS-409-502-A001



BHARAT HEAVY ELECTRICALS LTD

**POWER SECTOR PROJECT ENGINEERING MANAGEMENT
PPEI BUILDING, NOIDA-INDIA**



**TECHNICAL SPECIFICATION OF
ELEVATOR FOR
1X370 MW YELAHANKA**

SPECIFICATION NO. PE-TS-409-502-A001

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SECTION - A

SCOPE OF ENQUIRY / INTENT OF SPECIFICATION



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SCOPE OF ENQUIRY / INTENT OF SPECIFICATION

- 1.1 This specification includes, but not limited to design, engineering, material selection, manufacturing and assembly, inspection, testing at manufacturer's works, packing, forwarding and transportation to site, unloading, storage & handling at site, erection & commissioning, carrying out trial run and acceptance / functional guarantee test at site & final painting of passenger elevator for **1X370 MW YELAHANKA** and necessary accessories including supply of 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 Vol-III of the specification. In absence of any such clarifications, in case of any contradictory requirement, the more stringent requirement as per interpretation of Purchaser/Customer shall prevail and shall be complied by the bidder without any commercial implication on account of the same. Further in case of any missing information in the specification not brought out by the prospective bidders as part of pre-bid clarification, the same shall be furnished by Purchaser/ Customer as and when brought to their notice either by the bidder or by purchaser/customer themselves. However, such requirements shall be binding on the successful bidder without any commercial & delivery implication.
- 1.7 The bidder's offer shall not carry any sections like clarification, interpretations and /or assumptions.
- 1.8 Deviations, if any, should be very clearly brought out clause by clause in the enclosed schedule; 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.



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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.

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**PROJECT INFORMATION WITH WIND AND SEISMIC DESIGN
CRITERIA**

Yelahanka 1x350 MW CCPP Plant details

1	Topographical Details of site		
	a Latitude	:13 Deg 7 Min	
	b longitude	:77 Deg 35Min	
	c Elevation	: 900 Mtr (Please Refer the Contour Map)	
2	Highest Flood level	: Not applicable and can be finalized by studying the Plant Topography	
3	Elevation	: 900 Mtr (Please Refer the Contour Map)	
4	Annual Mean of Daily Max Temp	37.Deg.cent	
5	Annual Mean of Daily Min Temp	11.5 Deg cent	
6	Highest Temp Recorded	39.Deg Cent	
7	LowestTemp Recorded	9.9 Deg Cent	
8	Desigen Temperature	28.0 Deg Cent.	
9	Relative Humidity	at 830hrs	79%
		at 1730 hrs	52%
10	Annula total Rain Fall (Max rain fall during July to Oct)	970 mm	
11	Design Wind Speed	33M/sec (As per IS: 875)	
12	Earthquake Zone	Seismic Zone II As per IS 1893	



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SECTION C1A

**SPECIFIC TECHNICAL REQUIREMENT
(SCOPE OF SUPPLY & SERVICES, EXCLUSION AND TERMINAL
POINTS)**



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1.0 Introduction

Passenger elevator shall be provided for access to various operating floors / platforms in Service cum control building for 1X370 MW YELAHANKA 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, Erection & Commissioning, carrying out trial run and Acceptance / functional tests at site & final painting of Passenger Elevators for 1X370 MW YELAHANKA as listed below:-

Sl. no	Building	No. of elevator	Capacity	No. of landings	Total rise	Type	Speed
1	Service cum control building	1 No.	884 Kg	G+2 (EL.0.0M, 4.5M,11.5M)	11.5 M	Conventional (passenger elevator)	1.0 M/s

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 earthing.
- 14) Ladder in pits.
- 15) Emergency light with rechargeable battery.
- 16) All fixing materials require fixing rails, brackets, equipment including nuts and bolts.
- 17) Fascia plates (750 mm minimum) & sill angels.



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- 18) Full length infra-red Curtain safety feature in door along with pressure limiter as an extra mechanical safety.
- 19) ELCB if required as per statutory requirement.
- 20) Any other equipment required to meet the requirement of local statutory and regulatory body and prevailing lift etc.
- 21) Car lighting, recessed fluorescent light fittings for illumination level of 100 lux on car floor.
- 22) Elevator shaft, pit cable conduit fixtures, switches 3 pin or as required by bidder during erection / maintenance purpose at every 3 m.
- 23) Mirror for the car rear panel.
- 24) Floor announcement cum music system to be provided.
- 25) Special maintenance tools and tackles along with un-priced list with the offer.
- 26) Three (3) sided SS-304 mirror finish hand railing at suitable height.
- 27) Minor civil work including grouting as well as foundation bolt grouting as required during installation of elevator.
- 28) Scaffolding for erection.
- 29) Automatic rescue device with battery drive - Modern advanced electronic drive system of rescuing passenger trapped in an elevator shall be provided.
- 30) 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.
- 31) All steel embedment for fixing landing doors / indicators etc. to the elevator well shaft and fascia plate shall be supplied by the bidder
- 32) Guide rails complete with supporting brackets for the car and counter weights.
- 33) 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.
- 34) Any other steel works as well as all other accessories / components not specified in the technical specification but necessary for making the elevator complete.
- 35) 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, 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.
- 36) 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.
- 37) Any other requirement stipulated by state statutory body and prevailing local lift act requirement shall also be included by bidder in their scope.



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- 38) 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.
- 39) Mandatory Spares: NA
- 40) Air conditioner (reputed make) : Shall be provided by BHEL.
- 41) One (1) no. 1/2 Kg CO2/suitable type Fire extinguisher in bidder scope. Fixing arrangement shall be provided in Car accordingly.

NOTES:

- 1) Flooring for elevator shall be of vitrified ceramic tiles 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.
- 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 layout attached in the specification for different buildings.
- 5) Elevators pit for service 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. Trailing cable shall be FRLS type (with strain bearing member).
- 8) Make of various bought out items & QAP shall 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 etc) shall be painted with epoxy based paint for all elevators.
- 11) Protection class for 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, Landing door motor 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 1 hour or as per latest IS / as per the state statutory requirement whichever is more stringent.
- 14) Motor shall be S4 / S5 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



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- 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) Bidder shall include scaffoldings required in their scope of supply.
 - 20) Elevator shall be provided with AC VVVF type drive control system.

Bidder shall furnish the following documents only during tender stage as a part of technical bid. Any other technical documents furnished by bidder shall not be considered as the part of offer :-

- 1) Signed and stamped copy of electrical load list for each elevator
- 2) Signed and stamped copy of Deviation schedule (if any).
- 3) Signed and stamped copy of Compliance cum confirmation sheet.

Note : In case bidder fails to furnish any document specified above, bidder's offer shall be treated as incomplete and shall liable to be rejected.

3.0 SCOPE OF SERVICES

Scope of services will broadly include the followings:-

- 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



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- 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. Further cabling (all cables including power, control 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, 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) 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.
- f) All fixtures shall be in stainless steel face plates.
- g) Push buttons shall be fixed in the car for holding the door open for any length of time required.
- h) 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 (+3% 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

The cables used in the elevator installations shall conform to the latest edition of IS 4289. All wiring / cabling between the equipments in the lift machine room and that between the machine room and equipment in the lift well and at the landing shall be wired in HDP conduits / galvanised steel conduits to be supplied by the bidder.



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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 electrical equipments, including metal conduits shall be effectively earthed with the 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 . Proper allowance will be made for impact and wear and the factor of safety for rope shall not be less than twelve (12) or as per IS 14665 (all parts). The suspension wire rope will conform to IS-14665 or approved equivalent international standard.
- ii) The lift will be providing with automatic travelling device which will take care of overrun and under run of the car and rope stretch that the car floor is within 6.0 mm from the landing level at the floors while in operation.
- 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 finished to approved shade (including landing doors of the car). MS CHQ Plate and PVC tile flooring as indicated in the data sheet - A, 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 client 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.



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- 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 - 2010 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. However, minimum seven (7) days' notice shall be served for the same.
- 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.:-



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- 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.
- d) Specification / schedule of painting shall be made as a part of general arrangement drawing of each item indicating at least three (3) makes.
- 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 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) List of commissioning spares and tools and tackles in terms of numbers shall be furnished by the bidder along with the offer.
- 22) "Technical deviations" shall be clearly indicated in bidder's offer in prescribed format only.
- 23) 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.



**TECHNICAL SPECIFICATION OF
ELEVATOR FOR
1X370 MW YELAHANKA**

SPECIFICATION NO. PE-TS-409-502-A001

VOLUME II - B

SECTION -C1 B

REV 00

DATE JAN 2016

TECHNICAL DATA SHEET OF ELEVATOR

Sl.No.	DESCRIPTION	VALUES
A	LIFT PARTICULARS	
1.	Elevator Location	Service cum control building
2.	Type of Service Type of Elevator	Passenger Type Conventional type
3.	Rated Load on Elevator	884Kg.(13 person)
4.	Quantity	One(1) No. for Service cum control building
5.	Rated Speed of Lift	1.0 M/Sec
6.	Total Travel	11.5 m
7.	Nos. of floors to be served	G+2 (EL.0.0M, 4.5M,11.5M)
8.	Design, construction, installation, codes including car size, door size, shaft size, size of platform and car entrance	As per IS: 14665 all relevant part.
9.	CAR	
9.1	Size	As indicated above under Sl.no.8
9.2	Car frame	Structural Steel and bolted construction
9.3	Car enclosure	SS-304, 1.5mm thick sheet.
9.3.1	Other 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	Handrails on three sides	Stainless steel (SS-304 mirror polished finish)
9.3.1.3	Lighting & fan	One cabin fan, two recessed fluorescent lamp fittings for lux level : 100 CFL lighting shall be at every 3 meters interval in lift well
9.3.1.4	Ventilation fan in the car	Shall be provided for adequate ventilation of the car by elevator supplier.
9.3.1.5	Telephone facility in the lift car	Internal telephone wiring and hands free speaker telephone hand set shall be provided
9.3.1.6	Automatic rescue device with battery drive	Provided
9.4	Car platform	MS plates (Hot dip galvanized) with vitrified ceramic tiles
9.5	Car roof	Shall be provided with a three pin plug 5/15A, socket with switch on top of lift car.
9.6	Car operating panel	
9.6.1	Type of construction	Partial Height car operating panel (COP), Removable type from Car with SS face plate
9.6.2	Push button	Luminous push buttons with IP 54
9.6.3	Other accessories of car operating panel	Car operating panel with luminous buttons, car position indication (both visual and audio), direction arrows, overload warning indicator, battery operated alarm bell, emergency light with suitable battery-battery charger and controls, emergency stop switch.
9.6.4	Push button and call registered tell talk lights at each landing	
9.6.4.1	Type of construction	Box type with SS face plate
9.6.4.2	Push Buttons	Luminous push buttons with IP 54
9.6.5	Car position indicator	
9.6.5.1	Type of construction	As per manufacturer's standard
9.6.5.2	Type of display	7 segment LED display/ equivalent
10.	Car, Landing door	
10.1	Type of door	Centre opening, horizontal sliding type. Landing door shall be fire rated for 1hr.
10.2	Method of operation	Power operated with automatic door opening and closing devices. Infrared light curtain shall be provided for safety operation of door
10.3	Door Hangers and Tracks	Provided
10.4	MOC for Car, landing door	SS 304



**TECHNICAL SPECIFICATION OF
ELEVATOR FOR
1X370 MW YELAHANKA**

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11.	Buffers	Spring type for car and counterweight
12.	Load Plate	As per manufacturer's standard/as applicable
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
15.	Limit switches	
15.1	Location	Bottom & top terminal
16.	Apron / Facia Plate provided as per IS 14665	Yes
17.	Method of control	ACVVVF Control with automatic level adjustment.
18.	Position of Machine Room	Directly above the lift Shaft.
19.	Operation	Selective simplex collective, automatic operation with and without attendant with provision for locking control in "auto" or "Attendant" position. Key type lock switch shall be provided.
20.	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
21.	Power supply :	
	a) Power	415 Volts, 3 Phase, 50 c/s, 4 wire system
	b) Lighting & fan	240 Volts, 1 Phase, 50 c/s
22.	Motor details	
	(a) Type	3 phase AC squirrel Cage Induction motor
	(b) Type of Duty	Lift Duty
	(c) Motor Duty	S4
	(d) Duty Cycle of Motor	60%
	(e) Applicable standard	IS:325
	f) No. Of Starts Per Hour	Elevator Motor shall be suitable for minimum of 150 Starts per hour
	g) Direction of rotation	Both Clockwise & Anticlockwise
	h) Class of Insulation	F
	i) Method of Starting	AC Variable Voltage Variable Frequency
	j) Type of enclosures	IP54
23.	Door Motor	
	a) Equipment driven by Motor	Door (car and landing)
	b) Direction of rotation	Bidirectional
	c) Type of enclosures	IP54
24.	Metallic Wire Mesh between Car & Counter Weight	Yes, by elevator supplier
25.	Fire Man Switch	Yes, by elevator supplier
26.	Automatic Rescue Device	Provided
27.	Trailing cables	FRLS type/as per specification.
28.	Protection class	Protection class for main control panel shall be IP 21, motor IP-54.
29.	AC for Machine room	Window air conditioner of suitable capacity shall be provided by BHEL



TECHNICAL SPECIFICATION OF
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SPECIFICATION NO. PE-TS-409-502-A001

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FUNCTIONAL/PERFORMANCE / DEMONSTRATION GUARANTEE (AS APPLICABLE)

A.0 TRIAL OPERATION, COMMISSIONING, PERFORMANCE/ DEMONSTRATION GUARANTEE TESTS:

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

- A. Rated capacity of the elevator.
- B. Travel and hoist Speed of the elevator.
- C. Accurate positioning of the elevator.
- D. Over Load test as per IS.



TECHNICAL SPECIFICATION OF
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1X370 MW YELAHANKA

SPECIFICATION NO. PE-TS-409-502-A001

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SECTION C1 D

QUALITY ASSURANCE

QUALITY ASSURANCE PLAN

1		2		3		4		5		6		7		8		9		10		11	
Sr. No.		COMPONENT & OPERATION		CHARACTERISTICS		CLASS		TYPE OF CHECK		QUANTUM OF CHECK		REFERENCE DOCUMENT		ACCEPTANCE NORMS		FORMATE OF RECORD		AGENCY		REMARKS	
		MANUFACTURING QUALITY PLAN FOR=MS vendor		PROJECT: PACKAGE: ITEM: ELEVATOR BHIL REF. NO.:		PROJECT: PACKAGE: ITEM: ELEVATOR BHIL REF. NO.:		PROJECT: PACKAGE: ITEM: ELEVATOR BHIL REF. NO.:		PROJECT: PACKAGE: ITEM: ELEVATOR BHIL REF. NO.:		PROJECT: PACKAGE: ITEM: ELEVATOR BHIL REF. NO.:		PROJECT: PACKAGE: ITEM: ELEVATOR BHIL REF. NO.:		PROJECT: PACKAGE: ITEM: ELEVATOR BHIL REF. NO.:		PROJECT: PACKAGE: ITEM: ELEVATOR BHIL REF. NO.:		PROJECT: PACKAGE: ITEM: ELEVATOR BHIL REF. NO.:	
<p>A. Boughtout Items :</p>																					
1	Raw materials, Round Hexagon & Structural. Type : EN-8/EN-8D to EN-9,B and EN-24	A: Chemical Composition B: Mechanical Properties C: Dimensional Checks	Major	Analysis Hardness Measurement	Sample Sample 100%	IS/BS : 970 IS/BS : 970 DRG.	IS/BS : 970 IS/BS : 970 DRG.	O.S.L/T.C QA REG. D.I.R/Q.C.R	V V V	V V W											
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											
3	Casting : a. C.I. Graded Castings	A: Chemical Composition B: Mechanical Properties C: Dimensional Checks D: Blow Holes	Major	Analysis Hardness on traction sheave Measurement Visual	Sample Sample Sample 100%	IS-vendor DRG vendor-DRG IS : 210 vendor-DRG —	AS PER DRG. vendor-DRG IS : 210 vendor-DRG	S.T.C S.T.C QA/FMT/02 QA/REG	√ √ - -	V V W W											
4	Suppliers Item : a. Manufactured Items b. Moldings Rubber Items (ABSORBER) c. Springs (Buffer) d. Guide Rail. e. Wire rope	Dimensional Check A: Dimensional Checks B: Hardness A: Dimensional Check B: Spring Constant compression. A: Chemical Test. B: Dimension check. A: Dimensional Check B: Mechanical Properties.	Major Major Major Major Major Major	Measurement Measurement Compression Test Measurement Compression Analysis Measurement Measurement of O.D/ Const. Measurement	100% 100% Sample 100% Sample Sample Sample Correlate S.T.C	vendor/DRG. vendor-DRG. vendor-DRG. vendor-DRG. vendor-DRG. vendor- DRG vendor-DRG. IS/2365 & IS : 2286	vendor/DRG. vendor-DRG. vendor-DRG. vendor-DRG. vendor-DRG. vendor -DRG vendor-DRG. IS/2365 & IS : 2286	D.I.R QA/FMT/02 QA/FMT/02 QA/FMT/02 S.T.C S.T.C QA/FMT/02 QA/FMT/02 S.T.C	- - - - √ √ - - √	W W W W V V W W V											
<p>*W= Verification as appropriate. *M= Manufacturer/Sub contractor. *W=Witness. *VE= Manufacturer/ sub contractor Vendor. *S.T.C= Supplier Test Certificate, *B=BHEL/Nominated inspection agency. *O.S.L= Out Side Lab. *D.I.R=Daily inspection register. *R.Q.C= Rvendonript Quality Control (vendor) . *P =Perform. *Q.C.R= Quality Control Register (vendor) . *T.C. = Test Certificate. *D.I.R= Daily inspection register. *T.C. = Documents. *U.E.Q=Ultra Sonic Examination Record .</p>												<p>NAME & SIGN OF APPROVING AUTHORITY & SEAL</p>									

1	2	3	4	5	6	7	8	9	10			11	
Sr. No.	COMPONENT & OPERATION	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS	
									D	VE	M	B	
	f. Power & control (PVC)cable	a- FRLS , b- Insulation resistance.	Major do	Electrical do	Sampling do	IS - 694 do	IS - 694 do	S.T.C do	√ √	V V	V V	V V	
5	Raw material for motor. (1) Enameled wire.	a) Dimension Check b) High voltage test	Major Major	Measurement Elect.	Sample One Sample each roll	vendor -STD IS:4800	vendor -STD IS:4800	D.I.R D.I.R	V V	W W	V V	V V	
6	(2) Copper base (Flat) Finished Manufactured Components	Chemical check Plating thickness control	Major Major	Analysis Measurement	Sample Sample	Cu=min 99.5% vendor-STD.	Cu=min 99.5% vendor-STD.	O.S.L / T.C vendor-STD	V V	V W	V V	V V	
B. Inspection During mfg.													
1	Machine Shop :	A: Dimensional Check B: Crack detection Motor bodies C: Surface check	Major Major Major	Measurement D.P. Test Visual	100% 100% 100%	vendor-DRG. vendor-STD. vendor-STD.	vendor-DRG. vendor-STD. vendor-STD.	QAFMT/01 - -	- - -	W W W	- - -	- - -	
2	Fabrication Shop :	Dimensional Checks of critical items Welding	Major minor	Measurement Visual	100% Sampling	vendor-DRG. do	vendor-DRG. do	Q.C.R .	- .	W W	- .	- .	Welding by approved welder
C. Assembly Inspection.													
1	Winding gear.	A- Back lash of gears & Maching contact. B- Vibration . C- Noise level. D- Visual .	Major Major Major Oil leakage	Measurement Measurement Measurement Visual	100% 100% 100% 100%	vendor INSP NORMS INSP NORMS INSP NORMS INSP NORMS	vendor INSP NORMS INSP NORMS INSP NORMS INSP NORMS	QAFMT/11 do do do	V V V V	W W W W	- - - -	- - - -	
						CONTRACTOR SIGN AND SEAL .			NAME & SIGN OF APPROVING AUTHORITY & SEAL /HPGCIL				
						MANUFACTURER SEAL AND SIGN							

*V= Verification as appropriate. *M= Manufacturer/Sub contractor.
*W= Witness , *VE= Manufacturer/ sub contractor Vendor.
*S.T.C= Supplier Test Certificate. *B=BHEL/Nominated inspection agency.
*O.S.L= Out Side Lab. *D.I.R=Daily inspection register.
*R.Q.C = Revendorip Quality Control (vendor) . *P =Perform
*Q.C.R = Quality Control Register (vendor) . *T.C. = Test Certificate,
*D.I.R = Daily inspection register.
*U.E.R. =Ultra Sonic Examination Record .

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



TECHNICAL SPECIFICATION OF
ELEVATOR FOR
1X370 MW YELAHANKA

SPECIFICATION NO. PE-TS-409-502-A001

VOLUME II - B

SECTION -C1 E

REV 00

DATE JAN 2016

PAINTING SPECIFICATION

A) Structural

Surface preparation: Degreasing and Mechanical cleaning with wire brush or hand tool.
(SA 1/ ST 2 / ST 3 as applicable)

Primer : HB Zinc Phosphate (alkyd Medium) as per IS: 2074, 2 coat ,
DFT 35-45 μ per coat.

Finish Coat : Synthetic enamel (Alkyd medium) as per IS: 2932- 2 coats,
DFT 20-25 μ per coat.

Total DFT : 110-140 μ

B) Electrical /Control Panel

Surface preparation: Seven tank process

Primer : Red Oxide Zinc phosphate (Alkyd medium)- 2 coat , Minimum DFT 35 μ per
coat.

Finish Coat : Synthetic enamel (Alkyd medium) as per IS: 2932- 2 coats, Minimum DFT 35 μ per
coat.

Total DFT : 140 μ



TITLE :
ELECTRICAL EQUIPMENT SPECIFICATION
FOR ELEVATORS

1 x 370 MW YELAHANKA CCPP

SPECIFICATION NO.

VOLUME NO. : **II-B**

SECTION : **C**

REV NO. **00** : DATE : 14.01.16

SHEET : 1 OF 3

TECHNICAL SPECIFICATION

FOR

ELEVATORS

(ELECTRICAL PORTION)



TITLE :
**ELECTRICAL EQUIPMENT SPECIFICATION
FOR ELEVATORS**

1 x 370 MW YELAHANKA CCPP

SPECIFICATION NO.

VOLUME NO. : **II-B**

SECTION : **C**

REV NO. **00** : DATE : 14.01.16

SHEET : 2 OF 3

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.



TITLE :
ELECTRICAL EQUIPMENT SPECIFICATION
FOR ELEVATORS
1 x 370 MW YELAHANKA CCPP

SPECIFICATION NO.

VOLUME NO. : **II-B**

SECTION : **C**

REV NO. **00** : DATE : 14.01.16

SHEET : 3 OF 3

4.0 List of enclosures :

- a) Electrical scope between BHEL & vendor (Annexure –I)
- b) Standard BHEL specification for motors.
- c) Datasheets(A&C) & quality plan for motors.
- d) Electrical Load data format (Annexure –II)
- e) BHEL cable listing format (Annexure –III)
- f) Specification & quality plans for cabling, earthing & lightning protection.

STANDARD ELECTRICAL SCOPE BETWEEN BHEL AND VENDOR

PACKAGE: ELEVATORS

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

PROJECT: YELAHANKA CCPP

<u>S. NO</u>	<u>DETAILS</u>	<u>SCOPE SUPPLY</u>	<u>SCOPE E&C</u>	<u>REMARKS</u>
1	Isolating Switch	Vendor	Vendor	BHEL will provide two number 415 V (3ph, 4W) supply feeder only up to isolating switches for elevators. Any other voltage level (AC/DC) required will be derived by the vendor. Motor starter shall be part of elevator control panel.
2	Power cables, control cables, screened control cables and any special cables (if required) between equipment supplied by vendor.	Vendor	Vendor	Cable from supply feeder to isolating switch shall be in BHEL scope.
3	Cabling material (cable trays, accessories, cable tray supporting system, conduits etc.).	Vendor	Vendor	
4	Equipment Earthing	Vendor	Vendor	All equipment metallic enclosures / frames, metal structure etc. shall be grounded at two points each to the nearest grounding points / risers provided by BHEL.
5	Motors	Vendor	Vendor	
6	Cable glands and lugs for equipment supplied by vendor	Vendor	Vendor	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.



TITLE :
GENERAL TECHNICAL REQUIREMENTS

FOR

LV MOTORS

SPECIFICATION NO.
PE-SS-999-506-E101
VOLUME NO. : **II-B**
SECTION : **D**
REV NO. : **00** DATE :
SHEET : 1 OF 1

GENERAL TECHNICAL REQUIREMENTS

FOR

LV MOTORS

SPECIFICATION NO.: PE-SS-999-506-E101 Rev 00



TITLE :
GENERAL TECHNICAL REQUIREMENTS

FOR

LV MOTORS

SPECIFICATION NO.
PE-SS-999-506-E101
VOLUME NO. : **II-B**
SECTION : **D**
REV NO. : **00** DATE :
SHEET : 1 OF 4

1.0 INTENT OF SPECIFICATION

The specification covers the design, materials, constructional features, manufacture, inspection and testing at manufacturer's work, and packing of Low voltage (LV) squirrel cage induction motors along with all accessories for driving auxiliaries in thermal power station.

Motors having a voltage rating of below 1000V are referred to as low voltage (LV) motors.

2.0 CODES AND STANDARDS

Motors shall fully comply with latest edition, including all amendments and revision, of following codes and standards:

IS:325	Three phase Induction motors
IS : 900	Code of practice for installation and maintenance of induction motors
IS: 996	Single phase small AC and universal motors
IS: 4722	Rotating Electrical machines
IS: 4691	Degree of Protection provided by enclosures for rotating electrical machines
IS: 4728	Terminal marking and direction of rotation rotating electrical machines
IS: 1231	Dimensions of three phase foot mounted induction motors
IS: 8789	Values of performance characteristics for three phase induction motors
IS: 13555	Guide for selection and application of 3-phase A.C. induction motors for different types of driven equipment
IS: 2148	Flame proof enclosures for electrical appliance
IS: 5571	Guide for selection of electrical equipment for hazardous areas
IS: 12824	Type of duty and classes of rating assigned
IS: 12802	Temperature rise measurement for rotating electrical machines
IS: 12065	Permissible limits of noise level for rotating electrical machines
IS: 12075	Mechanical vibration of rotating electrical machines

In case of imported motors, motors as per IEC-34 shall also be acceptable.

3.0 DESIGN REQUIREMENTS

3.1 Motors and accessories shall be designed to operate satisfactorily under conditions specified in data sheet-A and Project Information, including voltage & frequency variation of supply system as defined in Data sheet-A

3.2 Motors shall be continuously rated at the design ambient temperature specified in Data Sheet-A and other site conditions specified under Project Information
Motor ratings shall have at least a 15% margin over the continuous maximum demand of the driven equipment, under entire operating range including voltage & frequency variation specified above.

3.3 Starting Requirements

3.3.1 Motor characteristics such as speed, starting torque, break away torque and starting time shall be properly co-ordinated with the requirements of driven equipment. The accelerating torque at any speed with the minimum starting voltage shall be at least 10% higher than that of the driven equipment.

3.3.2 Motors shall be capable of starting and accelerating the load with direct on line starting without exceeding acceptable winding temperature.



TITLE :
GENERAL TECHNICAL REQUIREMENTS

FOR

LV MOTORS

SPECIFICATION NO.
PE-SS-999-506-E101
VOLUME NO. : **II-B**
SECTION : **D**
REV NO. : **00** DATE :
SHEET : 2 OF 4

The limiting value of voltage at rated frequency under which a motor will successfully start and accelerate to rated speed with load shall be taken to be a constant value as per Data Sheet - A during the starting period of motors.

3.3.3 The following frequency of starts shall apply

- i) Two starts in succession with the motor being initially at a temperature not exceeding the rated load temperature.
- ii) Three equally spread starts in an hour the motor being initially at a temperature not exceeding the rated load operating temperature. (not to be repeated in the second successive hour)
- iii) Motors for coal conveyor and coal crusher application shall be suitable for three consecutive hot starts followed by one hour interval with maximum twenty starts per day and shall be suitable for minimum 20,000 starts during the life time of the motor

3.4 **Running Requirements**

3.4.1 Motors shall run satisfactorily at a supply voltage of 75% of rated voltage for 5 minutes with full load without injurious heating to the motor.

3.4.2 Motor shall not stall due to voltage dip in the system causing momentary drop in voltage upto 70% of the rated voltage for duration of 2 secs.

3.5 **Stress During bus Transfer**

3.5.1 Motors shall withstand the voltage, heavy inrush transient current, mechanical and torque stress developed due to the application of 150% of the rated voltage for at least 1 sec. caused due to vector difference between the motor residual voltage and the incoming supply voltage during occasional auto bus transfer.

3.5.2 Motor and driven equipment shafts shall be adequately sized to satisfactorily withstand transient torque under above condition.

3.6 Maximum noise level measured at distance of 1.0 metres from the outline of motor shall not exceed the values specified in IS 12065.

3.7 The max. vibration velocity or double amplitude of motors vibration as measured at motor bearings shall be within the limits specified in IS: 12075.

4.0 **CONSTRUCTIONAL FEATURES**

4.1 Indoor motors shall conform to degree of protection IP: 54 as per IS: 4691. Outdoor or semi-indoor motors shall conform to degree of protection IP: 55 as per IS: 4691 and shall be of weather-proof construction. Outdoor motors shall be installed under a suitable canopy

4.2 Motors upto 160KW shall have Totally Enclosed Fan Cooled (TEFC) enclosures, the method of cooling conforming to IC-0141 or IC-0151 of IS: 6362.

Motors rated above 160 KW shall be Closed Air Circuit Air (CACA) cooled

4.3 Motors shall be designed with cooling fans suitable for both directions of rotation.



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- 4.4. Motors shall not be provided with any electric or pneumatic operated external fan for cooling the motors.
- 4.5. Frames shall be designed to avoid collection of moisture and all enclosures shall be provided with facility for drainage at the lowest point.
- 4.6. In case Class 'F' insulation is provided for LV motors, temperature rise shall be limited to the limits applicable to Class 'B' insulation.
In case of continuous operation at extreme voltage limits the temperature limits specified in table-1 of IS:325 shall not exceed by more than 10°C.
- 4.7. **Terminals and Terminal Boxes**
- 4.7.1 Terminals, terminal leads, terminal boxes, windings tails and associated equipment shall be suitable for connection to a supply system having a short circuit level, specified in the Data Sheet-A.

Unless otherwise stated in Data Sheet-A, motors of rating 110 kW and above will be controlled by circuit breaker and below 110 kW by switch fuse-contactor. The terminal box of motors shall be designed for the fault current mentioned in data sheet "A".
- 4.7.2 unless otherwise specified or approved, phase terminal boxes of horizontal motors shall be positioned on the left hand side of the motor when viewed from the non-driving end.
- 4.7.3 Connections shall be such that when the supply leads R, Y & B are connected to motor terminals A B & C or U, V & W respectively, motor shall rotate in an anticlockwise direction when viewed from the non-driving end. Where such motors require clockwise rotation, the supply leads R, Y, B will be connected to motor terminals A, C, B or U W & V respectively.
- 4.7.4 Permanently attached diagram and instruction plate made preferably of stainless steel shall be mounted inside terminal box cover giving the connection diagram for the desired direction of rotation and reverse rotation.
- 4.7.5 Motor terminals and terminal leads shall be fully insulated with no bar live parts. Adequate space shall be available inside the terminal box so that no difficulty is encountered for terminating the cable specified in Data Sheet-A.
- 4.7.6 Degree of protection for terminal boxes shall be IP 55 as per IS 4691.
- 4.7.7 Separate terminal boxes shall be provided for space heaters.. If this is not possible in case of LV motors, the space heater terminals shall be adequately segregated from the main terminals in the main terminal box. Detachable gland plates with double compression brass glands shall be provided in terminal boxes.
- 4.7.8. Phase terminal boxes shall be suitable for 360 degree of rotation in steps of 90 degree for LV motors.
- 4.7.9 Cable glands and cable lugs as per cable sizes specified in Data Sheet-A shall be included. Cable lugs shall be of tinned Copper, crimping type.
- 4.8 Two separate earthing terminals suitable for connecting G.I. or MS strip grounding conductor of size given in Data Sheet-A shall be provided on opposite sides of motor frame. Each terminal box shall have a grounding terminal.



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- 4.9.1 Motors provided for similar drives shall be interchangeable.
- 4.9.2 Suitable foundation bolts are to be supplied alongwith the motors.
- 4.9.3 Motors shall be provided with eye bolts, or other means to facilitate safe lifting if the weight is 20Kgs. and above.
- 4.9.4 Necessary fitments and accessories shall be provided on motors in accordance with the latest Indian Electricity rules 1956.
- 4.9.5 All motors rated above 30 kW shall be provided with space heaters to maintain the motor internal air temperature above the dew point. Unless otherwise specified, space heaters shall be suitable for a supply of 240V AC, single phase, 50 Hz.
- 4.9.6 Name plate with all particulars as per IS: 325 shall be provided
- 4.9.7 Unless otherwise specified, the colour of finish shall be grey to Shade No. 631 and 632 as per IS:5 for motors installed indoor and outdoor respectively. The paint shall be epoxy based and shall be suitable for withstanding specified site conditions.

5.0 INSPECTION AND TESTING

- 5.1 All materials, components and equipments covered under this specification shall be procured, manufactured, as per the BHEL standard quality plan No. PED-506-00-Q-006/0 and PED-506-00-Q-007/2 enclosed with this specification and which shall be complied.
- 5.2 LV motors of type-tested design shall be provided. Valid type test reports not more than 5 year shall be furnished. In the absence of these, type tests shall have to be conducted by manufacturer without any commercial implication to purchaser.
- 5.3 All motors shall be subjected to routine tests as per IS: 325 and as per BHEL standard quality plan.
- 5.4 Motors shall also be subjected to additional tests, if any, as mentioned in Data Sheet A.

6.0 DRAWINGS TO BE SUBMITTED AFTER AWARD OF CONTRACT

- a) OGA drawing showing the position of terminal boxes, earthing connections etc.
- b) Arrangement drawing of terminal boxes.
- c) Characteristic curves:
(To be given for motor above 55 kW unless otherwise specified in Data Sheet).
- i) Current vs. time at rated voltage and minimum starting voltage.
- ii) Speed vs. time at rated voltage and minimum starting voltage.
- iii) Torque vs. speed at rated voltage and minimum voltage.
For the motors with solid coupling the above curves i), ii), iii) to be furnished for the motors coupled with driven equipment. In case motor is coupled with mechanical equipment by fluid coupling, the above curves shall be furnished with and without coupling.
- iv) Thermal withstand curve under hot and cold conditions at rated voltage and max. permissible voltage.



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16.0 **CABLING SYSTEM**

16.1 **Cable Types**

16.1.1 For 6.6 kV services, XLPE cables with following specification shall be provided.

6600 volts unearthed grade single or multi core, stranded aluminium conductor, screened by triple extruded semi conducting compound gas cured, gas cooled, tree retardant, cross linked polyethylene insulated, cores screened with semi conducting compound is combination with copper tape, laid up, inner sheathed with extruded PVC compound type ST2, armoured with galvanised wire or strips for multi core cables and aluminium wire armoured for single core cables and overall sheathed with extruded FRLS PVC type ST2 cable complying with IS : 7098 part-2.

16.1.2 For 415 V power supply services, space heating, outdoor lighting, lighting in the hazardous areas, power supplies to lighting panels etc., XLPE power cables with the following specifications shall be provided.

1100 volt grade, single or multi core, stranded aluminium conductor, extruded XLPE insulated, cores laid up, inner sheathed with extruded PVC compound, armoured with galvanised steel wire or strip for multicore cables and aluminium wire or strip armoured for single core cables, outer sheathed with extruded FRLS PVC compound type ST2 complying with IS:7098 pt-1.

16.1.3 For control, protection, CT/PT connections and interlocks, metering, solenoids, and for digital signals from the field devices/junction boxes/switchgears to terminal cabinets of the control system etc., with signal voltages more than 60 volts, PVC control cables with the following specifications shall be provided. 1100 volt grade, multi core, stranded annealed high conductivity copper conductor (class 2 as per IS 8130), extruded PVC compound type A insulated, cores identified by numerals, cores laid up, inner sheathed with extruded PVC compound type ST1, armoured with galvanised steel wire/strip and outer sheathed with extruded FRLS PVC compound type ST1 cable complying with IS:1554, Pt-1.

16.1.4 For low voltage digital signals to instrumentation and control system and for the analog signals, instrumentation cables with following specification shall be provided :

Single pair, multi pair or triplets or quadruplets as required, stranded tinned, annealed, high conductivity copper conductor (class 2 as per IS

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8130), extruded PVC compound type-A insulated, cores identified by colour and coding, individual pair/triplet/quadruplets twisted, cores wrapped by non hygroscopic material by taping or extrusion, non metallic rip cord under wrapping, individual pair/triplet/quadruplet screened with aluminium mylar tape of 0.04 mm thick or copper tape of 0.04 mm thick or copper laminated plastic tape with 30% overlap, provided with 0.5 sq mm tinned copper drain wire for each cabling element, cabling elements suitably grouped, colour coded, cables overall screened with tinned copper wire braids of 0.15 mm dia with minimum coverage of 85% or aluminium mylar tape of 0.04 mm thick with overlap of 30%, inner sheathed with extruded PVC compound type ST1, armoured with GI wire strips/wires and outer sheathed with extruded FRLS PVC compound type ST1 complying with IEC.189-Part 1&2.

16.2 The HT & LT power cables shall be selected on the basis of current carrying capacity , short circuit rating and permissible voltage drop.

16.2.1 **Current carrying capacity**

The cable shall be able to carry the full load current of the circuit continuously under the specified ambient temperature and other conditions of installation. For this purpose, suitable derating factors shall be considered due to:

- (a) Thermal resistivity of soil
- (b) Ambient ground / Air temperature
- (c) Derating factor for grouping of cables over the current ratings at normal conditions given in standards. The design ambient air temperature and ground temperature for this plant shall be considered as 50 deg.C and 30 deg.C respectively.

16.2.2 **Short circuit rating :**

The cables for circuit breaker controlled circuits shall withstand the fault currents for the following fault clearing times.

- (a) Motor, service transformer (Protected by instantaneous over current protection) - 0.16 seconds
- (b) Tie feeders (with no IDMT relays on downstream) - 0.5 seconds
- (c) Others - 1 second

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For circuits which are protected by fuse short circuit rating capability need not be checked.

16.2.3 Permissible voltage dip normal running :

415V System: Voltage drop in cables between the transformer and the switchgear (PCC) or between PCC and MCC for full load current shall be limited to 2%. Further, the voltage drop in cables between PCC/MCC to the motor terminals for full load motor current shall be limited to 3% . However, these voltage drops may be adjusted in specific cases so that total voltage drop is within 5%.

16.2.4 Permissible voltage dip during starting :

- (a) 415V system : The voltage drop during starting of individual 415V motors shall be limited to less than 15% of the full load voltage.
- (b) 6.6kV system : The voltage drop during starting of BFP motors shall be limited to less than 20% of the full load voltage, for all other motors it shall be 15%.

16.2.5 Minimum conductor cross section for the power cables shall be 4.0 sq.mm aluminium or 2.5 sq. mm copper.

16.2.6 All D.C. power supply cables shall be single core cables.

16.3 Control cables

16.3.1 The minimum cross sectional area for control cables shall be 2.5 sq mm. However for Wiring of field device contacts (flow/level/pressure/temperature switches) to low burden circuits in annunciator relay panels, interlock relay panels, local cabinets etc., if the annunciator/ control/interlock relays are electro magnetic type, 1.5 sq.mm copper conductor can be used.

16.3.2 Current transformer leads shall be checked for lead burden, VA capacity and knee point voltage. In case 2.5 sq.mm Copper Conductor is not adequate, higher cross section cables shall be used.

16.4 Instrumentation Cables

16.4.1 The cross sectional area shall be 0.8 sq.mm or 0.5 sq.mm based on the requirement of I&C system employed. The minimum cross section however shall not be less than 0.5 sq mm.

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16.4.2 The instrumentation cables carrying digital signals shall have overall screening and analog signal carrying cables shall have each pair screening and overall screening.

16.5 **Specific Requirements of Cables**

The following aspects are applicable for all types of cables :

16.5.1 **Core Identification**

Colour coding shall be acceptable for all cables upto 5 cores. Cables with more than 5 cores shall have printed numerals on each core.

16.5.2 Core numbers with a minimum letter size of 3 mm shall be printed serially on each core of the control cable at intervals of not more than 200 mm.

16.5.3 Core numbers with a minimum letter size of 2 mm shall be printed serially on each core of the Instrumentation cable at intervals of not more than 200 mm and each core shall be colour coded as per IEC-189 Part-2

16.5.4 FRLS PVC compound for outer sheaths of all the cables shall meet the following performance requirements and cables shall pass these tests.

- (a) The critical oxygen index value shall be minimum 29 at room temperature and the temperature index value shall be minimum 250°C at oxygen index of 21 when tested as per ASTM-D-2863-77.
- (b) The maximum total acid gas generation as determined by titration shall be less than 20% by weight, when tested as per IEC 754-1.
- (c) The maximum smoke density rating expressed in percentage light absorption at any point on the curve during testing period shall not exceed 60 % when tested as per ASTM-D-2843-77.
- (d) The cables shall pass the hydrolytic stability and ultraviolet test as per DIN 53387. The measured values of ultimate tensile strength and elongation after the test shall not be less than 60% of that measured before the test.

16.5.5 The finished cables shall pass the flammability test as per IEC-332-1 and IEC-383. In addition it shall also pass flammability test as per class F3 of Swedish Standard S5-424-1475.

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16.6 **Tests**

16.6.1 The Bidder shall conduct the routine tests on each drum length, acceptance and type test on the cables as per applicable standards. Also special tests for critical oxygen index, temperature index values, acid gas generation, smoke generation, flammability test, effects of light and water test as specified shall be conducted on specimen, from different batches. Routine tests shall include but not limited to the following for instrumentation cables.

16.6.2 Test for dielectric strength for one minute (as per IEC-189-1)

16.6.3 Insulation resistance test (as per IEC-189-1)

16.6.4 The vendor shall carry out following type tests as per IEC.189-1 for instrumentation cables :

- (a) Tensile test
- (b) Test for stripping properties of insulation
- (c) Accelerated ageing test
- (d) Pressure test
- (e) Insulation shrinkable test
- (f) Solder test on conductor
- (g) Test for resistance of conductor
- (h) Mutual capacitance test
- (i) Capacitance unbalance test
- (j) Measurement of dimensions
- (k) Test for insulation resistance at 70°C
- (l) Cold bend test
- (m) Heat shock test.

16.6.5 **Cable carrier system**

(a) Following cable carrier system shall be adopted in various areas as indicated below.

- (i) Control room building :
 - Cable vault : Cable trays
 - False floor : Cables to be laid on the cable support arm
- (ii) Switchyard relay room
 - Cable vault : Cable trays
 - : Cables to be laid on the cable support arms

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- (iii) GTG building : Cable trays / conduits
- (iv) STG building : Cable trays / conduits
- (v) Switchyard and transformer yard : Cable trench
- (vi) Boiler area : Cable rack
- (vii) Boiler platforms : Cable trays
- (viii) Road / Rail crossings : Hume or steel pipes
- (ix) Cable carrier system connecting outlying areas : Cable rack or cable trenches
- (x) Off-side buildings and utilities : Cable trays
- (b) Cable tunnels shall have minimum head room of 1.8 m considering the obstruction due to light fittings, sprinkler piping, etc.
- (c) **Cable trench**
 - (i) Cable trenches shall be of different sizes depending on the number of cables laid in that route.
 - (ii) Preferred working space between the cable support arms and the wall are as follows. Contractor shall design the trenches accordingly.

Trench depth	Width of Trays	Working Space
1500 mm (5 tiers)	600 mm	750 mm
1200 mm (4 tiers)	600 mm	750 mm
1000 mm (3 tiers)	600 mm	750 mm
700 mm (2 tiers)	300 mm	350 mm

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(d) Cable trays

- (i) Cable trays of ladder and perforated types and the associated accessories such as coupler plates, tees, elbows, etc., shall be fabricated from 14 gauge (2.0 mm thick) mild steel sheets. Cable tray covers shall be fabricated from 16 gauge (1.70 mm thick) MS sheets.
- (ii) Cable trays and covers shall be hot dip galvanised.
- (iii) In battery rooms and water treatment plant, the cable trays, accessories and covers shall be epoxy painted.
- (iv) The spacing of rungs for ladder type of trays shall be not more than 250 mm.
- (v) Vertical raceways shall be formed by either structural members and slotted angles or by running the prefabricated trays vertically.

(e) Conduits & Pipes

- (i) The galvanised steel conduits shall be used for sizes upto 63.5 mm. The conduits shall be manufactured by electric resistance welding process and shall be hot dip galvanised. The conduits and fittings shall comply with IS:1653, 3837, 2667.
- (ii) Galvanised steel pipes shall be used for sizes from 80mm on wards. They shall be medium duty class-B type as per IS. The pipes shall be manufactured by electric resistance welding and hot dip galvanised. The pipes and fittings shall comply with IS.
- (iii) Flexible steel conduits shall be manufactured with electro galvanising process. The flexible conduits and their fittings shall comply with IS:3480, 4649.
- (iv) The hume pipes/RCC pipes shall comply with IS:458.

(f) Cable/Cable tray supports

- (i) Cable tray supports shall be fabricated from standard steel structures of different sizes. The sizes selected shall be adequate for the weight of cables/trays encountered.

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- (ii) The steel members shall be cleaned thoroughly for rust and painted as follows :
- For indoor - One shop coat of red oxide zinc chromate primer and two site coats of aluminium alkyd paint.
 - For outdoor & corrosive areas like battery room, R.O plant - Hot dip galvanised.

(g) Cable Carrier Installation practice

- (i) Minimum level difference between two tiers of horizontal cable trays in building, trenches, shall be 275 mm. In vertical race ways with multi-tiers the tiers shall be located atleast with 400 mm intervals.
- (ii) In trenches & tunnels the width of the cable tray shall be limited to 600 mm. In case of horizontal trays it shall be limited to 800 mm.
- (iii) Separate cable trays/tiers shall be provided for different voltage grade cable viz., 6.6 kV power, 415V/240V power, control cables and instrumentation & communication cables.
- (iv) Cable trays shall be supported at every 1000 mm interval. Cable trenches around the transformer shall be filled with sand.
- (v) Cable trays shall be welded to the mounting/carrier structures.
- (vi) Vertical trays (raceways) and all outdoor cable trays shall be provided with removable 16 guage galvanised MS sheet covers.
- (vii) Each continuous laid out length of cable tray shall be earthed at minimum two places by MS flats of minimum size 25mm x 3mm, the distance between earthing points shall not exceed 10 metres.
- (viii) When cables are taken in vertical raceways /trays and they pass from one floor & other floor pipe sleeves in concrete shall be provided.

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16.7 Cable Installation

16.7.1 Cables to each circuit shall be laid in one continuous length. Cable jointing and splicing shall be avoided. Jointing will be allowed only for the cases where the route length is more than the maximum possible drum length.

16.7.2 Outdoor cable installation

- (a) Where cables cross roads and water, oil, gas or sewage pipes, the cables shall be laid in hume or steel pipes. For road crossings, the pipe for the cable shall be buried at not less than 600 mm. Hume pipes shall be preferred to steel pipes from the point of view of corrosion.
- (b) The cables shall be tied to tray rungs by means of 3mm dia. nylon cord at an interval of 5000 mm and also at bends.
- (c) For good sealing arrangement at entry points, suitable pipe sleeves, adequate in number and of adequate sizes shall be provided in building walls/slabs for passage of cables into a building from cable trays/racks/cable trenches located outside the building.

16.7.3 Cables in Trays / on Racks

- (a) Different voltage grade cables shall be laid in separate trays. When trays are arranged in tiers, HV cables shall be laid in top trays and cables of subsequent voltage grades in lower tiers of trays.
- (b) The HV power cables shall be laid in trays/on racks as follows :
 - i) In single layer only without exception.
 - ii) 3 core cables to be laid in touching formation.
 - iii) Single core cables to be laid in trefoil groups.
- (c) 1100V grade power cables of 120 mm² size and above shall normally be laid in single layer in trays/on racks.
- (d) Smaller 1100V grade power cables below 120 mm² may be run in double layers, where required, due to space restrictions.

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- (e) Control and instrumentation cables can be laid upto a maximum of three layers in each tray/rack.
- (f) Single core power cables for 3 phase AC circuits laid in trays/racks/ trenches in trefoil groups shall be held in trefoil clamps placed at an interval of 3 m. The trefoil groups of cables shall be additionally tied by means of 3 mm dia. nylon cord as follows :
 - (i) At an interval of 1m when laid in cable trays/racks.
 - (ii) At an interval of 750 mm when laid in trenches without cable trays.
- (g) Control cables and small power cables on racks shall be run in ladder type cable trays supported on rack carrier arms. The cables shall be tied to tray rung by means of 3 mm dia. nylon cord at an interval of 5000 mm and also at bends.

16.7.4 **Bending radii for cables**

The bending radii for various types of cables shall not be less than those values specified by the cable manufacturer.

16.7.5 **Terminations, clamping and miscellaneous details**

- (a) Cable entry to motors, push button stations and other electrical devices shall be from the bottom as far as possible or from the sides. Top entry shall be avoided particularly for outdoor equipment.
- (b) Identification tags made from aluminium sheet shall be attached to each end of each cable by means of GI binding wire. Tags shall be additionally put at an interval of 30 metres on long runs of cables and in pull boxes.
- (c) All cable terminations shall be done with solderless crimping type lug. Cable terminations shall be done with double compression type brass cable glands.
- (d) Saddle type clamps to suit number of cables to be clamped at a particular location shall be used for clamping cables running along walls, ceilings, structures, etc. at 750mm interval.

16.7.6 H.T.cable termination shall be of heat shrinkable type.

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16.7.7 Testing and commissioning of cables

- (a) Cables shall be checked for insulation resistance before and after jointing.
- (b) High voltage testing

All cables of 1.1 kV grade 400 mm² and above and all HV cables shall be subjected to DC or AC (preferably DC) high voltage test after terminating but before commissioning as per Table 4 in IS:1255.

16.7.8 Earthing

- (a) Metallic sheaths, screens and armour of all multicore cables shall be earthed at both equipment and switchgear end.
- (b) Sheath and armour of single core power cables shall be earthed at switchgear end only. For long lengths of cables multiple earthing may have to be adopted to safeguard against the presence of standing voltages under normal as well as fault conditions.

16.7.9 Fire proof sealing system (FPS)

- (a) Fire proof sealing system shall consist of
 - (i) Fire-stops/fire-seals for sealing of cable/cable tray and conduit/pipe penetrations, both horizontal and vertical, through brick or RCC walls/floors, to prevent the spread of fire from one area which is separated from others by fire-resistant barriers.
 - (ii) 'Fire-breaks' provided on long runs of cable racks/trays to prevent the propagation of fire along the cable rack, within a single fire-area or fire- zone.
- (b) The FPS system shall also include all the necessary accessories and equipment required for supporting, holding in position, fixing and installation of the fire-stop/fire-break.
- (c) The FPS system shall comply in all respects with the requirements of the codes and standards listed below

IEEE-634, ASTM-E-814, ANSI-IEEE-383, IEC-331& IEC-332

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(d) Fire Stop/Seal

The FPS system adopted for cables or cable trays penetrating through walls and floor openings, or cables passing through embedded conduits/pipes/ pipe-sleeves, constitutes a `fire stop/seal', which is meant to prevent spreading of fire between areas separated by fire-resistant barriers.

(e) Fire Break

The fire proofing system, other than fire-stops, adopted to retard flame propagation along long runs of horizontal or vertical cable trays in the same fire zone or area, in an event of a fire, shall constitute a `fire-break' and shall be provided by applying a suitable fire-resistant coating on cables and cable trays for the required length, with or without a fire resistant panel, at the point of the fire break to obtain the fire-rating specified.

(f) Performance Requirements

(i) Requirement of fire stops

- The material, design and construction of the fire stops shall be such as to provide the fire-rating of 120 minutes for a fire on any side and meet all requirements listed in this specification and the relevant codes and standards.
- The materials used in the fire stops shall be non-hygroscopic, compatible with the type of cables.
- The fire stops shall be suitable for retrofitting of cables through the penetration seal without disturbing the sealing of the cables already existing.

(ii) Requirements of fire breaks

- Each fire break shall have a fire-rating of 30 minutes and shall be capable of withstanding for the duration specified, a fire on any side of the fire break.

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(g) Application of fire proof sealing system

(i) Fire stops

Fire stops shall be provided for cable penetration openings listed below

- The passage of cables/cable trays pipe sleeves/embedded conduits through walls / floors.
- Vertical raceways which carry cables between successive floors, through openings provided in the RCC floor slab, shall be sealed by fire stops at each floor level.
- Cable entry through openings in floor slabs below HT/LT switchgear, MCCs, various control and relay panels and other bottom entry panels, shall be effectively sealed by fire stops.

(ii) Location of fire breaks

- Fire breaks shall be provided on both cable rack and trenches at all cable tray intersections and tee-offs.
- On linear runs of cable trays between fire stops or fire breaks, fire breaks shall be provided at intervals of 15 metres on horizontal cable runs and 5 m on vertical cable runs.
- Fire breaks in linear runs of cable trenches between intersections and tee-offs shall be provided at intervals of 30 metres.

16.7.10 Contractor shall furnish the test certificates for the fire stops and fire breaks after award of contract for Owner / Owner's Representative review. If the certificates are not satisfactory all the tests shall be conducted free of cost. The offered system i.e. fire stops and fire breaks shall be identical (or better) with the system which is successfully type tested for the specified rating i.e. the composition density of the material, thickness of coating in case of fire breaks and any other properties of the material / system offered shall be identical or better than the tested system and shall be subject to Owner / Owner's Representative approval.

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16.7.11 Performance Tests: Tests on Fire Stops

- (a) The fire stops shall be subjected to the following type tests :
- (i) Fire Rating Test
 - (ii) Hose Stream Test
- (b) Type tests shall be conducted on different fire stop test specimens described above as per IEEE-634. The sizes of the fire stop test specimens, shall be similar to the largest of the sizes being used in the plant.
- (c) Preconditioning of fire stop test specimens
- Before conducting the fire rating and hose stream tests, each test specimen shall be preconditioned for thermal ageing, water immersion and vibration.
- (d) Test on Fire Stops
- During the fire rating test, the transmission of heat through the cable penetration fire stop shall not raise the temperature on its unexposed surface above the self ignition temperature of the outer cable covering, the cable penetration fire stop material, or material in contact with the cable penetration fire stop, with a maximum temperature limit on the unexposed surface of 200°C.
- (e) Tests on fire breaks
- Fire breaks shall undergo the following tests as per ANSI-IEEE-383 :
- (i) Ampacity test
 - (ii) Flame test

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SPEC. NO.CEGSW/
BIDADI/EPC/001

KARNATAKA POWER CORPORATION LIMITED

TITLE

**ELECTRICAL SYSTEMS -
EARTHING & LIGHTNING PROTECTION SYSTEM**

SECTION: D3.18

SHEET 1 of 6

18.0 **EARTHING SYSTEM**

Earthing system shall consist of earth grids and electrodes buried in soil in the plant area, embedded in concrete inside the buildings to which all the electrical equipment, metallic structures are connected to have earth continuity for safety reasons.

18.1 **DESIGN CRITERIA**

18.1.1 **Fault Current & Duration**

The earthing conductor shall be designed for 40 kA for a duration of 1 second.

18.1.2 **Conductor Material**

The earthing system conductors and accessories as proposed are to be as follows :

- (a) Conductors above ground level and in : Galvanised steel trenches
- (b) Conductors buried in ground or : Mild Steel embedded in concrete
- (c) Electrodes : GS Pipe / Rod
- (d) Lightning protection air termination and : GS Flat down conductors for buildings
- (e) Exposed lightning protection air : Lead coated copper termination on chimney top

The Bidder shall undertake the soil resistivity measurements at site and select suitable type of conductors.

18.1.3 **Size of Conductors**

(a) **Main Earthing Conductors**

The earthing conductor sizes shall be calculated IS 3043 and shall comply with Indian Electricity rules and IEEE-80.

The calculated size shall be suitably (depending on the resistivity of soil) increased as per table below to account for the loss of material (steel) due to corrosion in soil.

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SECTION: D3.18

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RESISTIVITY OF SOIL
OHM- METRIC

Reduction in thickness/diameter, mm

<10	8.0
>10 <25	7.0
>25 <50	5.5
>50 <75	4.5
>75 <100	3.0
>100	1.5

(b) Rod Electrodes

Galvanised steel rod electrodes of suitable diameter and length shall be used as per the recommendation of IS-3043. For test pits electrodes shall be heavy duty type (Class – C) GI pipe of suitable diameter with perforations. Electrodes installed in the test pits will have disconnecting facilities.

(c) Equipment Earthing Leads

The size of the earthing leads shall be decided based on the type of equipment and structure to be earthed and shall be provided generally as per IS-3043.

(d) Conductors for lightning protection system

The size of conductors for lightning protection system shall be decided based on mechanical strength.

18.2 EARTHING SYSTEM LAYOUT

18.2.1 The earthing system design and installation shall generally comply with IS-3043, IEEE-80 and Indian Electricity Rules.

18.2.2 General

(a) Metallic frames of all current carrying equipment, supporting structures adjacent to current carrying conductors, lightning protection system conductors and neutral points of various systems shall be connected to a single earthing system. Two earthing leads shall be used if rated voltage of equipment is above 250V. If the rated voltage is 250V or below, one earth lead shall be provided. Metallic structures adjacent to electrical equipment shall be earthed by one earthing lead.

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SECTION: D3.18

SHEET 3 of 6

- (b) Earthing conductors in outdoor areas shall be installed at a minimum depth of 600 mm.
- (c) All cable trays in the plant buildings as well as inside the trenches shall be connected to earth grid at an interval of about 10 m.
- (d) Each side of the generator neutral earthing resistor shall be terminated at two nos. treated pipe earth electrodes. The earth pipe electrodes shall be further interconnected to the buried earth grid.
- (e) Neutral of the auxiliary transformers shall be directly connected to two nos. treated pipe earth electrodes.

18.3.3 Earthing Conductor Layout in Switchyard

- (a) Main earthing conductors shall be laid in the form of a grid. Spacing between conductors, number of parallel conductors, etc., shall be decided such that step and touch potential are within safe limits.
- (b) The maximum permissible step and touch potentials shall be calculated in accordance with the formula, given in IEEE-80.
- (c) Earthing conductors shall be provided around the outside edge of fence at a distance of approximately 6000 mm. Fence grounding shall be done separately without connecting it to switchyard earthing grid.
- (d) An earthing mat comprising closely spaced (about 150 mm) conductors shall be provided below the operating handles of disconnecting switches and breaker operating kiosk for the additional safety of the operating personnel.
- (e) Each earth leads of transformer neutral, lightning arrester earth leads, CVT's earth leads shall be directly connected to two separate electrodes. Lightning protection down conductor shall be directly connected to a separate earth electrode. All earth electrodes in turn shall be connected to station earthing system. The earth grids of different areas of the plant shall be interconnected through, test pits to enable measurement of earth resistance for each area separately.

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**ELECTRICAL SYSTEMS -
EARTHING & LIGHTNING PROTECTION SYSTEM**

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18.3.4 **Earthing Conductors Inside Building**

- (a) Main earthing conductors shall be buried in earth around the building. Minimum two taps-off from this earthing loop shall be taken inside the building and connected to the earthing grid embedded in the floor slab with approximately 50 mm concrete cover.
- (b) In case, the building has more than one floor, each floor shall be provided with earth grid. Floor earthing grids shall be interconnected.
- (c) Each RCC / Steel column of the building shall be interconnected to the floor earthing grid in the ground floor.
- (d) Cable trays, steel pipes / conduits, steel columns, etc., shall not be used as earth continuity conductors.
- (e) Instrumentation system and computer system shall be provided with a dedicated earthing system suitable for the equipment.
- (f) Earthing grids of all the buildings, outdoor yards shall be interconnected to form a single grid for the plant.
- (g) Earthing grid design shall be done in such a manner that the grid resistance is less than one ohm.

18.4 **EARTHING SYSTEM INSTALLATION**

- 18.4.1 The spacing between two electrodes shall be atleast equivalent to twice the length of the electrode.
- 18.4.2 Earthing conductor running exposed on column, walls, etc., shall be supported by suitable cleating, at intervals of 750 mm.
- 18.4.3 The earthing conductor crossing the road / track shall be laid in hume pipe or laid at a greater depth to avoid damage.
- 18.4.4 When earth conductor passes through floors, walls, etc., suitable pipe sleeves shall be provided and the same shall sealed after installation.
- 18.4.5 The connection between earthing pads / terminal to the earth grid shall be made short and direct and shall be free from kinks & splices.

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- 18.4.6 Metallic conduits, and pipes shall not be used as earth continuity conductor.
- 18.4.7 Street lightning poles, flood light poles & towers, their junction boxes shall be connected to the earthing conductor to be run along with supply cable. This earth conductor shall be in turn connected to earth grid at two extreme points.
- 18.4.8 Flexible earth conductors shall be provided at expansion joints for earthing the gates, operating handles, etc..
- 18.4.9 Equipment bolted connection after being checked and tested shall be painted with anti-corrosive paint / compound.
- 18.4.10 Connection between the equipment earth lead and the grid conductor shall be welded. For rust protection, the welds shall be treated with zinc chromate primer and coated with zinc rich paint.
- 18.4.11 The cable sheaths, screens armour shall be earthed at both ends for multi-core cables. For single core cables the same shall be done at one end (switchgear end) only.
- 18.4.12 All bimetallic connections shall be treated with suitable compound to prevent moisture ingress.
- 18.4.13 Alternate switchyard fence posts shall be connected to the earth grid.

18.5 **LIGHTNING PROTECTION SYSTEM**

Lightning protection system shall consist of vertical air termination rods, horizontal roof conductors, downcomers, and pipe electrodes.

18.5.1 **Need for Protection**

The need for providing the lightning protection system shall be established by calculating risk index value for each building structure, etc., as per procedure given in IS-2309 and any building whose risk index is more than 40 (Probability of being struck/Acceptable risk) shall be provided with lightning protection.

18.5.2 **Lightning Protection System Layout**

- (a) The lightning systems design and installation shall generally comply with IS:2309 code of practice for the protection of building and allied structure against lightning.

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**ELECTRICAL SYSTEMS -
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SECTION: D3.18

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- (b) For stack air termination, rods interconnected by circumferential conductors will be provided at the apex of flue and also upon outer shell of the stack. The air termination system will be formed by lead coated copper conductors to prevent corrosion of conductors due to flue gas.
- (c) For cooling towers, air termination system will comprise of horizontal circumferential conductors at the top.
- (d) For switchyard down conductors from the shield wires shall be run along the tower and connected to rod / electrode. The zone of coverage for the shield wires and 45° on end conductor. shall be considered as 60° between two
- (e) Each down conductor shall be connected to a rod electrode which in turn shall be connected to the station earthing system through test links.


18.5.3


Lightning Protection System Installation

- (a) Conductors of lightning protection system shall not be connected with conductors of safety earthing system above ground level.
- (b) The down conductors shall be welded to steel structures at 1000 mm interval or cleated to wall at 750 mm interval. Wherever welded, the weld locations shall be treated to provide rust protection.
- (c) Each down conductor shall be provided with a test link at a height of about 1000 mm above ground level.
- (d) All the metallic structures within a vicinity of 2000 mm shall be connected to the lightning protection conductors.

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

QUALITY PLAN		CUSTOMER :		PROJECT		SPECIFICATION :				
 SHEET 2 OF 2 COMPONENT/OPERATION CHARACTERISTICS CHECK		BIDDER/ :		TITLE		NUMBER :				
		VENDOR		QUALITY PLAN		SPECIFICATION :				
SYSTEM		CAT.		ITEM AC ELECT. MOTORS BELOW 55KW (LV)		TITLE :				
SHEET 2 OF 2		TYPE/METHOD OF CHECK		ACCEPTANCE NORM		SECTION VOLUME III				
CHARACTERISTICS CHECK		EXTENT OF CHECK		FORMAT OF RECORD		AGENCY				
3. NAMEPLATE DETAILS		VISUAL		IS-325 & DATA SHEET		P W V				
3. NAMEPLATE DETAILS		100%		IS-325 & DATA SHEET		10				
3. NAMEPLATE DETAILS		100%		IS-325 & DATA SHEET		11				
1	2	3	4	5	6	7	8	9	10	11
NOTES: 1 ROUTINE TESTS ON 100% MOTORS SHALL BE DONE BY THE VENDOR. HOWEVER, BHEL SHALL WITNESS ROUTINE TESTS ON RANDOM SAMPLES. THE SAMPLING PLAN SHALL BE MUTUALLY AGREED UPON 2 WHERE EVER CUSTOMER IS INVOLVED IN INSPECTION, (1) SHALL MEAN BHEL AND CUSTOMERS BOTH TOGETHER. 3 FOR EXHAUST/VENTILATION FAN MOTORS OF RATING UPTO 1.5KW , ONLY ROUTINE TEST CERTIFICATES SHALL BE FURNISHED FOR SCRUTINY.										
<u>Legends for Inspection agency</u> 1. BHEL/CUSTOMER 2. VENDOR (MOTOR MANUFACTURER) 3. SUB-VENDOR (RAW MATERIAL/COMPONENTS SUPPLIER) P. PERFORM W. WITNESS V. VERIFY										
BHEL		PARTICULARS		BIDDER/VENDOR						
		NAME								
		SIGNATURE								
		DATE								
										BIDDER'S/VENDORS COMPANY SEAL

		QUALITY PLAN		CUSTOMER :			PROJECT TITLE :			SPECIFICATION NO. :		
		SHEET 1 OF 2		BIDDER/ VENDOR SYSTEM CAT.	EARTHING TYPE/METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	STANDARD QP NO. : PE-QP-999-509-E001, REV. 0	SPECIFICATION TITLE:	
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	4	5	6	7	8	9	DOC. NO. : AGENCY			REMARKS
1	2	3	4	5	6	7	8	9	P	W	V	
1.0	RAW MATERIAL		MA	VERIFICATION, OF TCS	100%	IS2062	IS:2062	MILL TC	3	-	1/2	Refer note in Remark at Sl. No.3
1.1	MILD STEEL (FLATS & RODS) AS PER SPECIFICATION	1.CHEMICAL & PHYSICAL PROPERTIES	MA	VERIFICATION, OF TCS	100%	IS - 1730	IS - 1730	QC RECORD	3/2	-	-	
		2.DIMENSIONS	MA	MEASUREMENT	100%	IS : 1079	IS : 1079	QC RECORD	3/2	-	-	
		3.SURFACE FINISH	MA	VISUAL	100%	IS - 209	IS - 209	QC RECORD	3/2	-	1/2	
1.2	ZINC	1.CHEM.COMP.	MA	CHEM.TEST	SAMPLE							
2.0	IN-PROCESS		MA	MEASUREMENT	100%	APP. DATA SHEET/ APP. DRAWING	APP. DATA SHEET/ APP. DRAWING	QC RECORD	2	-	1	
2.1	CUTTING, DRILLING	1.DIMENSIONS	MA	MEASUREMENT	100%	FREE FROM DEFECTS & SLAG	FREE FROM DEFECTS & SLAG	QC RECORD	2	-	1	
		2.SURFACE FINISH	MA	VISUAL	100%	IS:2629	IS:2629	QC RECORD	2	-	-	
2.2	SURFACE PREPARATION	1.CLEANING PICKLING, RINSING, & FLUXING	MA	VISUAL	PERIODIC IN EACH SHIFT	IS:2629	IS:2629	QC RECORD	2	-	-	
		2.SURFACE QUALITY	MA	VISUAL	100%	IS:2629	IS:2629	QC RECORD	2	-	-	
BHEL												
			PARTICULARS			BIDDER/VENDOR						
			NAME									
			SIGNATURE									
			DATE									
LEGEND :			1 - BHEL/ CUSTOMER	2 - VENDOR	3 - SUB- VENDOR	P - PERFORM	W - WITNESS	V - VERIFICATION	BIDDER'S/VENDORS COMPANY SEAL			

SL. NO.		COMPONENT/OPERATION		SHEET 2 OF 2 CHARACTERISTIC CHECK		QUALITY PLAN		CUSTOMER :		PROJECT TITLE :		SPECIFICATION NO. :											
								BIDDER/ VENDOR SYSTEM		STANDARD QP NO. : PE-QP-999-509-E001 REV. 0		SPECIFICATION TITLE:											
1		2		3		4		5		6		7		8		9		10		11			
2.3		GALVANISING		1. TEMPERATURE OF BATH 2. DROSS 3. RATE OF IMMERSION 4. SURFACE QUALITY		MA MA MA MA		TEMPERATURE INDICATOR VISUAL VISUAL/ MEASUREMENT VISUAL		CONTINUOUS PERIODIC 100% 100%		IS - 2629 IS - 2629 IS - 2629/ MFRS PRACTICE IS - 2629		IS - 2629 IS - 2629 IS - 2629/ MFRS PRACTICE FREE FROM BURRS, ROUGHNESS, SLAG, FLUX, STAIN ETC.		QC RECORD QC RECORD QC RECORD QC RECORD		3/2 3/2 3/2 3/2		- - 2 -		If vendor doesn't have his own galvanizing plant duly approved by BHEL PEM; then galvanizing shall be carried out at BHEL-PEM approved other galvanizing plants as per Annexure-2.	
3.0		FINISHED ITEMS		1. CHEMICAL 2. DIMENSIONS 3. SURFACE FINISH 4. MASS OF ZINC COATING 5. UNIFORMITY OF ZINC COATING 6. THICKNESS OF ZINC COATING 6. ADHESION		MA MA MA MA MA MA MA		CHEMICAL MEASUREMENT VISUAL CHEM. TEST CHEM. TEST ELCOMETER MECH. TEST		1 No./LOT/SIZE IS 2500 (PART 1) LEVEL S-4 IS 2500 (PART 1) LEVEL S-4 IS - 4759 IS - 4759 IS - 4759 IS-4759		IS-2062 APP. DATA SHEET/ APP. DRAWING FREE FROM BURRS, SLAG, ROUGHNESS, FLUX, STAIN, ETC. IS-6745 / APP. DATA SHEET IS-2633 APP. DATA SHEET IS-2629		LAB TC INSP. REPORT INSP. REPORT INSP. REPORT INSP. REPORT INSP. REPORT INSP. REPORT		2 2 2 2 2 2 2		- 1 1 - - - -		Note : Sample shall be selected by BHEL & testing shall be done at NABL/ govt. approved lab			
BHEL		PARTICULARS		BIDDER/VENDOR		BIDDER/VENDOR		BIDDER/VENDOR		BIDDER/VENDOR		BIDDER/VENDOR		BIDDER/VENDOR		BIDDER/VENDOR		BIDDER/VENDOR		BIDDER/VENDOR			
		NAME		SIGNATURE		NAME		SIGNATURE		NAME		SIGNATURE		NAME		SIGNATURE		NAME		SIGNATURE			
		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE			

LEGEND : 1 - BHEL/CUSTOMER 2 - VENDOR 3 - SUB-VENDOR P - PERFORM W - WITNESS V - VERIFICATION

		QUALITY PLAN		CUSTOMER :		PROJECT TITLE :		SPECIFICATION NO. :			
		SHEET 1 OF 2		BIDDER/ VENDOR :		STANDARD QP NO. : PE-QP-999-507-E006, REV. 0		SPECIFICATION TITLE:			
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	SYSTEM	CABLING	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY	REMARKS
1	2	3	4	5	6	7	8	9	10	11	
1.0	RAW MATERIAL										
1.1	MILD STEEL SECTIONS (CHANNEL & ANGLES) AS PER SPECIFICATION	1.CHEMICAL & PHY. PROPERTIES	MA	VERIFICATION OF TC'S	100%	IS-2062	IS-2062	IS-2062	MILL TC	3	Steel shall be procured from SAIL/ISCO/IRINJ/BHUSAN/JINDAL STEEL/JINDAL ISPAT/ESSAR/LLOYD/ISCO/ authorised SAIL Re Rollers.
		2.DIMENSIONS	MA	MEASUREMENT	100%	IS-808/IS-1852	IS-808/IS-1852	IS-808/IS-1852	QC RECORD	3/2	-
		3.SURFACE FINISH	MA	VISUAL	100%	IS:2062	IS:2062	IS:2062	QC RECORD	3/2	-
1.2	ZINC	CHEM.COMP.	MA	CHEM. TEST	EACH HEAT	IS-209	IS-209	IS-209	QC RECORD	3/2	1/2
2.0	IN-PROCESS										
2.1	CUTTING	1.DIMENSIONS	MA	MEASUREMENT	100%	APP. DATA SHEET	APP. DATA SHEET	APP. DATA SHEET	QC RECORD	2	1
		2. WELDING QUALITY (IF APPLICABLE)	MA	VISUAL	100%	GOOD WELDING PRACTICE	GOOD WELDING PRACTICE	FREE FROM DEFECTS & SLAG	QC RECORD	2	1
		3.SURFACE FINISH	MA	VISUAL	100%	FREE FROM DEFECTS & SLAG	FREE FROM DEFECTS & SLAG	FREE FROM DEFECTS & SLAG	QC RECORD	2	1
2.2	SURFACE PREPARATION	1.CLEANING, PICKLING, RINSING & FLUXING	MA	VISUAL	PERIODIC IN EACH SHIFT	IS:2629	IS:2629	IS:2629	QC RECORD	2	-
		2. SURFACE QUALITY	MA	VISUAL	100%	IS-2629	IS-2629	IS-2629	QC RECORD	2	-
2.3	GALVANISING	1.TEMPERATURE OF BATH	MA	TEMPERATURE INDICATOR	CONTINUOUS	IS-2629	IS-2629	IS-2629	QC RECORD	3/2	-
BHEL											
			PARTICULARS			BIDDER/VENDOR					
			NAME								
			SIGNATURE								
			DATE								
			2 - VENDOR			3 - SUB-VENDOR			P - PERFORM W - WITNESS V - VERIFICATION		
			1 - BHEL/CUSTOMER						BIDDER/SVENDORS COMPANY SEAL		

CUSTOMER :		PROJECT TITLE :		SPECIFICATION NO. :							
BIDDER/ VENDOR		STANDARD QP NO. : PE-QP-999-507-E006, REV. 0		SPECIFICATION TITLE:							
SYSTEM		CABLING		ITEM : CABLE TRAY SUPPORT MATERIAL (WELDED TYPE)							
CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD						
4	5	6	7	8	9						
3	4	5	6	7	8						
2	3	4	5	6	7						
1	2	3	4	5	6						
AGENCY	P	W	V	REMARKS							
DOC. NO. :	10		11								
3.0 FINISHED ITEMS	1. DIMENSIONS	MA	MEASUREMENT	IS 2500 (PART 1) LEVEL S-4	APP. DATA SHEET	INSP. REPORT	2	1	-		
	2. SURFACE FINISH	MA	VISUAL	IS 2500 (PART 1) LEVEL S-4	FREE FROM BURRS, SLAG, ROUGHNESS, FLUX, STAIN, ETC.	INSP. REPORT	2	1	-		
	3. MASS OF ZINC COATING	MA	CHEM. TEST	IS - 4759	IS-6745 / APP. DATA SHEET	INSP. REPORT	2	1	-		
	4. UNIFORMITY OF ZINC COATING	MA	CHEM. TEST	IS - 4759	IS-2633	INSP. REPORT	2	1	-		
	5. THICKNESS OF ZINC COATING	MA	ELCOMETER	IS - 4759	APP. DATA SHEET	INSP. REPORT	2	1	-		
	6. ADHESION	MA	MECH. TEST	IS-4759	IS-2629	INSP. REPORT	2	1	-		
BHEL											
PARTICULARS						BIDDER/VENDOR					
NAME											
SIGNATURE											
DATE											
LEGEND :						BIDDER/SVENDORS COMPANY SEAL					
1 - BHEL/ CUSTOMER						2 - VENDOR		3 - SUB- VENDOR		P - PERFORM W - WITNESS V - VERIFICATION	

CUSTOMER :		PROJECT TITLE :		SPECIFICATION NO. :						
BIDDER/ VENDOR		STANDARD QP NO. : PE-QP-989-507-E005, REV. 0		SPECIFICATION TITLE :						
SYSTEM CABLING		ITEM : CABLE TRAYS & ACCESSORIES		DOC. NO. :						
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY	REMARKS
1	2	3	4	5	6	7	8	9	10	11
1.0	RAW MATERIAL									
1.1	ROLLED SHEET	1.CHEM.& PHY. PROPERTIES 2.DIMENSIONS 3.SURFACE FINISH	MA	VERIFICATION OF TCS	100%	IS1079	IS1079	MILL TC	3/2	1/2
			MA	MEASUREMENT	100%	IS-1730/ APPD. DATA SHEET	IS-1730/ APPD. DATA SHEET	QC RECORD	3/2	-
			MA	VISUAL	100%	IS-1079	IS-1079	QC RECORD	3/2	-
1.2	ZINC	CHEM.COMP.	MA	CHEM TEST	EACH HEAT	IS-209	IS-209	QC RECORD	3/2	1/2
2.0	IN-PROCESS									
2.1	FABRICATION	1.DIMENSIONS 2.WELDING QUALITY 3.SURFACE FINISH	MA	MEASUREMENT	100%	APPD.DRG.	APPD.DRG.	QC RECORD	2	1
			MA	VISUAL	100%	GOOD WELDING PRACTICE	FREE FROM DEFECTS & SLAG	QC RECORD	2	1
			MA	VISUAL	100%	APPD.DRG.	APPD.DRG.	QC RECORD	2	1
2.2	SURFACE PREPARATION	1.CLEANING PICKLING & RINSING & FLUXING 2. SURFACE QUALITY	MA	VISUAL	PERIODIC IN EACH SHIFT	IS-2629	IS-2629	QC RECORD	2	-
			MA	VISUAL	100%	IS-2629	IS-2629	QC RECORD	2	-
BHEL										
PARTICULARS										
NAME										
SIGNATURE										
DATE										

LEGEND : 1 - BHEL/ CUSTOMER 2 - VENDOR 3 - SUB-VENDOR P - PERFORM W - WITNESS V - VERIFICATION

SHEET 2 OF 2		CUSTOMER :		PROJECT TITLE :		SPECIFICATION NO. :							
		QUALITY PLAN	BIDDER/ VENDOR	STANDARD QP NO. : PE-QP-999-507-E005, REV. 0	SPECIFICATION TITLE:								
SL. NO.	COMPONENT/OPERATION	SYSTEM	CABLING	ITEM : CABLE TRAYS & ACCESSORIES	DOC. NO. :	AGENCY		REMARKS					
1	2	3	4	5	6	7	8	9	10	11			
2.3	GALVANISING	CHARACTERISTIC CHECK	CAT.	TEMPERATURE INDICATOR	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	P	W	V		
3.0	FINISHED ITEMS	1. TEMPERATURE OF ZINC BATH	MA	VISUAL	CONTINUOUS	IS-2629	IS-2629	QC RECORD	2/3	-	-		
3.1	(CABLE TRAY, ACCESSORIES & HARDWARES)	2. DROSS	MA	VISUAL	PERIODIC	IS 2629	IS 2629	QC RECORD	2/3	-	-		
		3. RATE OF IMMERSION	MA	VISUAL	100%	IS 2629/ MFR'S PRACTICE	IS2629/ MFR'S PRACTICE	QC RECORD	2/3	-	2		
		4. SURFACE QUALITY	MA	VISUAL	100%	IS 2629	FREE FROM BURRS, ROUGHNESS, SLAG FLUX, STAIN, ETC.	QC RECORD	2/3	-	-		
		1. DIMENSIONS	MA	MEASUREMENT	IS-2500 (PART 1) LEVEL S-4	APPD. DRG	APPD. DRG	INSP. REPORT	2	1	-		
		2. SURFACE FINISH	MA	VISUAL	IS-2500 (PART 1) LEVEL S-4	APPD. DRG	FREE FROM BURRS, SLAG, ROUGHNESS, FLUX, STAIN, ETC.	INSP. REPORT	2	1	-		
		3. RIGIDITY (FOR TRAYS)	MA	DEFLECTION TEST	2 No./ LOT/TYPE	APPD. DRG	APPD. DRG	INSP. REPORT	2	1	-		
		4. MASS OF ZINC COATING	MA	CHEM. TEST	IS-4759	IS-6745/ APPD. DATASHEET	APPD. DATASHEET	INSP. REPORT	2	1	-		
		5. UNIFORMITY OF ZINC COATING	MA	CHEM. TEST	IS-4759	IS-2633	IS-2633	INSP. REPORT	2	1	-		
		6. THICKNESS OF ZINC COATING	MA	ELCOMETER	IS-4759	APPD. DATASHEET	APPD. DATASHEET	INSP. REPORT	2	1	-		
		7. ADHESION	MA	MECH. TEST	IS-4759	IS-2629	IS-2629	INSP. REPORT	2	1	-		
BHEL		PARTICULARS	BIDDER/VENDOR										
		NAME											
		SIGNATURE											
		DATE											
		LEGEND :		1 - BHEL/ CUSTOMER	2 - VENDOR	3 - SUB- VENDOR	P - PERFORM	W - WITNESS	V - VERIFICATION				



TITLE

LV MOTORS**DATA SHEET-A****1 X 370 MW YELAHANKA CCPP**

SPECIFICATION NO.

VOLUME II B

SECTION D

REV NO. 00 DATE 14.1.16

SHEET 1 OF 1

- 1.0 Design ambient temperature : 50 °C
- 2.0 Maximum acceptable kW rating of LV motor : 200 KW
- 3.0 Installation (Indoors/ Outdoors) : As required
- 4.0 Details of supply system
- a) Rated voltage (with variation) : 415V ± 10%
 - b) Rated frequency (with variation) : 50 Hz + 3 % to - 5%
 - c) Combined voltage & freq. variation : 10% (sum of absolute values)
 - d) System fault level at rated voltage : 50 kA for 1 sec
 - e) Short time rating for terminal boxes
 - o 110 kW and above (Breaker : 50 KA for 0.2 sec..
Controlled)
 - o Below 110 kW (Contactor : 50 KA protected by fuse
Controlled)
 - f) LV System grounding : Solidly
- 5.0 Class of insulation : Class 'F', with temp rise limited to class B.
- 6.0 Minimum voltage for starting : (a) 85% of rated voltage
(As percentage of rated voltage)
- 7.0 Power cables data : Shall be given during detailed engg.
- 8.0 Earth Conductor Size & Material : As per attached Datasheet of Earthing.
- 9.0 Space heater supply : 240 V, 1ϕ, 50 Hz
- 10.0 Rating up to which Single phase motor : Acceptable below 0.20 kW
- 11.0 Applicable standard : IS 325
- 12.0 Degree Of protection for motor/ terminal box : IP 54/ IP 55
- 13.0 Paint shade : Shall be given during detailed engg
- 14.0 Method of Starting : DOL
- 15.0 Cooling : TEFC

16.0 TESTING**16.1 Type Tests**

For LT Motors above 55kW, type test reports for type tests as per IS: 325/ IEC 60034 conducted on equipment similar to those proposed to be supplied and carried out within last five years from the date of bid opening shall be submitted. However, if such reports are not available, one motor of each type shall be subjected to type tests for free of cost.



TITLE

LV MOTORS

DATA SHEET-A

1 X 370 MW YELAHANKA CCPP

SPECIFICATION NO.

VOLUME II B

SECTION D

REV NO. 00 DATE 14.1.16

SHEET 1 OF 1

16.2 Routine Tests

All motors shall be subjected to routine tests as per IS: 325 / IEC 60034 in the presence of customer or customer representative.

	TITLE	<p style="text-align: center;">MOTOR DATA SHEET – C 1 X 370 MW YELAHANKA CCPP</p>	SPECIFICATION NO.
			VOLUME II B
			SECTION D
			REV NO. 00 DATE
			SHEET 1 OF 2

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

NAME OF VENDOR			SEAL	REV.	
NAME	SIGNATURE	DATE			

	TITLE	<p style="text-align: center;">MOTOR DATA SHEET – C 1 X 370 MW YELAHANKA CCPP</p>		SPECIFICATION NO.
	VOLUME			II B
	SECTION D			
	REV NO. 00			DATE
	SHEET			2 OF 2

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

NAME OF VENDOR			SEAL	REV.	
NAME	SIGNATURE	DATE			



**TECHNICAL SPECIFICATION OF
ELEVATOR FOR
1X370 MW YELAHANKA**

SPECIFICATION NO. PE-TS-409-502-A001

VOLUME II - B

SECTION -C

REV 00

DATE JAN 2016

**ANNEXURE-I
LIST OF MAKES**

SR. NO.	ITEM	SUPPLIERS	PLACE	REMARKS
1.	WIRE ROPES	USHA MARTIN	RANCHI	
		BHARAT WIRE ROPE	MUMBAI.	
2.	TRAILING CABLE	GEBEUR & 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	PREMIMUM ENERGY TRANSMISSION LTD,	PUNE	
		SICOR S.P.A-	ITLY	
		OEM		
5.	DRIVER MOTOR	Seimens-	MUMBAI	
		ABB	FARIDABAD	
		BHARAT BIJILI	-	
		CGL	-	
		KIRLOSKER	-	
6.	STAINLESS STEEL	OEM	-	
		SAIL,	-	
		MINOX METAL,	-	
7.	CR SHEET	JINDAL	-	
		ESSAR STEELS,	-	
8.	CABLES	BHUSHAN STEELS	-	
		DELTON,	-	
		NICCO	-	
		UNIVERASL,	-	
		FINOLEX,	-	
		CCI	-	
		MACROTHREM,	-	
		VARSHA CABLES	-	
		KEI.	-	
		PARAMOUNT	-	
9.	RELAYS	POLYCAB.	-	
		SIEMENS	-	
		SCHNEIDER TELEMCHANIQUE	-	
		SALZER,	-	
		SCHNIDER ELECTRIC.	-	



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SR. NO.	ITEM	SUPPLIERS	PLACE	REMARKS
10.	CONTACTORS	SIEMENS	-	
		L&T	-	
		GE	-	
		SCHNEIDER TELEMCHANIQUE.	-	
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	-	
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.



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ANNEXURE-III

List of Tools & tackles for elevator.

Sl. No.	DESCRIPTION	Qty.	Remarks
1	Spanner of all sizes required for maintenance	1 No.	
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	Other tools if any (Please specify)		



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ANNEXURE-IV**Drawing document submission schedule**

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

Note:

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



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ANNEXURE-V

MDL FOR ELEVATOR

S.NO.	BHEL DOC No	TITLE	PURPOSE	
1	PE- V0-409-502-A001	GAD OF SERVICE CUM CONTROL BUILDING ELEVATOR	APPROVAL	4
2	PE- V0-409-502-A002	DATA SHEET OF SERVICE CUM CONTROL BUILDING ELEVATOR	APPROVAL	4
3	PE- V0-409-502-A003	Manufacturing Quality Plan SERVICE CUM CONTROL BUILDING ELEVATOR	APPROVAL	4
4	PE- V0-409-502-A004	Detailed BOM/BOQ SERVICE CUM CONTROL BUILDING ELEVATOR	Information	8
5	PE-V0-409-502-A006	O & M Manual and Installation guide	Information	20

A= APPROVAL

I= INFORMATION

ANNEXURE-VI

Check List for Operation & Maintenance Manual

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

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

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

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

SITE STORAGE AND PRESERVATION GUIDELINES

FOR

MECHNANICAL BOPs

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



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

CONTENT

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

1. SCOPE OF THE DOCUMENT

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

2. PURPOSE OF STORAGE & PRESERVATION

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

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

a) GENERAL STORAGE REQUIREMENTS

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

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

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

b) GENERAL PRESERVATION REQUIREMENTS

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

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

c) GENERAL INSPECTION REQUIREMENTS

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

4. TYPE OF STORAGE FOR VARIOUS EQUIPMENT

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

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

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



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

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





iii Open storage (O)

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

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

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



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

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

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

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

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

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

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

5. CONCLUSION

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

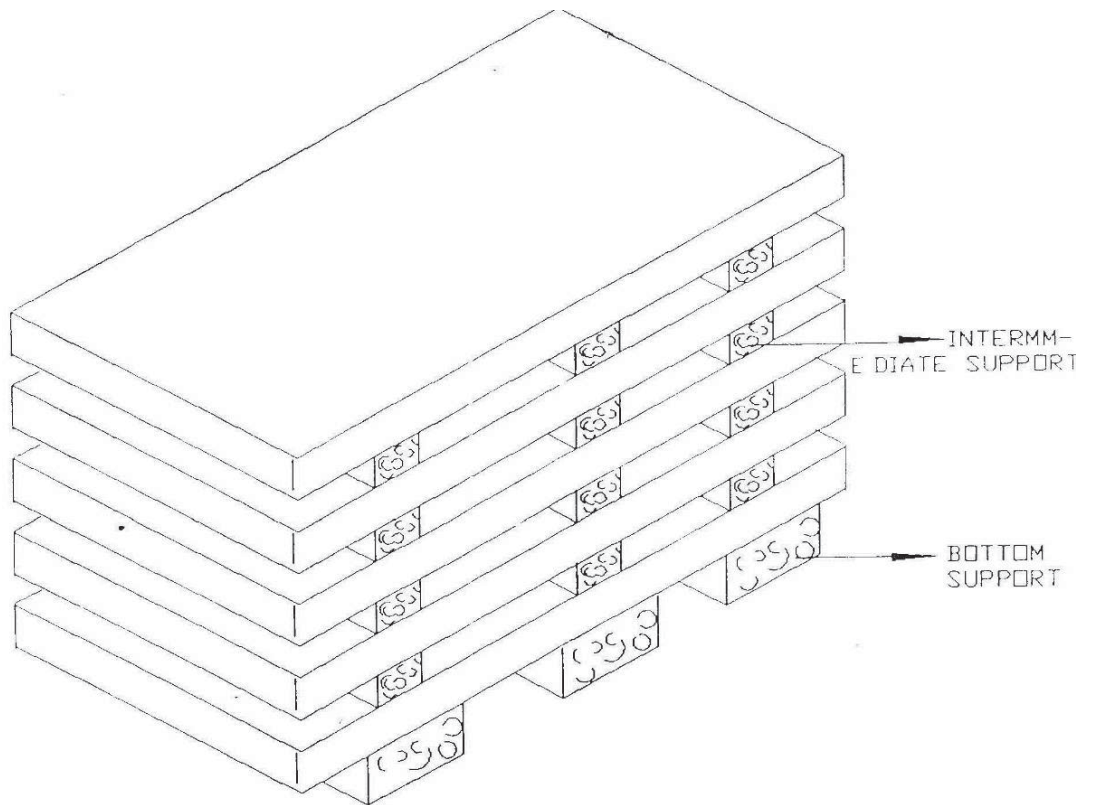


Figure – 1 – PLATE STACKING ARRANGEMENT

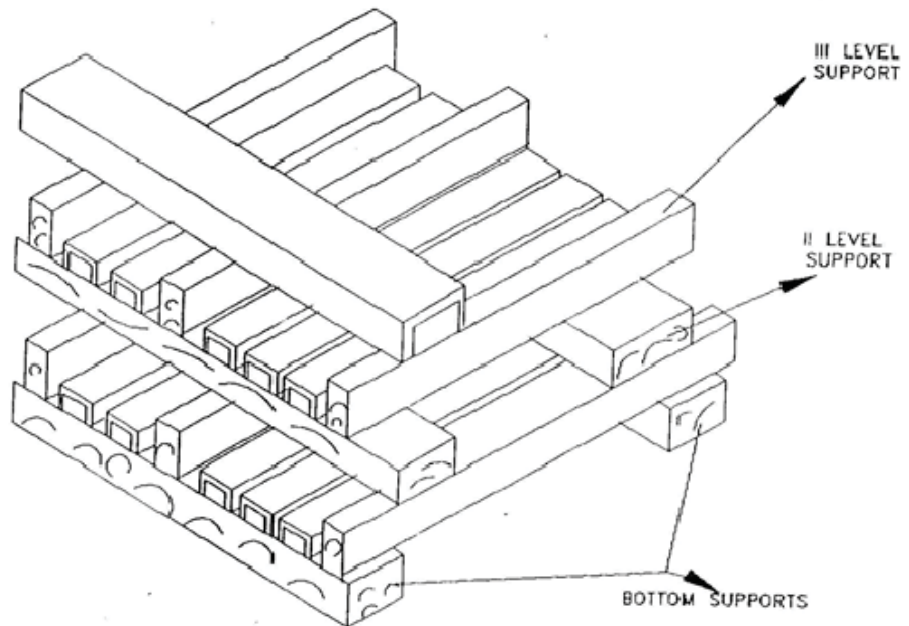


Figure – 2 – STRUCTURAL STEEL STACKING ARRANGEMENT

ANNEXURE VIII

Date: JAN 2016

CIVIL INPUT DETAILS.

Project: 350 MW YELHANKA CCPP.
Job No. K-10
PACKAGE: ELEVATORS

Details of Elevator shaft well dimension as per IS: 14665 (all parts) is tabulated below.

Building / Location	No. of elevator	Capacity of elevator (KG)	Type of elevator (Conventional / panoramic)	Type of service (Passenger Elevator / Passenger cum goods elevator / Goods cum passenger elevator)	Elevator shaft dimension (inside clear space over plaster) as per IS :14665 (C X D) mm		Elevator shaft construction with	Remarks
					C (Entrance)	D		
Control room building	1 No.	884	Conventional	Passenger Elevator	2500	1900	Clay Brick or concrete with plastered and white washed shaft walls from inside. (Plastering and white wash requirement may be omitted in case RCC shaft walls are being considered).	As per manufacturer's recommendation, fly ash brick not to be used.

Note:

1. Min height above M/c Room slab till M/c Room ceiling (below secondary roof beams) shall be 4.00 m.
2. Please note that Lift Well/Shaft dimensions furnished are as per IS 14665, Part-I. Further CIVIL to note that TOC of pit for Control room building elevator shall be (-)1.6 m.
3. Shaft construction shall be done with RCC or clay bricks (230 mm thk) only.



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SECTION -D

REV 00

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SECTION – D
STANDARD TECHNICAL SPECIFICATION FOR VVVF DRIVE



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SECTION -D

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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**



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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 +5 % 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



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- and need for training in several different units.
- 3.2 Inputs and outputs
- A. At least, the following standard Inputs and Outputs shall be provided, to be used in interface with the control system:
- Analogue Inputs : 1 x Programmable differential voltage input $\pm 10V$,
1 x Programmable current input 0(4) - 20mA
1 x Programmable voltage input 0 – 10V
- Analogue Output : 1 x Programmable analogue outputs 0(4) - 20mA or 0 – 10V
- Logic inputs : 6 x Programmable logic Inputs isolated from the mains
- Relay Outputs : 2 x Programmable Digital outputs with a changeover dry contact

All the control terminals shall be clearly marked.

- 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:
- Input Voltage
 - Input Frequency
 - Output Frequency
 - Output Power



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- 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:

Schneider Electric, L&T-YASKAWA, Siemens, ABB, Allen Bradley (Rockwell Automation).

PEM-6666-0



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

- 1) Schedule of technical deviation (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.

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 4.0 along with their offer then their offer is liable to be rejected.



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COMPLIANCE CUM CONFIRMATION CERTIFICATE

The bidder shall confirm compliance with following by signing/ stamping this compliance certificates (every sheet) and furnishes 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 resolved as per 'Schedule of Deviations', with regard to same.
- b) There are no other deviations w.r.t. specifications other than those furnished in the 'Schedule of Deviations'. Any other deviation, stated or implied, taken elsewhere in the offer stands withdrawn unless specifically brought out in the 'Schedule of Deviations'
- c) Bidder shall submit QP in the event of order based on the guidelines given in the specification & QP enclosed therein. QP will be subject to BHEL/ CUSTOMER approval & customer hold points for inspection / testing shall be marked in the QP at the contract stage. Inspection/ testing shall be witnessed as per same apart from review of various test certificates / Inspection records etc. This is within the contracted price with extra implications to BHEL after award of the contract.
- d) All drawings / data-sheets / calculations etc. submitted along with the offer shall be considered for reference only, same shall be subject to BHEL/ CUSTOMER approval in the event of order.
- 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. Prices for special tools & tackles, if any, shall also be included in the base price.
- 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. 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) That 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.

1X370 MW YELAHANKA CCPP

PRICE SCHEDULE - ELEVATOR PACKAGE

SI.No	DESCRIPTION OF EQUIPMENT / ITEM	Ex-works price	ED	CST / VAT	FREIGHT	E&C Charges	Service tax on E & C	Total
		3	4	5	6	7	8	9 (3 to 8)
1 1.0.0	<p>2</p> <p>Total lumpsum firm price inclusive of all taxes duties and other levies as applicable for design, engineering, manufacturing, inspection and testing, painting, supply of mechanical, electrical equipments and control system & equipments with minor civil works, delivery duly packed at project site including unloading, storage and handling at site, scaffolding supply, erection and commissioning, trial run at site, and handing over to the customer in line with drawings/ documents/ test procedures approved by BHEL/Customer for Service cum control building, one (1) no. 884 Kg capacity passenger elevator (conventional type) with speed 1.0 m/s, Three (3) nos. of landings including ground and 1.5 M (last landing elevation) Total travel, complete with all accessories, Erection and commissioning spares and one set of Maintenance Tools and Tackles (Annexure-IV) for the total scope defined for 1X370 MW YELAHANKA CCPP FOR ELEVATOR package as per technical specification PE-TS-409-502-A001 taking into account all clarifications, confirmations and agreements till date.</p>							
NOTES	Bidder to note that total price indicated above at 1.0.0 shall be considered for evaluation and hence should be complete in all respect for the full scope defined and considering all terms and conditions agreed.							
a	Any item not included in the price quoted above and shown separately will not be taken cognizance of and the offer shall be liable for rejection.							
b	Total Lumpsum price in column-9 should match with summation of total prices as in [Column (7) of 1.0.0 of Annexure- I + Column (6) of 1.0.0 of Annexure- III + Column (10) of A of Annexure- IV.							
c	As per cl. no. 3.0 of GCC Rev-06, Total erection & commissioning charges including service tax should be minimum 20% (or as specified in NIT) of the total quoted package price failing which the break-up of prices shall be adjusted accordingly for ordering.							
d	All deviations should be marked in Cost of withdrawal sheet (Annexure-V) only. Deviations marked elsewhere other than schedule of deviation shall not be taken into cognizance.							
	Bidder's / bidder's representative signature						Company seal	

PRICE SCHEDULE							
1X370 MW YELAHANKA CCPP							
ANNEURE-I							
MAIN SUPPLY - PRICE SCHEDULE FOR ELEVATOR PACKAGE							
Sl.No	DESCRIPTION OF EQUIPMENT / ITEM	2	Ex-works price	ED	CST / VAT	FREIGHT	Total
			3	4	5	6	7 (3 to 6)
1							
1.0.0	Total lumpsum firm price inclusive of all taxes duties and other levies as applicable for design, engineering, manufacturing, inspection and testing, painting, supply of mechanical, electrical equipments and control system & equipments with delivery duly packed at project site including scaffolding supply in line with technical specification for service cum control building, one (1) no. 884 Kg capacity passenger elevator (conventional type) with speed 1.0 m/s, Three (3) nos. of landings including ground and 11.5 M (last landing elevation) Total travel, complete with all accessories, Erection and commissioning spares, and one set of Maintenance Tools and Tackles for the total scope defined for 1X370 MW YELAHANKA CCPP. FOR ELEVATOR package as per technical specification PE-TS-409-502-A001 taking into account all clarifications, confirmations and agreements till date.						
NOTE	1) Any variation in total travel length and no of landing due to change in travel length and no of landing will be adjusted based on unit rates arrived from 3.1.0 and 3.2.0 below.						
2.0.0	Break Up Prices						
2.1.0	Total lumpsum firm price inclusive of all taxes duties and other levies as applicable for design, engineering, manufacturing, inspection and testing, painting, supply of mechanical, electrical equipments and control system & equipments with delivery duly packed at project site including scaffolding supply in line with technical specification for service cum control building, one (1) no. 884 Kg capacity passenger elevator (conventional type) with speed 1.0 m/s, Three (3) nos. of landings including ground and 11.5 M (last landing elevation) Total travel, complete with all accessories for the total scope defined as per technical specification PE-TS-409-502-A001, including E&C spares taking into account all clarifications, confirmations and agreements till date.						
2.3.0	Total lumpsum firm price inclusive of all taxes duties and other levies as applicable for supply/delivery duly packed at project site including freight, unloading, storage and handling at site, and handing over to the customer in line with drawings/documents approved by BHEL/Customer for one set of Maintenance tools and Tackles (as per Annexure -IV)						
2.4.0	Lumpsum firm prices of any other item under 1.0.0 inclusive of all taxes, duties and other levies as applicable (please specify)						
3.0.0	Unit rates for scope adjustment (both for (+) ve and (-) Ve variation)						
3.1.0	Additional/ takeout price for supply of one landing inclusive of all taxes, duties and other levies as applicable						
3.2.0	Additional/takeout supply price for per meter increase/decrease in total rise/travel inclusive of all taxes, duties and other levies as applicable						
	Bidder's / bidder's representative signature						Company seal

SUGGESTIVE PRICE SCHEDULE

1X370 MW YELAHANKA CCPP

ANNEURE-III

ERECTION & COMMISSIONING - PRICE SCHEDULE FOR ELEVATOR PACKAGE

S/No	DESCRIPTION OF EQUIPMENT / ITEM	Ex-works price 3	E&C Charges 4	Service tax on E & C 5	Total 6 (3 to 5)
1					
1.0.0	2 Total lumpsum firm price inclusive of all taxes duties and other levies as applicable for erection and commissioning, trial run at site, and handing over to the customer in line with drawings/ documents/ test procedures approved by BHEL/Customer for service cum control building, one (1) no. 884 Kg capacity passenger elevator (conventional type) with speed 1.0 m/s, Three (3) nos. of landings including ground and 11.5 M (last landing elevation) Total travel, complete with all accessories, for the total scope defined for 1X370 MW YELAHANKA FOR ELEVATOR package as per technical specification PE-TS-409-502-A001 taking into account all clarifications, confirmations and agreements till date.				
NOTE	1) Any variation in total travel length and no of landing due to change in travel length and no of landing will be adjusted based on unit rates arrived from 3.1.0 and 3.2.0 below. 2) As per cl. no. 3.0 of GCC Rev-06, Total erection & commissioning charges including service tax should be minimum 20% (or as specified in NIT) of the total quoted package price (excluding mandatory spares but including all taxes and freight), failing which the break-up of prices shall be adjusted accordingly for ordering.				
2.0.0	Break Up Prices				
2.1.0	Total lumpsum firm price inclusive of all taxes duties and other levies as applicable for erection and commissioning, trial run at site, and handing over to the customer in line with drawings/ documents/ test procedures approved by BHEL/Customer for service cum control building, one (1) no. 884 Kg capacity passenger elevator (conventional type) with speed 1.0 m/s, Three (3) nos. of landings including ground and 11.5M (last landing elevation) Total travel, complete with all accessories for the total scope defined as per technical specification PE-TS-409-502-A001, taking into account all clarifications, confirmations and agreements till date.				
3.0.0	Unit rates for scope adjustment (both for (+) ve and (-) Ve variation)				
3.1.0	Additional/ takeout price for Erection & commissioning of one landing inclusive of all taxes, duties and other levies as applicable				
3.2.0	Additional/takeout E&C price for per meter increase/decrease in total rise/travel inclusive of all taxes, duties and other levies as applicable				
	Bidder's / bidder's representative signature				Company seal

1X370 MW YELAHANKA

ANNEXURE-IV

List of Maintenance Tools & Tackles for Elevator package

Sl.no	Description	Qty.	Unit	Unit Ex-works price	Total ex-works price	ED	CST	FREIGHT	FOR SITE
1	2	3	4	5	6	7	8	9	10
1	Spanner of all sizes required for maintennce	1 No.							
2	Adjustable Spanner	1 No.							
3	Allen Key set all sizes required for maintennce	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	Other tools if any (Please specify)								
A	Total price for maintenace tools & tackles								

DEVIATION SHEET (COST OF WITHDRAWAL)**ANNEXURE-V****PROJECT:- 1X370 MW YELAHANKA****PACKAGE:- ELEVATOR****TENDER ENQUIRY REFERENCE:-****NAME OF VENDOR:-**

SL NO	VOULME/ SECTION	PAGE NO.	CLAUSE NO.	TECHNICAL SPECIFICATIO N/ TENDER DOCUMENT	COMPLETE DESCRIPTION OF DEVIATION	COST OF WITHDRAWAL OF DEVIATION	REFERENCE OF PRICE SCHEDULE ON WHICH COST OF WITHDRAWAL OF DEVIATION IS APPLICABLE	NATURE OF COST OF WITHDRAWAL OF DEVIATION (POSITIVE/ NEGATIVE)	REASON FOR QUOTING DEVIATION
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TECHNICAL DEVIATIONS

COMMERCIAL DEVIATIONS

PARTICULARS OF BIDDERS/ AUTHORISED REPRESENTATIVE

NAME	DESIGNATIONS	SIGN & DATE
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NOTES:

- For self manufactured items of bidder, cost of withdrawal of deviation will be applicable on the basic price (i.e. excluding taxes, duties & freight) only.
- For directly dispatchable items, cost of withdrawal of deviation will be applicable on the basic price including taxes, duties & freight.
- All the bidders have to list out all their Technical & Commercial Deviations (if any) in detail in the above format.
- Any deviation not mentioned above and shown separately or found hidden in offer, will not be taken cognizance of
- Bidder shall submit duly filled unpriced copy of above format indicating "quoted" in "cost of withdrawal of deviation" column of the schedule above along with their Techno-commercial offer, wherever applicable.
- Bidder shall furnish price copy of above format along with price bid.
- The final decision of acceptance/ rejection of the deviations quoted by the bidder shall be at discretion of the Purchaser.
- Bidders to note that any deviation (technical/commercial) not listed in above and asked after Part-I opening shall not be considered.
- For deviations w.r.t. Payment terms, Liquidated damages, Firm prices and submission of E1/ E2 forms before claiming 10% payment, if a bidder chooses not to give any cost of withdrawal of deviation loading as per Annexure-VIII of GCC, Rev-06 will apply. For any other deviation mentioned in un-priced copy of this format submitted with Part-I bid but not mentioned in priced copy of this format submitted with Priced bid, the cost of withdrawal of deviation shall be taken as NIL.
- Any deviation mentioned in priced copy of this format, but not mentioned in the un-priced copy, shall not be accepted.
- All techno-commercial terms and conditions of NIT shall be deemed to have been accepted by the bidder, other than those listed in unpriced copy of this format.
- Cost of withdrawal is to be given separately for each deviation. In no event bidder should club cost of withdrawal of more than one deviation else cost of withdrawal of such deviations which have been clubbed together shall be considered as NIL.
- In case nature of cost of withdrawal (positive/negative) is not specified it shall be assumed as positive.
- In case of discrepancy in the nature of impact (positive/ negative), positive will be considered for evaluation and negative for ordering.