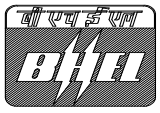
NEYVELI LIGNITE CORPORATION LIMITED
(NLC LTD)

NNTPP- (2X500 MW) LIGNITE FIRED UNITS AT NEYVELI

VOLUME - II B & III

TECHNICAL SPECIFICATION
FOR
ELEVATOR

SPECIFICATION NO. PE –TS – 402- 502 – A001



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

INDEX
VOLUME – IIB

SECTION - A

SCOPE OF ENQUIRY

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 Goods cum passenger elevator and passenger for **2X500 *MW NNTPP* at NEYVELI CUDALORE district, Tamilnadu state**, and necessary accessories including supply of mandatory spares, erection and commissioning spares, 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.

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.

SECTION - B

PROJECT INFORMATION

SECTION - 2

2 GENERAL PROJECT INFORMATION

2.1 Introduction

The project site at Neyveli has distinct location advantages, being at pit-head distance from the source of lignite supply from Mines, making it convenient for transportation of lignite by belt conveyor. Water source is readily available from the nearby mines lake. Besides, other infrastructure such as access road, railway connection etc, already exist.

2.2 Power Plant Site

The power plant site is located at Neyveli, opposite to the now defunct Fertilizer and Briquetting & Carbonization Plant, near TPS-1 Expansion and TPS-II.

2.3 Project & Site Information

(i).	Owner/Purchaser	:	Neyveli Lignite Corporation Limited (NLC Ltd), Neyveli, Cuddalore District, Tamil Nadu State, India
(ii).	Consultant	:	Lahmeyer International (India) Pvt. Ltd (LII), Gurgaon, NCR, India.
(iii).	Project Title	:	2x500 MW Neyveli New Thermal Power Station (NNTPS)
(iv).	Location	:	200 kms south of Chennai and 50 kms south-west of Cuddalore
(v).	Latitude	:	11° 34′ 00″ N to 11° 35′ 00″ N
(vi).	Longitude	:	79° 26′ 00″ E to 79° 27′ 00″ E
(vii).	Elevation above MSL	:	+67 m
(viii).	Nearest Railway Station	:	Neyveli,
(ix).	Nearest Sea Port	:	Chennai, at a distance of 200 km
(x).	Nearest Airport	:	Chennai, at a distance of 200 km
(xi).	Road Access/Approach to Site	:	Connected by Chennai-Thanjavur NH 45C road and state highway connecting Cuddalore – Virudhachalam via Neyveli. Both NH and state high way roads are well connected to NLC township roads.The approach road is approximately 15 kms from Chennai–Thanjavur NH – 45C road
(xii).	**Site Meteorological Data**		
	• Max ambient temperature	:	42.8° C

	• Min Ambient Temperature	:	26.9° C
	• Wet bulb temp	:	29° C
	• Max. Relative Humidity	:	92 % in the month of September
	• Min. Relative Humidity	:	23 % in the month of May
	• Rainfall	:	About 1265.7 mm annually (average)
	• Wind direction	:	South West to North East direction
	• Wind Speed	:	97.2 km/hr (maximum recorded) 4.3 km/hr (average wind speed)
	• Seismicity	:	As per IS: 1893 (part 4) (Zone-II) Importance factor: 1.75.
(xiii).	Languages spoken in the region	:	English, Tamil

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SECTION – C

SECTION C1-A
SPECIFIC TECHNICAL REQUIREMENTS

1.0 Introduction

Passenger elevator shall be provided for access to various operating floors / platforms in TG building and Service building for 2x500 MW NNTPP 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 and goods cum passenger elevator for 2X500 MW NNTPP as listed below:-

Sl. no	Building	No. of elevators	Capacity	No. of landings	Total rise	Type	Speed
1	TG building	2 No.	1088 Kg	0.0m, 8.5m, ,17.0m, 24.0m, 27.5m, 31.75m, & 36.0m. (Seven including ground)	36.0M	Conventional Type (Goods cum passenger elevator).	1.0 M/s
2	Service Building	1 No.	680 Kg	0.0m, 4.25m, 8.5m, 12.75 and 17.0m. (Five including ground)	17M	Panoramic type (passenger elevator)	1.00 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 hairline 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 hairline 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 or PA which shall be finalized during contract stage.

12) Ropes for hoisting.

13) Circuit breaker, switch fuse unit etc. in machine room for terminating the power supply cable (power supply cable provided by purchaser up to machine room level), other power/control and trailing cabling and equipment earthling.

14) Ladder in pits.

15) Emergency light with rechargeable battery.

16) All fixing materials require fixing rails, brackets, equipment including nuts and bolts.

17) Fascia plates (750 mm minimum) & sill angels.

18) Full length infra-red Curtain safety feature in door along with pressure limiter as an extra mechanical safety.

19) ELCB if required as per statutory requirement.

20) Any other equipment required to meet the requirement of local statuary 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 and machine room light cable conduit fixtures, switches 3 pin or as required by bidder during erection / maintenance purpose at every three (3) m.

23) Mirror for the car rear panel.

24) Floor announcement cum Music system to be provided.

25) Three (3) sided SS- mirror finish hand railing at suitable height.

26) Special Maintenance tools and tackles along with un-priced list with the offer.

27) Minor civil work including grouting as well as foundation bolt grouting as required during installation of elevator.

28) Scaffolding for erection of elevators.

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) Any other requirement stipulated by state statutory body shall also to be included by bidder in their scope.

37) Dummy landing/s, as required in case travel between two consecutive landings is more than 10 m, shall be considered by bidder in his offer.

38) Mandatory Spares

A complete unused and new set of Mandatory Spare parts shall be supplied. The items supplied shall be of the best quality and specially protected against

rusting in tropical climate. The minimum requirement of mandatory spare parts is listed in Annexure –II section-C, volume II-B of this specification.

NOTES:

1) Flooring for all elevators shall be MS CHQ plate for goods cum passenger elevator. PVC flooring for passenger elevator 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 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 IS 14665 (Relevant part). Bidder to refer the layouts attached in the specification for different building.

5) All Equipment's / facilities needed for erection commissioning shall be in bidder's scope.

6) Bidder to note that all LT Power cables (Fixed power and control cables etc), Trailing cable and instrument / signal cable for elevator shall be in bidder's scope as per electrical specification. Trailing cable shall be FRLS type (with strain bearing member).

7) Make of various bought out items & QAP shall subject to approval of BHEL / Customer during detail engineering stage.

8) Bidder shall provide all required spares during E & C without any commercial implication.

9) Car frame and structure (guide brackets, supports etc) shall be painted with epoxy based paint for all elevators.

10) Protection class for motor shall be IP 54 and main control panel shall be min IP 21and elevator control shall be VVVF type. Push buttons, Car operating Panel, Landing Operating Panel, Landing door motor and other equipment shall be IP-54.

11) Factor of safety for rope shall be 12 (min).

12) All Landing door shall be fire rated for at min 1 hour or as per latest IS / as per the state statutory requirements whichever is more stringent.

13) Motor shall be S4/S5 duty with insulation class F & temp rise limited to class B.

14) Bidder shall submit the following documents (min) for BHEL/customer approval during detail engineering stage:-

a) General arrangement of Elevator.
b) Technical data sheet of elevator.
c) Technical data sheet of motor along with power, control and trailing cable details
d) Wiring schematic diagram.
e) MQP for elevator along with test procedure of various components.

15) 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.

16) 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.

17) Bidder shall include scaffoldings required in their scope of work.

18) Elevator shall be provided with AC VVVF type drive control system.

19) All equipment shall be treated with anti corrosive paint / zinc plating.

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 equipment / 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.

11) Window Air conditioner of min 2 Ton capacity in the machine room which includes fans, air filter and accessories to prevent dust ingress in the machine room. However, successful bidder shall furnish heat load calculation and capacity of air conditioner after considering all actual heat loads of machine room during detail engineering stage for selection of final capacity of air conditioner.

12) 1/2 Kg CO2/suitable type Fire extinguisher in bidder scope. Fixing arrangement shall be provided in Car accordingly.

4.0 Exclusion

1) Complete civil works for hoist way, machine room, pit complete with the side enclosure (brick / RCC), interconnecting platform (if any) and monorail beam.

2) Electric hoist with travelling trolley of 3T capacity to facilitate handling of equipment in the machine room.

3) Power supply cable (AC 415 V, 3 Ph, 50 Hz) up to machine room level. 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) Bidder shall provide electronic door detector (infrared curtain type) along with pressure limiter as an extra mechanical safety.

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f) Two (2) push buttons, one for upward movement and the other for downward movement at each intermediate landing and one (1) push button at each terminal landing shall be provided in order to call the car. Digital hall position indicator at all floors, tell lights at all floors shall also be provided by the bidder.

g) All fixtures shall be in stainless steel face plates.

h) Push buttons shall be fixed in the car for holding the door open for any length of time required.

i) Every passenger and gods cum passenger lift shall be provided with an overloaded device, which will prevent the lift from starting in case the lift car is loaded to 110 % of the rated capacity of the lift or more. Lift shall remain stationary with door open. Audio and visual warning device shall be provided to alert the passengers in case of overload.

j) 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 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. 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 one (1) 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 confirm to IS-14665 or approved equivalent international standard.

ii) The lift will be providing with automatic travelling device which will take care of overrun and under run of the car and rope stretch that the car floor is within 6.0 mm from the landing level at the floors while in operation.

iii) The lift will be equipped with upper and lower terminal switches arranged to stop the car automatically within the limit of the top car clearance and bottom run-by, from the any normal operating speed.

iv) The elevator car shall be provided with SS-304 sheet fabricated, bright finished to approved shade (including landing doors of the car). Vitrified ceramic tile of matt finish 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 (all parts) 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.

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.:-

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 3 make.

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) 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.

20) List of tools and tackles in terms of numbers shall be furnished by the bidder along with the offer.

21) List of commissioning spares and list of 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 "Technical deviation 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.

VOLUME II A
SECTION XI
~~EOT CRANES, HOISTS &~~ ELEVATORS

Document Number	Rev No.	Description	Page No.	Date of Issue
LII-GEOE11019-G-00155-002	02	NTA2 Vol-IIA, Sec – XI, ~~Cranes~~	i	25-Jun-11

11.14. PASSENGER & FREIGHT CUM PASSENGER ELEVATORS

11.14.1 INTRODUCTION

It has been decided to provide the following:

1) One number "**680 kg VIP Elevator**" in Service Building

2) Two numbers "**1088 kg Freight cum Passenger Elevator**" in TG Building on both the ends.

11.14.2 SCOPE OF WORK

The scope of work of the bidder shall consist of design, manufacture, fabrication, supply, inspection, transportation to site, erection, testing and commissioning of **VIP elevator and Freight cum Passenger elevators** of latest design, to be operated with or without an attendant at Service Building and TG building.

a. Supply of necessary fixtures, if any, required for erecting the elevator in position shall also be under bidder's scope of work.

b. The bidder shall quote separately item wise prices for supply of mandatory spares. Proper coding and referencing of spare parts shall be done so that later identification with appropriate equipment shall be facilitated.

c. The scope of supply shall cover the required quantity of initial fill of grease, lubricants hydraulic fluids etc. (including quantity required for flushing and upto completion of trial operation), consumables and commissioning spares necessary for erecting and commissioning the equipment.

d. Technical data sheets as enclosed shall be duly filled in and submitted along with the Bid.

e. Necessary statutory clearance / certificate if applicable, shall be obtained by the bidder.

f. Mechanical details:

- The elevator cage shall be of welded steel construction with floor made of suitably braced chequered plates for 1088kg Passenger cum freight elevators where as for 680 kg VIP elevator, lift well shall be of RCC construction.
- Vertically biparting Sliding type doors shall be provided and shall be suitable for the purpose intended. Necessary interlocking between the doors and car movement during normal operation shall be provided. Complete car body with fan on top shall be provided. The landing doors shall be provided with arrangement for opening it during emergency.
- The driving mechanism for the elevator shall be installed in a machine room located and designed suitably for easy maintenance. Machine room shall be provided with adequate ventilation facilities.
- The elevator shall be suitable to operate without any operator. Every floor shall be provided with call push button and indication about movement and its direction. The elevator cage shall be provided with necessary switches including limit switches, landing stop switches, door contacts, counter weight buffers, car buffers, emergency light, emergency bell, switch and floor indicator. It shall also be provided with overload alarm and protection.

- An over speed safety device to stop the car whenever the car achieves runway speed limit resulting from high speed descending of the car shall be in the scope of Bidder. The actuation of safety device shall cut off the power supply to the motor and apply the brake immediately.
- Terminal limit switches shall be provided to slow down and stop the car automatically at the terminal landing. To arrest the movement of car beyond the terminal landings, final limit switches shall be provided which on operation cut off the power and apply the brake immediately. Inching device shall be provided for accurate position of the car with landings.
- Necessary light points in the elevator machine room, in the hoist way and pit for the proper illumination of shaft and pit.
- Necessary test weight for carrying out the load test shall be provided by the Bidder.
- Commissioning spares required for the lift shall be included in the scope of the Bidder..
- Safe access for maintenance and removal of all mechanical and electrical parts shall be ensured to the extent possible, without additional scaffolding.
- All parts requiring replacement or inspections or lubrication shall be easily accessible without the need for dismantling of major parts/equipment.
- All machinery or equipment included under this specification shall be equipped with safety devices and clearances to comply with recognized standards and purchaser's requirement.
- Minor civil works and equipment grouting of all bolts, sills, support members, indicator and button box etc.
- Difference in levels of the car floor and landing, shall be maximum ± 25 mm as per IS.
- Suitable lubrication system shall be provided for guide rails as well as for other items required to be lubricated periodically.
- The hoist rope shall have adjustable self-aligning hitches.
- Steel T-Guides shall be provided for the car and counter weight. The counter weight shall be guarded/ protected by means of wire mesh cage for safe operation.
- Suitable spring buffers shall be provided as a means of stopping the car and counter weight at the extreme limits of travel. Buffers in the pit shall be mounted on steel channels which extend between both the car and counter weight guide rails.
- As per latest IS, automatic rescue device (ARD) shall be provided in the elevator for emergency exit in the event of fire or any other emergency.

g. General

The elevators shall conform to the following stipulations, in general:

- The elevator shall be designed in accordance with IS: 14665 (Part I) Part – 2/Sec – 1, Part – 3/Sec – 1)2000 and IS: 14665 (Part 4/ Sec 1 to 9) 2001 and other relevant IS specifications and subject to any modifications and requirements specified herein after.
- Elevators shall be installed inside the building to facilitate movement of man and material to various floor levels and shall operate from lower most level to top most level and shall be located at identified location.
- The elevator shall be operated electrically with fittings as indicated in technical parameters.
- The elevator shall be equipped with all standard safety systems such as Bell and cranking in case of power failure, emergency rescue battery back-up, hand wheel connected with motor shaft for manual lowering of elevator to the nearest landing level incase of power failure, limit switches, indicators, over speed safety governor for car, emergency light fittings, etc.
- The elevator shall be suitable for continuous 24 hours round-the-clock operation.
- The motor for the elevator shall be squirrel cage induction motor with speed resistance control/ VVVF control for controlling the speed during starting and stopping at landings
- Trouble-free performance of the elevator incorporating the operational, controlling and safety requirements, as specified, is to be guaranteed.
- The Bidder under this specification shall assume all responsibility in proper design and operation of each and every component of the elevator as well as the elevator as a whole.
- Complete drive, electrical and mechanical control equipment, & control panel etc., shall be installed in the machine room.
- A selector switch and a set of push buttons shall be provided on the top above the ceiling of the car to operate the elevator locally for inspection and maintenance. The selector switch when set to position “Inspection" shall exclude control from other places and movement of the car in the desired direction shall be effected by the push buttons.
- For normal operation of the elevator, the selector switch shall be set to the position working. It shall be possible to operate the elevator only when the appropriate button is kept in pressed condition
- Provision shall be made for a safety gear, which shall operate in case of free fall or over speeding of elevator car or counter weight in the descending direction. This safety gear, while freezing the cabin mechanically to the guides, shall also interrupt the control supply through a limit switch.

- The particular landing door shall open only after the elevator car has stopped at the landing. Additional provision shall be made for opening of the landing door in case of emergency by means of a special key. The landing doors shall be so designed that their closing and opening is not likely to injure a person.
- Provision shall be made to prevent the opening of any landing door when the car is passing that zone in response to a call from another landing.
- At all the intermediate levels "Up" & "Down" call buttons with indicators shall be provided. Car position indicator shall also be provided at all levels. At ground level, "Up" call button with indicator & at top most level "Down" call button with indicator shall be provided.
- The circuit which supplies current to the motor shall not be included in any twin or multi-core trailing cable used in connection with the control safety devices /signaling equipment.
- Difference in levels of the car floor and landing shall not exceed the figures indicated in IS 14665 (Para 3/Sec 1 & 2)-2000 on page 4 sub clause c as +/- 12 mm under heading "Levelling Accuracy Max ".
- For other details relevant BS standards shall be followed.

h. Design construction and performance requirement.

- Load:

  The elevator shall be designed to lift the pay –load in addition to weight of the car itself and other accessories.
- Speed

  The elevator shall travel at a speed mentioned in the technical characteristics
- Size

  The inside dimensions of the platform of the car (clear inside) shall be as furnished. The inside clear height of elevator shall be 2300 mm.
- Travel and landings

  The lift car shall travel from ground floor at reference elevation to top landing as specified in the technical parameters table. In between these two levels the car shall stop at every intermediate platform level.
- Wire Rope

  The car and counter weight shall be suspended by steel wire ropes. The number of wire ropes and size of wire rope shall be so chosen that highest factor of safety is achieved as per standard (IS 2266). Also not less than three independent suspension ropes shall be used. However the minimum diameter of rope shall be 12mm and factor of safety shall be 12.
- Car

- **Car frame**
  Every elevator car shall be carried in a complete frame of steel which shall be sufficiently rigid to withstand the operation of the safety gear without permanent deformation to the car frame. The car structure shall be of steel with special painting or of stainless steel.

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

- **Car enclosure**
  The car shall be enclosed on all sides by means of car body and door. The sides of the car shall be lined with heavy gauge stainless steel sheet plate in hair line finish with properly braced and reinforced.

  The enclosure shall be flush on the inside and securely fastened to the platform. The car body floor shall be of M.S steel construction with chequered plate top for 1088kg passenger elevators where as car body floor shall be of M.S steel construction with Vinyl tiles top for 680 kg VIP elevator. Side panels shall be of stainless steel grade 304 in hair line finish and roof/ false ceiling of stainless steel/ powder painted with lighting and fans over MS frame.

  The car shall be equipped with handrails on three sides at one metre height from the car floor, fan with grills and suitable lighting with fittings. The light shall be left on during the whole time of use. The car shall be provided with floor selector panel and indication about movement and its direction. The car shall be provided with necessary switches including limit switches, landing stop switches, door contacts, counter weight buffers, car buffers, emergency light, emergency bell and switch. It shall also be provided with overload alarm and protection.

  Necessary provisions shall be made for adequate ventilation of the car. Ventilation opening shall be provided in the enclosure roof as per requirement of IS: 14665 (Part 3/Sec 1 & 2)-2000. A separate switch shall be provided in the car for the fan.

  The enclosure of the elevator car shall withstand a thrust of 35 kgs applied normally at any point, excepting any vision panel, without permanent deformation.

- **Car platform**

  Car platform shall be constructed of structural steel shapes or securely fastened with steel flooring covered with polyvinyl flooring.

The platform shall be designed on the basis of rated loads evenly distributed. The car floor shall comprise a smooth non-slip surface.

Since the car leveling device shall be used, subsequent aprons of sufficient depth shall be fitted to the car floor to ensure that no space is permitted between the threshold and the landing while the car is being leveled to a floor.

- **Car roof**

  Car roof shall be covered with sheet metal to prevent dripping of lubricants from ropes-sheave bearings. The top flooring shall be of steel with decorative false ceiling. A three pin plug socket with a switch for head lamp shall be fitted on the top of the car for use during maintenance. The roof shall be strong enough to support atleast two persons.

  Provision for slow speed (1/2 of rated speed) operation from car top in up and down directions in independent mode shall be made to facilitate maintenance of devices in the hoist way. Necessary fittings shall be provided for this purpose.

  Manhole with door shall be provided for maintenance purpose.

- **Car Door**

  The elevator car shall be provided with vertically biparting doors.

  The door of elevator shall open at all the platform levels.

  Car door shall be made up of stainless steel in hair line finish. Car door shall have a clear opening of 800 mm wide X 2000 mm high for 680 Kg VIP Elevator and for the 1088 kg Passenger elevator it shall be 1000 mm wide X 2000 mm high. The door operation shall be automatic and designed in such way not to injure the person entering inside the car.

- **Hoist way door**

  Vertically biparting type doors having a clear opening as per IS:14665 (Part 4/ section 6): 2001 shall be provided at each of the landing for elevator door

- **Door hangers & tracks**

  Hangers and tracks for car door and each having a clear hoist way door shall be provided. Suitable material shall be used to minimize the noise. Ball / roller bearings or equivalent arrangement shall be provided to take upward thrust of the doors. Suitable devices shall be provided for transmitting from one door panel to the other.

All required material for landing entrance e.g. extruded aluminum or equipment sills, structural angles, headers etc. shall be provided.

- **Door operation for car door and hoist way doors**

  The doors operations shall be **automatic**. However the door operation shall be equipped with an additional opening provision with a key to operate manually during power failure. The necessary door cushioning device shall be provided.
  Necessary safety devices shall be provided to prevent the movement of the car until the car door and hoist way doors are closed properly.

i. Car Self-Leveling Device

The elevator shall be equipped with automatic self-leveling devices to bring the car to the floor landings. These self leveling device shall be correct for over travel or under-travel and rope stretch.

j. Control and operation

The elevator control i.e. the system governing starting or stopping the elevator machine, determine the direction of the travel, regulating the rate of travel, regulating the rate of acceleration and deceleration and controlling running speed of the moving member shall be through 3 phase two speed squirrel cage induction motor. The AC drive motor for the elevator shall be accelerate or decelerate the elevator according to requirement. Reversal in direction of movement of the elevator shall be achieved by reversing the motor 3phase supply.

The operation of the elevator i.e. method of actuating the control shall be " Selective Collective Automatic Operation" as per clause 3.41.3 of IS 14665 (Part2/Sec1) : 2000 with and without attendant. All accessories required for the "collective operation as outlined therein, namely selector and its driving shall be furnished complete.

The controller shall be preferably microprocessor based.

k. Car Operation Panel

In the car the Bidder shall provide an operation panel containing push buttons numbered to the landing served; two position switch marked to indicate "" with attendant" and "without attendant" an emergency call button connected to alarm bell to serve as an emergency signal; push buttons or switches for fans and other facilities provided in the elevator as required.

l. Car Position Indicator in Car

A signal indication shall be provided by the appropriate numeral (which shall be floor no./ level of respective floor) being illuminated when the car is passing the corresponding floor. The indication shall remain illuminated when the car is stopped at a floor. Up & Down direction jewel lights shall also be

provided. The car position indicators are needed to be provided at all landings.

Provision to indicate lift capacity in Kg as well as in terms of person, shall be made available in the car. Other signals like "over load" "Lift is under maintenance" etc. shall also be provided.

m. Push Button Station and Call- Registered Tell-tale Lights at Hoist way

A single 'Up" and "Down" push button at terminal landings and "Up" "Down" each push intermediate landing including call register light for each push button shall be provided. These shall remain illuminated till the call is answered.

n. **Emergency Exit.**

The elevator car shall be provided with an emergency exit (on top of the car) of adequate dimension.

o. **Terminal Buffers**

The terminal buffers shall be provided for stopping the car and the counter weight at the extreme ends of travel. All structural steel members required to install the buffers shall be supplied by the lift supplier.

p. **Counter-Weights and Counter-weight Frames.**

Counter weight sections shall be mounted on structural metal frames so designed to retain the weights securely in its place.

Counter –weight frame shall be guided on each guide rail by upper and lower guiding members attached to the frame

A substantial metal counter- guard of required length shall be provided at the bottom of the hoist way.

A compensating chain of adequate strength connecting car bottom and counter weight frame shall be provided for balancing the car and counter-weight while running with minimum load condition.

q. Guides for Car and Counter- weight.

Car and counter- weight guides shall be of rigid steel and shall be continuous throughout the entire length and shall be provided with adequate steel bracings and stiffeners. Guide for both car and counter weight shall meet the requirement of IS: 4666-1980. The necessary lubrication device for guide rail shall be provided.

r. Terminal Limit Switches and Final Limit Switches

Terminal limit switches for normal operation shall be provided to slow -down and stop the car automatically at terminal landings and final limit switches shall be provided to automatically cut off the power and apply the brake, when the car travel beyond the terminal landing.

s. Traction Machine

The design ambient temperature for this equipment shall be taken, as 50° C. The motor insulation shall be class F or superior. The motor shall be S5 duty incase of regenerative or dynamic braking is applied.

Space heater with thermostat shall be provided where necessary.

Protective relays shall be furnished on the controller to protect against phase reversal, low voltage and phase failure. Overload and other protective relays shall also be furnished for traction motor.

t. **The elevator after erection shall be tested as follows:**

- Load test with 100% and 110% of rated load as per IS: 14665 - 2000.
- A static load test with 125% of rated load as per IS: 14665 – 2000 to check that the brake shall sustain the car.
- All other tests on electrical system as mentioned in IS: 14665 - 2000.
- Any other test felt necessary by Owner and supplier to ensure proper functioning and installation of the lift.
- Demonstration of the functioning of all safety provisions made available in the elevator.

The successful Bidder shall arrange for sample weights, slings, wire ropes, stop watches and other necessary equipment/ instrument to carryout the test.

u. Technical characteristics

Sl.No	Description	Freight cum Passenger Elevator	VIP Elevator
1	Capacity	1088 Kg	680 Kg
2	Location	TG Building B-C bay on both the ends	Service Building B-C Bay
3	Quantity	2 Nos.	1 No.
4	Type	Electrically operated	Electrically operated
5	Car speed	No. of Floor	Speed
		4 to 5	0.5 to 0.75 m/s
		6 to 12	0.75 to 1.5 m/s
		13 to 20	Above 1.5 m/s
6	Total Car travel	As per layout requirement	
7	No. of landings	As per layout requirement	As per layout requirement
8	Landing levels	All floors in TG building in B-C Bay up to Deaerator Floor. However, exact no. of landings shall be decided by the Bidder.	All floors in service building with interconnection to TG building at all floors. However, exact number of landings to be

Sl.No	Description	Freight cum Passenger Elevator	VIP Elevator
		Final no.of landings shall be approved by the purchaser.	decided by the Bidder. Any other landings where access is required shall be considered.
9	Location of machine room	Directly above the Lift well. The approach to the machine room shall be provided from the Deaerator floor.	
10	Power Supply	1 No. ACB Feeder of suitable rating shall be made available by the Bidder at 415V ,3 ph.N/E bus.	1 No. ACB Feeder of suitable rating shall be made available by the Bidder at 415V ,3 ph.N/E bus.
11	Signals	Landing calls registered indicators, UP / DOWN (visual) Combine luminous button with Digital hall position indicator in car and at all Floors.	
12	Car gate & landing gate	Sliding type vertical biparting doors	
13	Car panels	Stainless Steel panels in hair line finish (Stainless Steel hand rails shall be provided on 3 sides of car). The two panels are interconnected.	
14	False ceiling	Elegant powder painted ceiling with diffused lighting & fan.	
15	Door operation	Automatic with Light Ray Door Protection Device	
16	Elevator	Selective & collective automatic control operation	
17	Hoist way construction	Structural Steel.	RCC (Civil building)
18	No. of openings	As per reqirement	
19	Special feature	1. Car lighting and Fan automatic sleep 2. Provision of battery back up system for automatic rescue, alarm bell & emergency light in case of power failure.	

Additional features

- Power supply to the elevator shall be from N/E Bus which shall be fed from Emergency DG sets when normal power supply fails.

- Elevator shall be provided with telephone set and mounting bracket in side the car and necessary communication facilities which shall be hooked up with plant telephones.
- Suitable arrangement shall be provided to intimate control room during emergency in the form of audio-visual alarm. Necessary contacts/auxiliary relays shall be provided.
- Automatic rescue device shall be provided.
- Adequate capacity of reputed makes Elect. Hoist along with monorail shall be provided in the machine room for maintenance of the equipment.

v. Electrical Details

- **General**

  The scope of work of the Bidder shall include design, manufacture, shop testing, supply, erection, testing and commissioning of all electrical equipment associated with the Lift. The electrical scope of work for the lift shall commence from the N/E bus in unit 415V switchgear room and shall include but not limited to the following :-

  All cables (power , control & signal), motor, brakes, motor control panel (lift panel)including VVVF control(digital) for AC drives, limit switches, Suitably rated control transformer of ratio 415V/110V,digital indicators, illumination system inside the elevator, flexible cables required for the system, combined luminous buttons with luminous digital hall position indications at all floors, digital car position indicators inside elevator, car, battery operated alarm bell, emergency light, cabin fan, ventilation fan, overload warning indicator inside the car, fireman's switch, rescue device etc. to make the system complete in all respect for efficient operation of the elevator.

  415 V +/- 10%/, 50 Hz +/- 5%, 3 phase, 4 wire power supply shall be taken from the power supply feeder of the 415V N/E bus. One no suitably rated isolator shall be considered in the lift machine room. One no 15 Amp., 240 V socket outlet for hand lamp shall be provided on top of car by Bidder. Control supply shall be 110V A.C, 50Hz.

  The Bidder shall indicate the make of all equipment, components used for the electrics of the elevator car in their offer.

  The equipment offered shall be suitable for trouble free and efficient service in the tropical humid climate with an ambient temperature of 50°C and maximum relative humidity of 90%. The maximum temperature of 50°C and maximum humidity of 90%, however, may not occur simultaneously.

  The electrical equipment shall comply with the latest revision of relevant Indian Standards and wherever such Indian Standard is not

available, it shall comply with the generally accepted International codes and practices. The equipment shall be dust and waterproof.

All Electrical equipment shall conform to latest Indian Electricity Rules and regulations and the statutory requirement of Government of India and the Govt. of the State of Tamilnadu as regards to safety requirement, earthing and other essential provisions specified therein.

The materials used and the equipment supplied shall be new, reliable and of the class most suitable for the purpose for which they are intended. The equipment design and installation shall allow easy access to facilitate inspection, maintenance and repair.

Test certificates of all equipment shall be submitted before inspection of the same.

All necessary assistance in getting the equipment inspected by authorities shall be given by the Bidder.

Bidder shall provide free maintenance on the elevator equipment for a period of one year after commissioning of the lift

After commissioning of lift, vendor's services shall also be available if required on chargeable basis for maintenance purpose, for which Bidder shall quote separately.

w. Design Construction and Performance Requirement

Low voltage squirrel cage induction motor

The design and performance of motors shall conform to IS: 325 -1978

i. **Constructional Features**

- Frame sizes and rating as per IS: 1231-1974, IS: 2223-1983, and IS: 2254-1985.
- Motor shall be with cast steel body.
- Motor feet shall be integral with motor body.

- Degree of protection for motor, bearings and the terminal box shall be IP 54.
- The shaft ends shall be cylindrical.
- The bearings/fan shall be suitable for running the motor in either direction.
- Two numbers earthing studs shall be provided on the motor body.
- The motors shall be painted with paint of shade no. 632 as per IS: 5-1991.

ii. **Electrical Design**

- Motors shall be cage induction motor suitable for DOL starting/VVVF control. Motors shall be suitable for 415V + 10% /-10%, 50HZ + 5% /-5% supply. Motor shall be suitable for frequent start/stop operation.
- Rating of the motor selected shall be based on the class of duty and the load imposed by the equipment. The accelerating characteristics of the motor shall be matched with those of the coupled machine so that smooth acceleration is obtained without over heating the motor.
- Motors shall be capable of starting and running up with normal load and 85% of rated voltage at its terminals. The pull out torque of the motor shall not be less than 275 % of the full load torque.
- Motor shall be suitable for heavy duty, reversible, frequent starting, elevator service.
- The motor KW shall be de-rated for 502C ambient and heating due to VVVF control.
- The class of insulation shall be `F'. Under normal running conditions the temperature rise shall be limited to class B as measured by resistance method.

iii. Terminal Box

- The terminal box shall be amply dimensioned to receive FRLS PVC insulated and armoured cables with aluminium conductors.
- The terminal box shall normally be provided on the top.
- A suitable earthing stud shall be provided inside the terminal box.
- It shall be possible to rotate the terminal box by 90 degrees.

iv. Cooling

- Motors shall be of TEFC design.
- Cooling shall be effective in either direction of rotation.

v. Quality of Operation

- Motors shall be dynamically balanced with full key in the shaft and the fan.
- The vibration levels shall be as per IS:12075-1987.
- Continuous noise level shall not exceed 85 db at a distance of 1 m from the motor body.

vi. Additional requirements for LT VVVF duty Motors:

Sl.No	Parameters	Description
1.0	Type	- AC Squirrel cage induction motor. - Inverter Duty

Sl.No	Parameters	Description
2.0	Standard	- IPSS 1-03-001/ IS 325 - NEMA Standard MG1-1993 Part 31, or the latest revision in so far as it is applicable. -
3.0	Constructional Features	
a)	Frame size & rating	- As per IS 325 - 10:1 constant torque speed range motors may exceed frame standard by one frame rating.
b)	Motor body	Grey iron casting as per IS:210-1978
c)	Motor Feet	Integrally cast with the stator
d)	Body Design	- Prevent breakage or other failures due to vibrations normally encountered in heavy industries . - Motors shall be of weather proof construction. - Designed to operate in the humid air stream .
e)	Protection for Motor & Bearing	IP - 54 (with canopy for motor)
f)	Motor Shaft	Shall be provided with an external recessed slinger at the drive end of the motor to provide additional (minimum IP-54) protection from moisture and foreign material.
g)	Shaft ends & Extension	Cylindrical as per requirement Shaft shall be extended for encoder / tacho. mounting, accordingly suitable hole shall be drilled and tapped .
h)	Internal Encoder	Motors with speed variation of 1000:1 at constant torque shall have internal built in encoder for speed feedback
i)	Bearing	Roller type bearing upto 5 kW . Ball Bearing at NDE end for above 5 kW All motors shall have fully re-greasable, anti-friction bearings. All motors shall have cast iron inner bearing caps. Bearings shall be oversized . All motors shall have a charged lubrication system to inhibit moisture condensation.

Sl.No	Parameters	Description
		Standard motors shall have extended grease fittings on the opposite drive-end to facilitate re-lubrication. Grease ports shall be located on the periphery of the motor end shield. Motor shall be fitted with a shaft slinger or V ring seal on the drive end for a minimum of IP-54 protection (to help protection of bearing from ingress of dust , dirt or fluids) .
4.0	**Terminal box**	
a.	Location	RHS viewed from DE / On top
b.	Suitability	4 Core Aluminium Cable The terminal box shall be oversize as compared to NEMA requirements .
c.	Rotation	4 X 90 deg.
d.	Earthing stud	Inside Terminal Block
e.	Miscellaneous	Shall be gasketed between the terminal box halves. The conduit box shall be field convertible to cast iron. External screws and bolts shall be grade five, hex heads and be plated to resist corrosion
5.0	**Cooling**	TEFC, Effective bi-directional Motor with 1000:1 speed range and constant torque shall have external fan . External fan motor shall be 3 phase , 415 V AC .
6.0	**Quality of operation**	
a.	Vibration intensity	Shall be limited as per IS 12075-1986. Shall not exceed .08 inches / second velocity.
b.	Noise level	As per IS: 12065-1987
7.0	**Electrical design**	
a.	Power Supply	415 V +- 10%, 3-phase, 50 Hz + 5% & -5%, 4-wire AC, 50 kA for 1 second, solidly earthed.
b.	Starting	VVVF Drive
c.	Service factor	1.0 for VFD power . 1.15 for sine wave power .
d.	Peak transient voltage	1600 V
e.	Minimum rise time	0.1 microsecond
f.	Starting Torque	200 % rated torque for 1 minute below base

Sl.No	Parameters	Description
		speed
g.	Constant horsepower operation	1.5 times base speed .
h.	Duty	S1 / Suitable for operating with Elevator duty motor
i.	Max speed permissible	150 % rated for 2 minutes
j.	Dearating for VVVF	As per above mentioned standard
k.	Insulation	Minimum Class F or better insulation materials with additional phase insulating material, extra end-turn bracing and Class H spike resistant wire.
l.	Torque Type	Normal / High / High slip type / Stall Torque type
m.	Space Heater	All motors above 30 kW Indoor Motor above 110 kW
n.	Temperature Rise	By resistance, shall be 70 degrees C or less when measured at rated load on sine wave power, on inverter power ratings shall be 105 degrees C or less.
o.	No. of Poles	4/As per the manufacturer's recommendation
8.0	**Operating Characteristics**	
a.	Operation with variation in the voltage or the frequency	Motor shall able to start and accelerate with 85% of rated voltage. Motors shall operate successfully under running conditions at rated load with variation in the voltage or the frequency not exceeding the following conditions: +/-10% rated voltage at rated constant V/f ratio except for specific torque boost situations. Motors shall operate successfully under running conditions at rated load and V/f ratio when the voltage unbalance at the motor terminals does not exceed one percent.
b.	Torques	Motors shall meet or exceed the minimum locked rotor (starting) and breakdown torques specified in NEMA Standard MG1 Part 12 for Design B for the rating specified when on sine wave power.
c.	Locked rotor (starting) currents	Shall not exceed NEMA Design B values for the specified rating on 5:1 constant torque or less and variable torque motors. NEMA Design A values are allowed for 6:1 constant torque or higher value constant torque rated motors.

Sl.No	Parameters	Description
		Motors shall be capable of a 20 second stall at six times full load current without injurious heating to motor components.

11.15. BRAKES

a) Brakes shall be DC electro magnetic type/

b) Brake power supply 220V DC obtained through individual transformer rectifier set.

c) Brakes shall be of heavy duty type suitable for elevator operation having long mechanical life.

d) Brakes shall be self-aligning and quick acting type.

e) Brakes shall be electrically released and spring applied for fail safe operation.

f) Brakes shall have facility for torque adjustment.

g) The coil connection shall be brought out to a suitable terminal box.

h) The necessary rectifier and brake control panel shall be supplied along with the brake.

11.16. LIMIT SWITCHES

a) Limit switches shall be of robust construction capable of withstanding repetitive operations.

b) Limit switches shall be heavy duty type either lever or rotating cam operated.

c) The limit switch contacts shall be rated at least for 10A at 110 V AC / 5A at 220 V DC.

d) The limit switches shall be housed in robust metallic oil and dust tight enclosure conforming to IP:65.

e) At least 2 NO and 2 NC contacts shall be provided for each limit switch.

11.17. L.T. MOTOR CONTROL PANEL

a) Basic Design Parameters

- Power Supply system - 415 V+10%/-10% 3 phase and neutral 50 HZ +5%/-5%
- System Neutral
- Earthed
- Insulation level - 2.5 kV for 1 minute
- System short circuit level - 50 kA for 1 second.

b) Constructional Features

- Floor mounting, free standing with base channel for fixing on the inserts in the floor.
- Single front, totally enclosed.
- Enclosure conforming to IP:52 as per IS:2147-1962.
- Suitable for cable entry from bottom with detachable gland plate
- Rear access through removable rear cover.
- Minimum operating height of devices on panel to be 400m and maximum operating height to be 1900 mm.
- Clear legible identification labels shall be provided for all compartment panels and control devices.
- To ensure good earth continuity, all bolted joints shall be provided with tooth spring washers.
- Two separate earthing terminals shall be provided for earthing.
- The motor control panel of the elevator shall be provided with base channel of 75 mm (ISMC 75).
- Painting shall be shade no. 631 as per IS:5-1978
- Pilot devices operable from the front.
- Components and devices accessible from the front.
- Protection against accidental contact with live parts while maintaining a compartment and keeping others in services.
- Compartment door interlocked with main power isolating devices.
- Bus bar sizes to be selected in accordance with the nominal current rating of incoming load break switch and for full short circuit power.

c) Incomers and Isolators

- The motor control panel shall have one incomer switch of AC 23 duty
- The incomers shall be provided with voltmeter and ammeters complete with fuse, selector switches and CTs.
- All switches shall be double break type.
- All fuses shall be HRC fuses and shall not be of bolted type in switch fuse units.

d) Contactors

- All contactors shall be AC4 duty as applicable with min. 25A rating.
- Shall have at least 2 NO + 2 NC auxiliary contacts with minimum rating of 16A at 110 V AC.
- For reversible drives mechanically interlocked, contactors shall be used.
- All coils shall be suitable for 110 V, AC with no economy resistor.
- Insulation of coils shall be class `E' or better. Shall pick up positively at voltage between 85% and 110% of the rated value.

e) Thermal Overload Relay

- Bimetallic Triple Pole, ambient temperature compensated

- inverse time lag, and reset type.
- Shall conform to IEC - 292-1.
- Shall have built in single-phase protection.
- At least one make and one break auxiliary contacts shall be provided.
- Manual reset push button shall be located on the compartment door.

f) Auxiliary Relays

- Coil voltage 110V AC
- 4 NO + 2 NC contacts rated for 10A

g) Timers

- Coil voltage 110V AC
- ON/OFF relay as required
- 2 NO + 2 NC contacts

h) Control Transformer

- Control transformer of ratio 415V/110V and of suitable rating shall be double wound dry type conforming to IS: 2026- 1977 with tapping at +/- 2.5% and +/- 5% on the primary side.

i) Switches & Fuses

- Isolating switches shall be triple pole/ double pole, air break, heavy duty type(MCCB), capable of safely breaking the full load current of the associated feeder.
- All MCCB shall be suitable for rated system fault level.
- Control circuit shall be protected by individual control MCB's with min. short ckt. rating 9kA and rating 16A.

j) Cables

All power cables for fixed wiring inside the premises shall be 1100 V grade, Copper Conductor, PVC insulated and FRLS PVC sheathed conforming to IS:1554 (Part1)-1988 armoured or unarmoured depending on application.

All flexible cable shall be EPR insulated and CSP sheathed or better.

Control cable shall be 1100 V grade, copper conductor PVC insulation and sheath conforming to IS:1554 (Part1)-1988.cable shall be armored or unarmored depending upon application.

The motor for the elevator shall be squirrel cage induction motor with speed resistance control/VVVF control for controlling the speed during starting and stopping at landings

k) Earthing

All structure electrical equipment conduit/ Tray etc. shall be effectively grounded in accordance with Indian Electricity rules. Earthing conductors are to be connected with earthing grid of the building. Earthing on the car including interconnection with main grid shall be under the Bidder's scope.

l) Wiring

All wiring shall be accessible from the front and shall be done by 1.1 KV grade PVC insulated flexible copper wires.

Not more than two connections shall be done at any one terminal.

Interlocked type identification ferrules shall be provided.

Auxiliary wiring shall be properly marked as per IS:5578 -1984

20% spare terminals with a minimum of 6 nos shall be provided.

All power terminals shall be stud type. All control terminals shall be Elmex type rated at least for 10A and suitable for terminating 2 nos 2.5 sq. mm copper conductors.

All hoist way and car wiring shall be done with armored cable as per IS:1554 (Part 1) - 1988 and IS:5571-1979 and flexible cable as applicable.

The cables used in the elevator installation shall conform to latest revision of IS:4289-1984.

A trailing cable, which incorporates conductors for the control circuit, shall be separate and distinct from that which incorporates lighting and signaling circuits. All control and signaling cables shall have stranded copper conductor of minimum size 1.5-sq mm copper. 20% spare cores shall be provided in each control/ signaling cable.

11.18. VVVF DRIVE

a) Basic Design Particulars

Rating as per class IV of IEC 146 viz., 100% continuous, 125% for two hours, 200% for 10 seconds
The protection class shall be class I as per IEEE- 444 - Direct voltage capability
Shall be able to maintain rated DC bus voltage at rated DC current at 94% rated AC voltage.
The converter shall safely perform inverter duty at 90% rated voltage and rated DC voltage
The drive shall be designed suitable for the following
Input parameter variations:

Input AC voltage	: +/- 10%
Frequency	: + 5%/-5%
Combined variation	: 10%

Control and regulation equipment shall be designed suitable for the following parameters variations:

Voltage	: +/- 10%
Frequency	: + 5%/-5%

b) VVVF assembly

The drive shall be Thyristor/Transistor/IGBT based Three phase out put supply as per requirement. The Inverter shall be suitably rated to take the load of total system for a duration of app. 10 minutes.
The suitability of rating, control & indication for the battery, battery charger & Inverter shall be checked during approval of drawing for the above system.
The Inverter shall be designed as per relevant IS & IEC standard.

11.19. Battery, Battery Charger

a) Battery unit.

Battery unit shall be maintenance free Nickel Cadmium type. The capacity of the battery shall be selected based on minimum site ambient temperature and shall be suitable to supply for short time rating of approx. 10 minutes to automatic rescue device control circuit, alarm bell & emergency lighting. The capacity of battery shall be supported with battery sizing calculation.

b) Battery Charger

The charger shall have 3 phase full wave controlled rectifier bridge with their protective device. Input voltage shall be 415 V + 10% & – 10%, 50 Hz +5% & –5%. Charger shall be suitable for float charge and boost charging.

11.20. PAINTING

The exposed surface of all items of equipment shall be thoroughly cleaned and painted. Refer chapter on painting.

11.21. QUALITY SYSTEM, INSPECTION & TESTING

11.21.1 General

Inspection & testing of plant & equipment shall be carried out by Purchaser/Consultant at the works of Bidder /Sub-bidder during manufacturing and on final product to ensure conformity of the same with the acceptable criteria of technical specifications, approved drawings, authenticated manufacturing drawings and reference national / international standards.

11.21.2 Quality System Requirements

Bidder shall recognize the importance of quality and follow defined quality programme in all manufacturing and quality control activities of the product. Bidder shall define and implement the tasks and controls shall provide needed assurance in case manufacturing of product is sub-contracted either partly or fully and/or for the procured components of the product.

Purchaser/Consultant reserves the right to verify and modify the quality programme and entire product characteristics to assure the intended and specified quality of the product.

11.21.3 Quality Assurance Plan (QAP)

Bidder shall furnish Quality Assurance Plan (QAP) for respective equipment after completion of detailed engineering and finalization of billing schedule/ equipment identification number for approval of the Purchaser/Consultant.

11.21.4 Test Certificates and Documents

For each of the items being manufactured, relevant test certificates and documents, as applicable for each of the equipment, in requisite copies including original shall be submitted to Inspection Agency. All test certificates shall be endorsed by the manufacturer and Bidder with linkage to project, purchase order and acceptance criteria.

11.21.5 Inspection of assemblies or their sub-assemblies

Winding unit consisting of motor, gear, traction sheaves, brake mounted on complete base plate, no load test run, part load and full load at Bidder / Sub-bidder's works.

a. Car body and doors.
b. Governor and guide rails.
c. Deflector pulleys, counter weight and its frame.

11.22. PERFORMANCE GUARANTEE PARAMETERS

The Successful Bidder shall prepare and submit performance test procedure for approval.

The Bidder shall stand guarantee specifically for the following performance.

a. Rated capacity of the elevator
b. Speed of the elevator
c. Accurate positioning of the elevator
d. Load Test as per IS

11.23. DOCUMENTATION

List of drawings/ documents to be furnished by the successful Bidder for approval

a. Equipment foundation and loading data.
b. General arrangement drawing of elevator showing full details in plan and sections.
c. Quality Assurance Plan for inspection.
d. Test and inspection certificate.
e. List of spares for 2 years normal maintenance.

f. List of special/ maintenance tools & tackles.
g. Equipment Sizing calculation.
h. Performance test Procedures
i. Test reports and inspection reports.
j. Instruction manuals for testing and commissioning.
k. Operation, maintenance and safety manuals

Technical requirement- ELEVATORS

Sl.no	Item description	Details
1.	Name of manufacturer	-
2.	Quantity	3 Nos.(2 Passenger +1VIP)
3.	Type of elevator	**Passenger Type**
4.	Capacity,	**TG** **Service**
	i. in Kg	Conventional Panaromic
	ii. Number of passengers to be	1088 680 16 10
5.	Rated Speed (m /min)	0.75 m/sec
6.	Total travel (m)	47.5 20
7.	Nos. of floor to be served	8 5
8.	Size of elevator well / mast	As per IS 14665
9.	Internal size of elevator car	As per IS 14665
10.	Construction, design and finished car body work	
11.	Type of car door	Centre opening sliding type
12.	Type of landing door	Centre opening sliding type
13.	Type of landing & car door operation	**Automatic**
14.	Headroom required above top landing	As per IS 14665
15.	Elevator operation	Push button
16.	Method of control	ACVVVF
17.	Ambient temperature	As per project information
18.	Quantity of Motor	One per lift
19.	Leveling accuracy	As per relevant IS based on number of landings
20.	Emergency power supply provided?	No
21.	Intercommunication facility provided?	Yes
22.	Electric power supply	
	i. Power Voltage (AC)	415 V
	ii. Phase	3Ph

Sl.no	Item description	Details
	iii. Cycles	50 Hz
	iv. Wire system	4 wire
	v. Control voltage (DC)	NA

SECTION – C
DATA SHEET A

S. No.	DESCRIPTION	PASSENGER ELEVATOR	
1.	Elevator	**TG building**	**Service building**
2.	Type of Service	Goods cum Passenger elevator, Conventional Type	Passenger elevator, Panoramic Type
3.	Rated Load on Elevator	1088 KG (16 Person)	680 KG (10 Person)
4.	Quantity	2 Nos. (Two nos)	1 No. (One no.)
5.	Rated Speed of Lift	1.0 M/Sec	1.0 M/Sec
6.	Total Travel	36 M	17 M
7.	Nos. of floors to be served	Seven (7) Nos. including Ground	Five (5) Nos. including Ground
8.	Method of control.	ACVVVF Control with automatic level adjustment.	
9.	Position of Machine Room	Directly above the lift Shaft.	
10.	Car enclosure construction, design and finish car.	SS -304, min 1.5 mm thick. sheet,	
11.	Design, construction, installation codes including car size, door size, Shaft size, Size of platform and car entrance.	As per IS: 14665 (all parts), latest edition	
12.	Car and landing door	Protected by central opening sliding stainless steel door (Horizontal bi-parting door).	
13.	Flooring	MS CHQ plate for goods cum passenger elevator. PVC tiles flooring for passenger elevator.	
14.	Operation	Automatic simplex collective with and without attendant with provision for locking control in “auto” or “Attendant” position. Key type lock switch shall be provided.	
15.	Signal	Car position indicator in car, car position indicator at car floors, telltale lights at all floors, battery operated alarm bell and emergency light with suitable battery, battery charger and controls, Remote alarm shall be provided.	
16.	Method of operation of car and landing doors.	Power operated with automatic door opening and closing devices.	
17.	Lighting & fan	One cabin fan, two recessed fluorescent light fittings on car roof. Lux level : 100 min.	
18.	Power supply : a) Power b) Lighting & fan	415 Volts, (+/- 10% variation), 3 Phase, 50 Hz (+3% to -5% variation), 4 wire system, 240 Volts, 1 Phase, 50 c/s.	

19.	Other requirements	Internal telephone wiring and telephone hand set to be provided. The external connection shall be provided by Customer. Also, automatic rescue device shall be provided.
20.	Additional requirements :-	
a)	Isolating cushion between car and car frame shall be provided.	Type of cushion shall be rubber pad or spring which shall be as per manufacturer's standard.
b)	Three pin plug with socket on car top	5/15A, 3 pin plug socket with switch on top of lift car and inside shaft to take care maintenance requirement.
c)	Car frame Material and type of construction	Steel and bolted construction
d)	Landing Door	Fire rated for min. 1 hour
e)	Type of operation	Automatic
f)	Door hanger tracks along with accessories shall be provided.	Required
g)	Safety shoes complete with accessories shall be provided.	Yes
h)	Safety device for door operation shall be provided.	Full length Infrared light curtain along with pressure limiter as an extra mechanical safety is required.
i)	Handrails on three sides	Mirror finish stainless steel
j)	False ceiling	Powder painted / SS 304 sheet, min 1.5 mm thick.
k)	Emergency stop switch	Yes
21.	Control and operation	
	(a)Type of control	Simplex
	(b)Type of drive	Variable voltage variable frequency drive
22.	Car operating panel	Provided
	(a)Type of construction	Partial Height car operating panel (COP), Removable type from Car with SS face plate.
	(b)Push Buttons	Luminous push buttons with IP 54
23.	Car position indicator	Provided
	(a)Type of construction	As per manufacturer's standard
	(b)Type of display	7 segment LED display.
24.	Push button station and call registered tell tale lights at each landing	Provided in each landing
	(a)Type of construction	Box type with SS face plate
	(b)Push Buttons	Luminous push buttons with IP 54
25.	Apron / Facia Plate provided as per IS 14665	Yes (To be provided by supplier)
26.	Emergency Light	Required

27.	Terminal buffers, their types and number of buffers	Spring buffers shall be Provided as per IS 14665.
28.	Load plate	As per manufacturer's standard / as applicable
29.	Counter weights frame	Fabricated Steel Construction
30.	Counter weight fillers	Cast Iron
31.	Number of Limit Switches	As per requirement
	a) Location	Bottom & top terminal
	b) Type	Electromechanical
	c) Operation	Cam Operated
32.	Controller and type	Selective Collective Controller with variable voltage variable frequency drive and Microprocessor based software controlled logic system
33.	Reverse phase relay and other protective devices	Required
34.	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
35.	Motor details	
	(a) Type	3 phase AC squirrel Cage Induction motor.
	(b) Type of Duty	Lift Duty
	(c) Motor Duty	S4/S5
	(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, temp rise limited to class. B. Motor shall be provided with thermal class 130 (B) or better insulation.
	i)Method of Starting	AC Variable Voltage Variable Frequency Drive
36.	Door Motor	
	a) Equipment driven by Motor	Door
	b) Direction of rotation	Both Clockwise & Anticlockwise
	c) Type of enclosures	IP54
37.	Metallic Wire Mesh between Car & Counter Weight	Required
38.	Fire Man Switch	Required
39.	Sound Reducing Material	Isolation Rubber / other arrangement in

		the Machine shall be provided
40.	Automatic Rescue Device (Battery Drive)	Provided
41.	Trailing cables	FRLS type
42.	Design seismic coefficient	According to IS 1893 - 1977
43.	Window Air conditioner in machine room	Min 2T Capacity.
44.	1/2 Kg CO2/suitable type Fire extinguisher with fixing arrangement.	Provided.

SECTION C1-B

FUNCTIONAL/PERFORMANCE / DEMONSTRATION GUARANTEE

TRIAL OPERATION, COMMISSIONING, PERFOMANCE/ 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.

SECTION C1-C

QUALITY ASSURANCE

ANNEXURE-III
QUALITY ASSURANCE PLAN

	MANUFACTURING QUALITY PLAN FOR=M/S vendor	PROJECT: PACKAGE: ITEM: ELEVATOR BHEL REF. NO.:	Q.P/FQP. NO & REV: DATE:1 PAGE: 1of 4 JOB NO:

1	2	3	4	5	6	7	8	9	10				11
Sr. No.	COMPONENT& OPERATION	CHARATERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMATE OF RECORD		AGENCY			REMARKS
									D	VE	M	B	
A. Boughtout Items :													
1	Raw materials, Round Hexagon & Structurals. Type : EN-8/EN-8D to EN-9,B and En-24	A: Chemical Composition	Major	Analysis	Sample	IS/BS : 970	IS/BS : 970	O.S.L/ T.C		V	V	V	
		B: Mechanical Properties	Major	Hardness	Sample	IS/BS : 970	IS/BS : 970	QA REG.		V	V	V	
		C: Dimensional Checks	Major	Measurement	100%	DRG.	DRG.	D.I.R/Q.C.R		V	w	V	
2	Raw material Rounds, En-8, EN-9, EN-24	Crack Detection	Major	Ultrasonic testing	100%	ASTM-388	ASTM -388	QA/FMT/03		V	W	V	
3	Casting : a. C.I. Graded Castings	A: Chemical Composition	Major	Analysis	Sample	IS-vendor DRG	AS PER DRG.	S.T.C	√	V	V	V	
		B: Mechanical Properties	Major	Hardness on traction sheave	Sample	vendor-DRG IS : 210	vendor-DRG IS : 210	S.T.C	√	V	V	V	
		C: Dimensional Checks	Major	Measurement	Sample	vendor-DRG	vendor-DRG	QA/FMT/02		-	W	-	
		D: Blow Holes	Major	Visual	100%	—	-	QA/REG		-	W	-	
4	Suppliers Item :												
	a. Manufactured Items	Dimensional Check	Major	Measurement	100%	vendor/DRG.	vendor/DRG.	D.I.R		-	W	-	
	b. Moldings Rubber Items (ABSORBER)	A: Dimensional Checks	Major	Measurement	100%	vendor-DRG.	vendor/DRG.	QA/FMT/02		-	W	-	
		B: Hardness	Major	Compression Test	Sample	vendor-DRG.	vendor-DRG.	QA/FMT/02		-	W	-	
	c. Springs (Buffer)	A: Dimensional Check	Major	Measurement	100%	vendor-DRG.	vendor-DRG.	QA/FMT/02		-	W	-	
		B: Spring Constant compression.	Major	Compression	Sample	vendor-DRG.	vendor-DRG.	S.T.C	√	V	V	V	
	d. Guide Rail.	A.Chemical Test.	Major	Analysis	Sample	vendor- DRG	vendor -DRG	S. T.C	√	V	V	V	
		B. Dimension check.	Major	Measurement	Sample	vendor-DRG.	vendor-DRG.	QA/FMT/02		V	W	V	
	e. Wire rope	A: Dimensional Check	Major	Measurement of O.D/ Const.	Sample	IS/2365 &	IS/2365 &	QA/FMT/02		-	W	-	
		B: Mechanical Properties.	Major	Measurement	Correlate S.T.C	IS : 2266	IS : 2266	S.T.C	√	V	V	V	

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

MANUFACTURER SEAL AND SIGN	CONTRACTOR SIGN AND SEAL .	NAME & SIGN OF APPROVING AUTHORITY & SEAL

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

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MANUFACTURER SEAL AND SIGN

CONTRACTOR SIGN AND SEAL .

NAME & SIGN OF APPROVING AUTHORITY & SEAL /HPGCIL

1	2	3	4	5	6	7	8	9	10				11
Sr. No.	COMPONENT& OPERATION	CHARATERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMATE OF RECORD		AGENCY			REMARKS
									D	VE	M	B	
2	Motor Assembly :	A-Winding Insulation test.	Major	High Volt. Test	100%	I S :325-96 1.5 KV for 5 SEC	I S :325-96 1.5 KV for 5 SEC.	D.I.R QA/FMT/13		V	W	V	
		B-Insulation Resistance	Major	Measurement	100%	> 10 mega ohms	> 10 mega ohms	Test report		V	W	V	
		C-Motor testing for elect. Pmt.	Major	Elect.	100%	IS : 325	IS : 325	Test report		V	W	V	
		D-Vibration measurement & noise lev	Major	Measurement	100%	vendor - Norms	vendor -Norms	Test report		V	W	.	
3	Speed Governor Assembly :	Tripping speed Easy Run test	Major	Function Check	100%	I S : 9878 LCH -112	I S : 9878 LCH - 112	T.C IN Pant.		V	W	V	
4	Controller Assembly / VVVF Unit.	1. Visual Inspection	Major	Visual	100%	vendor Norms	vendor Norms	T.C		V	W	V	
		2. Electrical Checks (Routine Test).	do	Electrical	100%	do	do	do		V	W	V	
		3. Functional Checks	do	Function	100%	do	do	do		V	W	V	
		4. Pretreatment in seven tank for sheet & paint thickness.	Major	Measurement + Visual	Sampling	do	do	vendor - FMT.		V	W	V	

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MANUFACTURER SEAL AND SIGN

CONTRACTOR SIGN AND SEAL.

NAME & SIGN OF APPROVING AUTHIRITY & SEAL.

1	2	3	4	5	6	7	8	9	10				11
Sr. No.	COMPONENT& OPERATION	CHARATERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMATE OF RECORD		AGENCY			REMARKS
									D	VE	M	B	
5	Mechanical assembly :	Cage assembly .	Major	Measurement	100%	Appd. L/o DRG. vendor-INSP. Norms	Appd. L/o DRG. vendor-INSP. Norms	QA/FMT/15		V	W	V	
6	Painting	Parts & Components	Major Major	Cross Hatch Test Powder Coating Thickness Test	Sampling Sampling	vendor-INSP. Norms vendor-INSP. Norms	vendor-INSP. Norms vendor-INSP. Norms	QA / REG. QA / REG.		V V	W W	V V	
6	Electrical Assembly	1- Break assembly .	Minor	Function check	Sampling	vendor- NORMS	vendor - NORMS	TC		V	W	V	

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MANUFACTURER SEAL AND SIGN

CONTRACTOR SIGN AND SEAL.

NAME & SIGN OF APPROVING AUTHORITY & SEAL

SECTION- C2

TECHNICAL SPECIFICATION
(Electrical Portion)

1.0 EQUIPMENT & SERVICES TO BE PROVIDED BY BIDDER:

The equipment and services to be provided by bidder under this specification shall be as detailed here below but shall not be limited to the following:

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 bidder without any extra charge shall provide the same.
c) Supply of mandatory spares as specified in the specifications of mechanical equipments.
d) Erection and Commissioning spares.
e) Erection & Maintenance tools & tackles.
f) Electrical load requirement for ELEVATORS.
g) All equipment shall be suitable for the power supply fault levels and other climatic conditions mentioned in the enclosed project information.
h) 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.
i) Various drawings including GA drg, data sheet as per required format, quality plans, calculations, test reports, test certificates, operation and maintenance manuals, characteristic curves, wiring diagrams/schemes etc shall be furnished as specified at contract stage. All documents shall be subject to customer / BHEL approval without any commercial implications to BHEL.
j) Motors shall meet minimum requirement of specification AC/DC motors.
k) All routine tests and type tests reports as per applicable standards shall be furnished at contract stage.
l) Purchaser will furnish data sheets to the vendor after award of contract. Vendor shall furnish filled in data sheets meeting the specification requirements.
m) Except for trailing cables for which relevant IS/IEC shall be followed, cables shall be as per Cable Annexure.
n) Technical requirements shall be as per specifications listed in Clause 4.1 to 4.7.

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

a) A copy of this sheet "Electrical Equipment Specification for EOT CRANES / ELEVATORS / ELECTRIC HOISTS System and sheet "Electrical Scope between BHEL and Vendor" with bidder's signature and company stamp.
b) List of Erection and Commissioning spares.
c) List of Erection & Maintenance tools & tackles.
d) Electrical load requirement.

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

4.0 **LIST OF ENCLOSURES**

4.1 Electrical scope between BHEL & vendor.
4.2 Std. Technical specification for LV motors.
4.3 Std. Technical specification for cabling installation.
4.4 Data Sheets (A) for 415V Electric Motors.
4.5 Data Sheets (C) for 415V Electric Motors.
4.6 Quality Plan for LV Motors.
4.7 Load Data Format.
4.8 Cable Annexure.

ANNEXURE – I TO SECTION – C : STANDARD ELECTRICAL SCOPE BETWEEN BHEL AND VENDOR

PACKAGE : PACKAGE : ELEVATORS

PROJECT : 2x500 MW NEYVELI NEW THERMAL POWER STATION (NNTPS)

S. NO	DETAILS	SCOPE SUPPLY	SCOPE E&C	REMARKS
1	415V Local Starter Panel	Vendor	Vendor	BHEL will provide two number 415 V (3 ph, 3W) supply feeder only up to isolating switches for elevators. Any other voltage level (AC/DC) required will be derived by the vendor. Motor starter shall be part of elevator control panel.
2	Power cables, control cables, screened control cables and any special cables (if required) between equipment supplied by vendor.	Vendor	Vendor	
3	Cabling material (cable trays, accessories, cable tray supporting system, conduits etc).	Vendor	Vendor	
4	Equipment Earthing	Vendor	Vendor	All equipments metallic enclosures / frames, metal structure etc. shall be grounded at two points each to the nearest grounding points / risers provided by BHEL / customer.
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 tinned copper heavy duty lugs for power cables. 3 solderless crimping type heavy duty copper lugs for 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 C & I systems for vendor supplied equipment shall be furnished during detail engineering by vendor in soft copies in the BHEL cable schedule format.
8	Equipment layout drawings	Vendor	-	
9	Electrical Equipment GA drawing	Vendor	-	For necessary interface review.

ANNEXURE – I TO SECTION – C : STANDARD ELECTRICAL SCOPE BETWEEN BHEL AND VENDOR

PACKAGE : PACKAGE : ELEVATORS

NOTE : - 1. Above is applicable if motor starters are part of starter cum control panel & control is relay based.
2. If motor starters are provided in main MCC then customer will provide power & control cable including supply, laying & termination.

SPECIFIC ELECTRICAL REQUIREMENT FOR ELEVATORS

SL.NO.	PARAMETERS	UNIT	NLC	
	MOTOR			
1	DESIGN AMBIENT TEMP	DEG. C	50	
2	VOLTAGE SUPPLY AND VARIATION	VOLT	415V, ± 10%	
3	FREQUENCY WITH VARIATION	Hz	50 (+) 3% to (-) 5%	
4	COMBINED VOLTAGE & FREQUENCY VARIATION		10%	
5	MAX ACCEPTABLE RATING OF MOTOR AT 415 V	KW	160 kW	
6	SYSTEM FAULT LEVEL AND ITS DUARTION	KA	50 KA, 1 Sec	
7.1	SUTABILITY OF TERMINAL BOX FOR FAULT LEVEL AND DURATION, 90 kW and above (Breaker controlled)		50 KA, 0.25 sec	
7.2	SUTABILITY OF TERMINAL BOX FOR FAULT LEVEL AND DURATION, o Below 90 kW (Contactor controlled)		50 KA protected by HRC fuse	
7.3	Supply system: LV System grounding .		Solidly	
8	CLASS OF INSULATION & TEMP RISE LIMITED TO		Class-F and temp rise limited to Class-B	
9	MIN. STARTING VOLTAGE		85%	
10	MOTOR RATING FOR SINGLE PHASE SUPPLY		Upto 200W	
11	MAXIMUM LOCKED ROTOR CURRENT	% OF FLC	Motor shall be rated for S4 duty. Starting current shall not exceed 6 times full load current. Tolerance shall be as per IS 12824.	
12	ACCEPTABLE NOISE LEVEL	DB	85dB at 1.0m in line with IS 12065. Motors shall be dynamically balanced with full key in the shaft and the fan.	
13	TYPE OF STARTER PROVIDED IN MCC		N.A.	
14	DOP OF ENCLOSURE		IP:54 for Indoor Motor, IP:55 for Outdoor. Motor for outdoor or semi outdoor service shall be of weather proof construction. DOP for terminal boxes shall be IP 55 as per IS 4691.	
15	SPACE HEATER REQUIREMENT		30KW & ABOVE	
16	PAINT SHADE		Shall be confirmed during detailed engineering.	
17	MAKES		BHEL/ Customer approval	
18	Power cables data		Shall be given during Detailed engg	
19	Earth Conductor Size & Material		Shall be given during Detailed engg	
20	SPECIAL REQUIREMENT		Type test to be conducted on the identical motor in the last 5 years or after the last design change, which ever is earlier. Otherwise, the equipment shall have to be type tested, free of charge, to prove the design. All motors shall be subjected to routine tests as per IS: 325 in the presence of customer or customer representative. The motors shall generally conform to IS 325/IEC-60034.	

GENERAL TECHNICAL REQUIREMENTS

FOR

LV MOTORS

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

1.0 INTENT OF SPECIFIATION

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 machnines
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.

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 mimimum 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: 4691and 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.

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.

4.9 **General**

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.

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

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

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

	QUALITY PLAN	CUSTOMER :		PROJECT TITLE			SPECIFICATION : NUMBER :			
		BIDDER/ VENDOR :		QUALITY PLAN NUMBER PED-506-00-Q-006, REV-01			SPECIFICATION : TITLE :			
	SHEET 2 OF 2	SYSTEM		ITEM AC ELECT. MOTORS BELOW 55KW (LV)			SECTION			VOLUME III
SL. NO.	COMPONENT/OPERATION	CHARACTERISTICS CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY P	W	V	REMARKS
1	2	3	4	5	6	7	8	9	10			11
		3.NAMEPLATE DETAILS	MA	VISUAL	100%	IS-325 & DATA SHEET	IS-325 & DATA SHEET	INSPN. REPORT	2	1	-	

NOTES:

1 ROUTINE TESTS ON 100% MOTORS SHALL BE DONE BY THE VENDOR. HOWEVER, BHEL SHALL WITNESS ROUTINE TESTS ON RANDOM SAMPLES. THE SAMPLING PLAN SHALL BE MUTUALLY AGREED UPON

2 WHERE EVER CUSTOMER IS INVOLVED IN INSPECTION, (1) SHALL MEAN BHEL AND CUSTOMERS BOTH TOGETHER.

3 FOR EXHAUST/VENTILATION FAN MOTORS OF RATING UPTO 1.5KW , ONLY ROUTINE TEST CERTIFICATES SHALL BE FURNISHED FOR SCRUTINY.

Legends for Inspection agency

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

P. PERFORM
W. WITNESS
V. VERIFY

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

VOLUME- IV
SECTION-16
LV POWER & CONTROL CABLE

TABLE OF CONTENTS

1 GENERAL

This specification is intended to cover the design, engineering, manufacture, assembly, testing at manufacturer's works, supply & delivery, properly packed for transport to site of LT Power & Control Cable complete with all accessories for efficient and trouble-free operationfor 2 x 500 MW New Thermal Power Plant at Neyveli, Tamilnadu for Neyveli Lignite Corporation Limited.

2 CODES AND STANDARDS

All equipment and materials shall be designed, manufactured and tested in accordance with the latest applicable Indian Standards (IS) / IEC as given below or any international standard acceptable to purchaser.

IS:1554(Part I)	:	PVC insulated(heavy duty) electric cables for working voltage up to and including 1100V
IS:1554(Part II)	:	PVC insulated(heavy duty) electric cables for working voltage from 3.3kv up to and including 11Kv
IS: 3961	:	Recommended current ratings for cables.
IS: 8130	:	Conductors for insulated electric cables and flexible cords
IS:5831	:	PVC insulation and sheath of electric cables
IS: 2982	:	Copper conductor in insulated cables and cords.
IS: 3975	:	Mild steel wires, strips and tapes for armouring cables
IS: 5609	:	Specification for low frequency wirers and cables with PVC insulation and PVC sheath
IS: 6380	:	Specification of elastomeric insulation of sheath of electric cables.
IS: 434(I and II)	:	Specification for rubber insulation cables.

IEC: 540	:	The methods for insulations and sheath of electric cables and cords(elastomeric and thermoplastic compounds)
IEC: 230	:	Impulse tests on cables and their accessories
IEC: 60	:	High voltage test techniques
IEC: 287	:	Calculation of the continuous current rating of the cables(100% load factor).
IEC: 288	:	Nominal cross sectional area and composition of conductor of insulated cables.
IEC: 502	:	Extruded solid dielectric insulated power cables for rated voltages from 1kV upto 30kV.
NEMA-WC-5	:	Thermoplastic insulated wires and cables for transmission and distribution of electrical energy.
IEEE: 383	:	Standard for type test for class IE electric cables, filled splices and connection for nuclear power generation station.
IEC: 332-1	:	Test on electric cables under fire conditions.
ASTM-D-2843	:	Standard test method for density of smoke from burning/decomposition of plastics.
ASTM-D-2863	:	Test for determination of oxygen index.
IEC-754-I	:	Test method for acid gas generation
IEC-331	:	Fire resisting characteristics of electric cables

SVENSK Standard SS-4241475 Class F3

- BICC Hand Book For cables in fire regarding temperature index-chapter-6
- Indian Electricity Rule.

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

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

3 DESIGN CRITERIA

The cable shall be used for connection of power and control circuits of the auxiliary electrical systems.

The cable shall be suitable for installation in the required site conditions.

Cables shall be sized suitably with proper derating factors as per the installation conditions of the cable.

For continuous operation at specified rating as well as during short circuit condition the maximum conductor temperature shall be limited to the permissible value as per relevant standard.

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

Armouring, wherever provided, shall be single round/ flat wire of galvanised steel for multi-core cables and aluminium for single core cable. Cables in buried formation shall be armored. Cables laid in duct banks/conduits shall be unarmoured.

The outer sheath as well as the inner sheath shall have flame retardant low smoke (FRLS) characteristics and shall meet the requirements of additional tests specified for this purpose.

Core identification for multi-core cable shall be provided by colour coding.

Power cables shall be chosen taking into account the following factors:

a) System Fault level.
b) Maximum time for fault clearance (i.e, operating time of the back up protection relays plus the time of operation of the circuit breakers).
c) Full load current of the circuit.
d) Short circuit current and duration (for breaker protected cables)
e) Installation conditions.
f) Voltage drop under normal running and starting condition
g) Voltage drop at motor terminals shall be within permissible limit during starting & normal running.

h) The cable should withstand the maximum fault current corresponding to the particular voltage level for the minimum time before the fault is cleared.

i) Consideration shall also be given to limit the cable to the nearest standard sizes instead of using too many types.

j) The standard cable sizes, ampacities, derating factors, etc. shall be as given in IS or relevant standard.

k) The minimum size of power cables to be used shall be as follow :

Aluminium conductor	:	6 Sq. mm.
Copper conductor	:	2.5 Sq. mm.

4 SPECIFIC REQUIREMENTS

4.1 Type of Cable

LV power cables shall be stranded aluminium conductor, cross linked polyethylene (XLPE) insulated, extruded black FRLS PVC inner sheathed, armoured and overall FRLS extruded black PVC sheathed cables conforming to IS : 7098.

Control Cables shall be 1100 V grade with annealed high conductivity stranded copper conductor, PVC insulated, FRLS PVC inner sheathed, armoured and FRLS extruded black PVC outer sheathed cables conforming to IS : 1554.

4.2 Conductor

The cable conductor shall be made from standard Aluminum for LT Power cables and Copper for control cables to form compact conductor having a resistance within the limits specified. All the cables of size 25mm^2 and above shall have sector shaped conductors.

4.3 Insulation

The insulation of the LV power cable shall be XLPE type & for control the insulation shall be PVC type. It shall be designed and manufactured for the specified system voltage. The manufacturing process shall ensure that insulation shall be free from voids. The insulation shall withstand mechanical and thermal stresses under steady state and transient operating conditions. The extrusion method should give a very smooth interface between semi conducting screen and insulation. The insulation of the cables shall be of high standard quality.

4.4 Inner Sheath

The sheath shall be suitable to withstand the site conditions and the desired temperature. It shall be of adequate thickness and applied by a continuous process to produce a sheath of consistent quality free from all defects. PVC sheath shall be extruded.

4.5 Armour

Hard drawn aluminum wire armouring/ galvanized steel tape/ wire armouring shall be used for single core and multi-core cable respectively. Cables should be un-armoured wherever indicated. The hard drawn aluminium wire for armour shall be of H4 grade, as per IS-8130 (having tensile strength above 150

N/mm2). The diameter of the aluminium wire shall be as per the table for the dimensions of the galvanized steel wire armour given in the relevant standard.

4.6 Outer sheath

FRLS extruded black PVC serving as per IS: 1554 otherwise shall be applied over the armouring with suitable additives to prevent attach by rodent and termites. All serving must be given anti-termite treatment.

4.7 Packing

- Cables shall be supplied in non-returnable drums. Drum lengths shall be such so that cable joints are totally avoided. The drums shall be of heavy construction. All wooden parts shall be manufactured from seasoned wood. All ferrous parts used shall be treated with suitable rust preventive finish or coating to avoid rusting during transit or storage. Wooden cable drum shall be treated by immersing in copper-nitrate solution.
- The ends of each cable length shall be sealed before shipment. Heat shrinkable cable cap shall be used for this purpose.
- A label shall be securely attached to each end of the reel indicating the Purchaser's order number, Owner's identification mark i.e. "NNTPS ", length, type, voltage grade, conductor size and number of cores of the cable. A tag containing the same information shall be attached to the leadings end of the cable inside. An arrow and necessary instructions shall be marked on the drum indicating the direction in which it should be rolled. Drum numbers are to be indicated on the cable drums.

4.8 Spare Core

Multi-core control cables shall have 20% spare core, minimum one spare.

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

a) Power.
b) Control, interlock and indication.
c) Metering and measuring.
d) Alarm and annunciation.
e) C.T. Cables.
f) V.T. Cables.

4.9 Constructional Requirements

a) Cable shall have suitable filters laid up with the conductors to provide a substantially circular cross section before the sheath is applied. Fillers shall be suitable for the operating temperature of the cable and compatible with the insulating material. All materials shall be new, unused and of finest quality.
b) Workmanship shall be neat, clean and of the highest grade.
c) LT Power cables shall be 1.1kV grade, heavy duty, stranded aluminium conductor, XLPE Insulated galvanized steel wire/strip armoured, flame retardant low smoke (FRLS) extruded PVC type outer sheathed.

d) Control cables shall be 1.1kV grade, heavy duty, stranded copper conductor, PVC Type-A insulated, galvanized steel wire armoured, flame retardent low smoke (FRLS) extruded PVC of Type - ST1 outer sheathed.

e) Special Properties:

f) All the above cables shall be conforming to the relevant Indian/IEC standard in general, with the following special properties:

- Oxygen Index of the outer sheath shall not be less than 29, when tested as per ASTM-D-2863.
- Temperature Index of the outer sheath shall not be less than 250°C, when tested as per ASTM-D-2863.
- Halogen acid contents in outer sheath shall not be more than 20%, when tested as per IEC-60754.
- The maximum smoke density in percent light absorption should not exceed 60% in case of PVC compound and 20% in case of fire survival cables, when tested as per ASTM-D-2843.
- Swedish chimney test as per SS-4241475 class F3 and ladder test for flammability as per IEEE-383.

4.10 Joints and Terminations

Materials of construction for a joint/termination shall perfectly match with the dielectric chemical and physical characteristics of the associated cables. The material and design concepts shall incorporate a high degree of operating compatibility between the cable and joints. The protective outer covering (jacket) used on the joints/terminations shall have the same qualities as that of the cable outer sheath in terms of ambient/operating temperature withstand capability and resistance to hazardous environments and corrosive elements. No joints shall be allowed unless the cable drawn length is exceeded.

4.11 Cable Identification

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

a) Manufacturer's name or trade mark
b) Voltage grade
c) Year of manufacture
d) Type of insulation.
e) Type of outer sheath e.g. "FRLS" etc.
f) ISI marks
g) Nominal cross sectional area of the conductor & no of cores
h) Sequential marking
i) Owner's identification mark "NNTPS"

5 TESTS

5.1 Type Test

Cables shall be type tested quality. For each type and rating of cables reports on all type tests as per relevant standards, and carried out with in last five years from the date of bid opening shall be submitted.

These reports shall be for the tests conducted on the similar type of cables proposed to be supplied under this contract. These tests should have been conducted at an independent laboratory. If type test certificate are not available the same shall be conducted in the presence of the purchaser.

5.2 Shop Tests

The Cables shall be tested in accordance with relevant IS/IEC standards at manufacturers' works in the presence of consultant /purchaser or his representative as given below:

- Routine tests on each drum of cables.
- Acceptance tests on drums chosen at random for acceptance of the lot shall be conducted in the presence of Consultant / purchaser or his representative.

5.3 Additional Tests

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

a) Oxygen index test (for both C1 & C2) – The oxygen index test shall be carried out as per ASTM D2863. The Oxygen index shall not be less than 29. All the additional tests shall be conducted in the presence of the purchaser.

b) Temperature Index Test (for both C1 & C2) - The measured value of temperature index shall be 21 at a temperature of 250°C.

c) Flame retardance test on single cable and on bunched cables (for both C1 & C2) - After the test, there should be no visible damages on the test specimen within 300mm from its upper end. After burning has ceased, the cables should be wiped clean and the charred or affected portion should not have reached a height exceeding 2.5 meter above the bottom edge of the burner, measured at the front and rear of the cable assembly.

d) Halogen acid gas evolution test (for category C2) – This test shall be as per IEC-754-1.The level of HCL evolved shall not exceed 20 per cent by weight.

e) Smoke density test (for category C2) – Smoke generation by outer sheath under fire as per ASTM D 2843. The cables shall meet the requirements of light transmission of minimum 40% after the test.

f) Test for rodent & termite repulsion property.

6 FIRE PROOF SEALING SYSTEM

Fire proof sealing system shall consist of 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.

'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.

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.

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

Fire stop/ seal

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

Fire Break

The fire proofing system, other than fire-stops, adopted to retard flame propagation 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 –resistance 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.

Application of fire proof sealing system

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 stop

Location of fire breaks

Firebreaks 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.

Bidder 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.

Test on fire stops

The fire stops shall be subjected to the following type tests:

Fire Rating Test

Hose Stream Test

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.

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.

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 200oC.

Tests on fire breaks

Firebreaks shall undergo the following tests as per ANSI-IEEE-383:

Ampacity test

Flame test

7 DRAWINGS, DATA AND MANUALS TO BE FURNISHED FOR APPROVAL

- Cable datasheets
- Cable sizing
- QAPs & Test Reports
- Relevant catalogues

8 RATINGS AND REQUIREMENTS

8.1 L.V. Power cables 1100 V grade

1100 V grade, power cable conforming to following requirement and in line with IS-1554, IS-5831, IS-8130 & IS-3975.

Conductor	:	Stranded and compacted plain aluminium of grade H2 and class 2/stranded, high conductivity annealed plain copper as per Annexure, generally conforming to IS:8130
Insulation	:	Extruded PVC compound conforming to type C of IS:5831 or XLPE.
Inner Sheath	:	Extruded cross linked Polyethylene FRLS PVC compound conforming to type ST2 of IS:5831 for multicore cable.
Armour	:	Galvanised single round/ strip steel wire armour for twin and multicore cables. Non-magnetic hard drawn aluminium single round wire conforming to H4 grade for single core cables.
Overall Sheath	:	Extruded FRLS PVC compound conforming to type ST2 of IS:5831.

8.2 Control Cables 1100 V Grade

1100 V grade, 700 C rating, PVC Control cable conforming to following requirement and in line with IS-1554, IS-8130, IS-5831 & IS-3975.

Conductor	:	Stranded, non-compacted & circular, high conductivity annealed plain copper, generally conforming to IS:8130.
Insulation	:	Extruded PVC compound conforming to type A of IS:5831.
Inner sheath	:	Extruded FRLS PVC compound conforming to type ST1 of IS:5831 for multicore cables. Single core cables shall have no inner sheath
Armour	:	Galvanised single round steel wire for twin and multicore cables.
Overall sheath	:	Extruded FRLS PVC compound conforming to type ST1 of IS:5831

8.3 Trailing Cables (Power & Control)

Trailing cable, 1.1kV grade with highly flexible stranded tinned copper conductor, insulation of EPR (Ethylene-propylene Rubber) each individual core protected and covered and overall outer cover of poly-chloroprene rubber cable shall conform to IS 9968 part-1.

GENERAL TECHNICAL REQUIREMENTS

FOR

CABLING INSTALLATION

SPECIFICATION NO.: PE-SS-999-507-E111 REV 0

1.0 **INTENT OF SPECIFICATION**

1.1 This specification covers the activities mentioned below, as applicable to various areas of power station:

b) Laying and termination of cables.
c) Testing and charging of cables.
d) Supply and erection of miscellaneous items for completion of the cabling system.
e) All associated work for completion of cabling system.
f) Receipt of cables and cabling materials supplied by purchaser/others.
g) Site handling and storage of material.
h) Minor civil works.

1.2 The scope of supply of cabling materials as a part of cable installation work includes supply of all accessories including, but not limited to, cable clamps, ferrules, cable tags, nuts, bolts, and consumables like anti-corrosive paints, welding electrodes etc. required to complete the cabling system. All other sundry materials for minor civil work shall also be supplied by vendor.

1.3 WORKS EXCLUDED FROM VENDOR'S SCOPE

a) Major civil works like excavation and concreting of concrete trenches, plate embedments on cable trenches, ceiling and floors.
b) Civil works for ducting for crossing of roads & rail tracks.
c) Conduits and pipes embedded in walls, floors etc.

2.0 CODES AND STANDARDS

2.1 Installation of cabling work shall comply with the latest edition of following Indian standards rules, regulations and acts. However, if Specification specifies conformance to any other international standard, equivalent BS / IEC / ISO / any other standard shall be applicable.

a)	IS:1255	Code of practice for installation and maintenance of power cables up to and including 33 kV rating.
b)	IS:732	Electrical wiring installation (system voltage not exceeding 650 V).
c)	IS:5216	Guide for safety procedures and practices in electrical works.
d)	IS:226	Structural steel (Standard Quality).
e)	IS:800	Code of practice for use of structural steel.
f)	IS:316	Code of practice for use of metal arc welding for general construction in mild steel.
g)	IS:1363	Hexagonal bolts, nuts and screws.
h)	IS:1572	Electroplated coatings of cadmium on iron and steel.
i)	IS:2629	Code of practice for hot dip galvanizing for iron and steel.
j)	IS:2633	Method of testing uniformity of coating on zinc coated articles.
k)		Indian Electricity Act.
l)		Indian Electricity Rules.
m)		Fire insurance regulations.
n)		Regulations laid down by the Chief Electrical Inspector of the State.
o)		Regulations laid down by the Factory Inspector of the State.
p)		Any other regulations laid down by the authorities.

2.2 In case any clause of contradictory nature arises between standards and this specification, the latter shall prevail.

3.0 CABLING MATERIALS TO BE PROVIDED

3.1 Trefoil Cable Clamps shall be provided for clamping single core cables carrying alternating current and shall be of aluminium alloy or nylon material as per Specification.

3.2 Omega Cable Clamps shall be provided to fasten the individual multi-core cable above 35mm outer diameter and shall be of aluminium alloy or mild steel.

3.3 Strip Cable Clamps shall be provided to fasten the group of multi-core cables up to 35mm diameter and shall be of mild steel or aluminium

3.4 Self Locking Clamps shall be shall be provided of nylon material with self locking feature when the cord is looped and shall provided with manual lock release.

3.4 Steel clamps shall be hot dip galvanized as per the requirements given in Specification.

3.5 Ferrules shall be provided for individual core of control cables and shall be of plastic material.

3.6 Cables shall be provided with cable number tags for identification Cable tags shall be of durable fibre, aluminium or stainless steel sheets as per Specification.

3.7 Miscellaneous items required for the buried cables such as cable markers, bricks, sand, protective slabs etc. shall be to provided by the vendor.

4.0 CABLING CONCEPT

4.1 In the plant building, substations, switchgear rooms, control rooms etc., power and control cables shall generally be laid on cable trays installed in concrete trenches, tunnels, cable basements, cable vaults, cable shafts or along building and technological structures as the case may be.

4.2 In case of multicore cables of diameter up to 30 mm where not more than 3 cables are taken in one run, these can be taken directly along structures, walkways, platforms, galleries, walls, ceiling etc. by proper clamping at regular intervals of 750 mm or less.

4.3 Power & control cables installed along buildings, structures, ceilings, walls, etc., which are required to be protected against mechanical damage, shall be taken in GI conduits.

4.4 GI Conduits shall also be used for flameproof installations, wherever required, with sealing at both ends.

4.5 Entry of cables from trenches/tunnels into buildings shall be by means method duly approved by purchaser approved, which shall be informed to successful bidder during detailed engg stage.

4.6 Cables laid exposed in racks/trays and routed from trenches/tunnels/basements etc to individual drive/ control devices etc shall be taken in embedded/exposed/surface-grouted rigid GI conduits and / or flexible conduits unless directly terminated to the equipment in the panels located above trenches, tunnels or basement.

4.7 All cables routed along walls or in equipment rooms shall be protected by means of laying them through G.I. pipes or by providing sheet metal covers up to a height of 2000 mm from

the working floor levels and platforms, for protection against mechanical damage. All vertical risers shall be enclosed type.

4.8 For 415 V power wiring in ancillary buildings, offices and laboratories, cables shall be taken through embedded/exposed GI conduits or rigid PVC pipes as applicable.

4.9 Wherever cables are to be laid below roads and railway tracks, the same shall be taken through ducts buried at a suitable depth.

4.10 At certain places where hazardous fumes/gases may cause fire to the cables, cable trenches after installation of cables shall be sand-filled.

4.11 In corrosive atmosphere, Epoxy painted G.I. conduits shall be used for cables.

4.12 Single core cables, when pulled individually, shall be taken through PVC pipes only.

4.13 Cables shall be avoided below oil pipes and in the vicinity of steam pipes.

4.14 Cable installation shall be properly coordinated at site with other services and wherever necessary suitable adjustment shall be made in the cable routings with a view to avoid interference with any part of the building, structures, equipment, utilities and services

4.15 All apparatus, connections and cable work shall be designed and arranged to minimise the risk of fire and ingress of water. All material required to achieve the same shall be included in the cost of installation of cables.

5.0 TRANSPORTATION & STORAGE OF CABLE DRUMS

5.1 Transportation and storage of cable drums shall generally conform to the requirements of IS:1255. The cable drums shall be transported on wheels to the place of work.

5.2 Transportation of all cables, which shall be provided by purchaser as free issue items, from purchaser's storage area to the work site shall be the responsibility of vendor. Empty cable drums shall be returned to purchaser.

6.0 LAYING OF CABLES

6.1 Laying and installation of power, control and special cables shall generally conform to IS:1255.

6.2 The cables shall be paid-out in proper direction from the cable drums (opposite to the normal direction of rotation for transportation).

6.3 In case of higher size cables, the paid out cables shall run over rollers placed at close intervals and finally transferred carefully on the racks/trays. Care shall be taken so that kinks and twists or any mechanical damage does not occur to cables. only approved cable pulling grips or other devices shall be used. Under no circumstances cables shall be dragged on ground or along structure while paying out from cable drums, carrying to site and straightening for laying purpose.

6.4 All possible care shall be given while handling un-armoured cables.

6.5 Additional length of power cables of one loop with permissible bending radius shall be provided. For control cables extra length of 1 - 1.5 metre shall be provided.

6.6 The bending radius of various types of cables shall not be less than those specified by cable manufacturers and that specified in IS:1255.

6.7 All cables shall be provided with identification tags indicating the cable numbers. Tags shall be fixed at both ends of cables, at each bend, and both sides of floor/wall crossings.

6.8 Single core cables for a. c. circuits shall form a complete circuit in trefoil formation supported by means of trefoil clamps of nonmagnetic material.

6.9 Multi-core cables above 1100 V grade shall be generally laid in ladder type trays in one layer with spacings not less than one cable diameter of bigger diameter cable.

6.10 All 1100 V grade multicore power cables and single core DC cables shall be placed in single layer, touching each other and clamped by means of single or multiple galvanized MS saddles/ aluminium strips/ nylon cable ties as specified in specification. Cables above 35mm outer diameter shall be clamped individually.

6.11 Control cables shall be laid touching each other and may not preferably be taken in more than two layers.

6.12 Segregation of the cables on the basis of their types and their functions shall be as under for horizontal formations:

a) HT cables shall be laid in the top tier(s).
b) LT power cables to be laid in the tray(s) below the HT cable trays.
c) LT control cables to be laid in the tray(s) next below to the LT power Cable tray(s).
d) Special control cables including screened control cables to be laid in the bottom most tray(s).

6.13 For vertical formations, the tray closest to the wall shall be considered as bottom most tray and the order indicated in clause just above shall be followed.

6.14 When it may not be possible to accommodate cables as per the criteria indicated in the clauses 6.12 & 6.13 above, the following rules In hierarchical order shall override the criteria:

a) Control cables are mixed up with the special control cables with clear minimum gap of 100mm between them.
b) LT power cables are mixed up with control cables with clear minimum gap of 150mm between them.
c) LT power cables are mixed up with HT power cables with clear minimum gap of 200mm between them.

However, under no circumstances HT power cables can be mixed up with control cables of any type.

6.15 For laying cables along building steel structures and technological structures, the cables shall be taken by clamping with MS saddles screwed to the MS flats welded to the structure. MS saddles and flats shall be galvanized.

6.16 For laying cables along concrete walls, ceilings etc., the cables shall be taken by clamping with MS saddles screwed to the MS flats welded on the inserts. Where inserts are not available the saddles shall be directly fixed to the walls using rawl plugs and MS flat spacers of minimum 6mm thickness.

6.17 To facilitate pulling of cables in GI conduits, powdered soft stone, plastic soap or other dry inert lubricant may be used but grease or other material harmful to the cable sheaths shall not be used.

6.18 No single core cable shall pass through a GI conduit or duct singly except DC single core cables. AC single core cables shall pass through GI conduits/pipes in trefoil formation only.

6.19 Entry of cables from underground trenches to the buildings or tunnels shall be by some approved method. Necessary precautions shall be taken to make the entry point fully water tight by properly sealing the pipe sleeves wherever they enter directly into the building at trench level. The sealing shall be by cold setting compound. Any alternative sealing arrangement may be suggested with the offer for purchaser's consideration.

7.0 CABLE TERMINATION AND JOINTING

7.1 All cable entries in the equipment shall be sealed by cable glands.

7.2 Power cable terminations shall be carried out in a manner such as to avoid strain on the terminals by providing suitable clamps near the terminals.

7.3 Control cable cores entering switchboard or control panels shall be neatly bunched and strapped with PVC perforated tapes/nylon ties and suitably supported to keep them in position at the terminal block. Spare cores shall be neatly dressed and suitably taped at both ends.

7.4 Cable joint, not more than one in a circuit, shall normally be made at an intermediate point in the straight run of the cable only when the length of the run is more than the standard drum length supplied by the cable manufacturer.

7.5 Junction boxes shall be used, wherever required, for jointing of control cables.

7.6 Termination and jointing shall generally conform to the requirements of IS:1255 and shall strictly conform to the recommendations of termination and jointing kit supplier.

7.3 Cable installation shall be properly coordinated at site with other services and wherever necessary suitable adjustment shall be made in the cable routings with a view to avoid interference with any part of the building, structures, equipment, utilities and services

7.8 All apparatus, connections and cable work shall be designed and arranged to minimise the risk of fire and ingress of water. All material required to achieve the same shall be included in the cost of installation of cables.

10.0 DRAWINGS / DUCUMENTS TO BE SUBMITTED AFTER AWARD OF CONTRACT

10.2 The following documents shall be furnished after award of contract for purchaser's approval.

a) Final Field Quality Plan.
b) Final Quality Plan.

1.0 General

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

b) Inverter construction and related devices:

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

c) Programming of VVVF Drives.

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

d) VVVF drives shall be connected with power supply and these drives generate their own low voltage control supply. Potential free contacts shall be connected to this control supply and few programmable control terminals. Starting / stopping / set speeds operations of VVVF drive shall be achieved by above control connection.

e) VVVF shall give smooth control over acceleration and deceleration making the motion jerk free and using Variable voltage variable frequency limits the inrush current to the squirrel cage motors. VVVF provides controlled torque to the motor due to which elevator operations are jerk free.

1.1 Experience

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

1.2 Local support

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

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

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

2.0 Basic requirements for the AC Drives

2.1 General requirements

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

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

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

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

Rated Input Voltages	380V to 480V (-10% to +10% variation), three-phase
Rated Input Frequency	50Hz +3 % to - 5%
Output Voltage	0 – Input voltage, three-phase
Output Frequency Range	0 to 400 Hz
Acceleration / Deceleration Time	0.01 – 999s, adjustable, linear, with S, with U or customised shapes
Overload capability (Constant Torque)	150% of nominal current for 1min.
Operating ambient Temperature	-10°C up to 50°C(shall be de-rated suitably if not rated at 50°C)
Storage ambient Temperature	-25°C up to 70 °C

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

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

Suitable encoder shall be provided for main hoist motion.

3.0 User interface

3.1 General

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

3.2 Inputs and outputs

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

Analogue Inputs : 1 x Programmable differential voltage input ± 10V,
1 x Programmable current input 0(4) - 20mA
1 x Programmable voltage input 0 – 10V

Analogue Output : 1 x Programmable analogue outputs 0(4) - 20mA or 0 – 10V

Logic inputs : 6 x Programmable logic Inputs isolated from the mains

Relay Outputs : 2 x Programmable Digital outputs with a changeover dry contact

All the control terminals shall be clearly marked.

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

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

3.4 Programming terminal

A. The AC drive shall have a keypad /display for programming and controlling purposes. An IP54 or IP65 remote mounting shall be possible at a distance of 10m.

B. Password protection shall be provided to avoid unauthorized tampering with the set parameters.

C. The programming terminal shall be able to display the commercial reference of the AC drive and of the options, the software version, the serial number

D. Direct keypad entry shall be provided to observe the following actual parameters. Any one of the following parameters or actual values shall be selected to be always displayed:

i) Input Voltage
ii) Input Frequency
iii) Output Frequency
iv) Output Power
v) Output Current
vi) Motor Speed

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

i) Drive Status

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

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

3.5 Application programming

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

3.6 PC Tools

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

4.0 Software features

A. Restart

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

B. Brake logic control

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

5. Preferred makes:

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

c) Short circuit withstand capability for 0.2 seconds (only for Breaker operated feeders feeding motors & transformers). For Breaker operated tie feeders short circuit withstand capability shall depend on actual fault clearing time.

5.9.17 Illumination System

Suitable illumination necessary to facilitate normal operation and maintenance activities and to ensure safety of working personnel shall be provided. This shall be achieved by following artificial lighting.

- Normal AC lighting
- Emergency AC Lighting
- Emergency DC Lighting
- Emergency lights with self-contained batteries.

About 80% of the total light fittings would be connected to the normal 230 V AC lighting supply and the balance 20% to the station emergency bus fed from the DG set in the station building and steam generator areas.

On all the time.

DC emergency lights are envisaged at strategic points in the power station viz., near entrances, staircases, control rooms, etc. These would be fed from 220 V DC systems, which would be normally off when AC power is available. These would be automatically switched on when the normal / emergency AC supply fails. Areas, where no separate dc system is available, shall be provided with emergency lights with self-contained batteries connected to the mains and shall switch on automatically when the supply fails. Battery backup time shall be at least one (1) hour.

Apart from maintenance factor as given below, Temperature correction factor shall be considered in the lighting design.

(a) Air conditioned indoor area : 0.8
(b) Non air conditioned indoor area : 0.7
(c) Dust prone and outdoor area : 0.6

Following Illumination Levels shall be maintained in various areas:

(a) Control Room, testing laboratories : 400 Lux
(b) Switchgear, electronic equipment rooms : 250 Lux
(c) Turbine Hall, Compressor House : 200 Lux
(d) DG Room, pump houses : 200 Lux
(e) Battery Room : 250 Lux
(f) Cable Spreader Room : 70 Lux
(g) Passages, stairs, Toilets : 70 Lux
(h) Transformer Yard : 50 lux
(i) Emergency Lighting in Plant Control Room : 50 Lux

Generally, fluorescent fixtures would be used for indoor illumination. CFL shall be used in control room, conference room etc, wherever possible

For yard illumination, flood lights would be installed at suitable locations to provide the requisite level of illumination. Pole-mounted high-pressure sodium

vapour fixtures would be used for approach roads. Maintenance light (24 Volt) would be used for maintenance purpose.

Power distribution from the lighting transformers would be through 415V, 3 phase, 4 wire MLDB. A suitable number of lighting panels would be located in each area. Each MLDB shall have two Incomer and one bus coupler. Each bus section shall be fed from suitably rated, 415 V/433 V lighting Transformer, which shall be fed from 415 V Lighting Switchgear.

The lighting system would be designed to ensure uniform illumination. The lighting fixtures shall be designed for minimum glare. The design shall prevent glare/luminous patch seen on VDU/ Large video screens, when viewed from an angle.

All outdoor fixtures shall be weather proof. Lighting pole shall be considered for Road Lighting and Lighting Mast shall be used for General Area Lighting. All Outdoor lighting shall be automatically controlled by synchronous timer and / or photocell. Provision to bypass the timer and / or photocell shall be provided in the panel.

At least one 5/15A, 230V AC universal socket outlet with switch shall be provided in offices, cabins, etc. 20A, 230V AC industrial receptacle with switch shall be provided strategically in all industrial area.

5.9.18 Welding Sockets

Suitable number of 63 A/100 A, 3ph., 4 wire, 5 pin, 415V AC industrial receptacles shall be provided for entire plant for welding purposes, particularly near all major equipment and at an average distance of 50m. At least one 63A, 3ph, 415V AC receptacle shall be provided in each room of main power house building.

63 A/100 A welding sockets shall be fed from respective 415 V Welding Switchgear (Maintenance Switchgear)

5.9.19 Grounding System

Grounding system design shall be carried out as per IEEE 80 and IS:3043.

For ground mat design, the size of the grounding conductor shall be arrived at considering the maximum fault current for a duration of 1 second and suitable corrosion factor. The spacing of the conductors shall be such that the touch and step potential are within the limits of permissible values. The grounding resistance shall be less than 1.0 ohm. The grounding system shall be designed for a life expectancy of at least 40 years.

The contractor shall assess the soil quality and site conditions and design the grounding system accordingly.

The grounding system below ground level shall consist of interconnected mesh of mild steel rods buried at a depth of minimum 600 mm and vertical electrodes. When the grounding conductor is laid beneath the building the depth of burial shall be increased so that sufficient earth coverage is available.

The grounding grid at different areas of the power plant shall be interconnected by minimum 2 Nos. of conductors.

Vertical electrodes shall be of mild steel. Treated earth pits as required shall be provided. Vertical risers shall be provided at suitable places for connecting to

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ILLUMINATION

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1. GENERAL

This specification is intended to cover the design, engineering, manufacture, assembly, testing at manufacturer's works, supply & delivery, properly packed for transport to site of Illumination System complete with luminaries and all accessories for efficient and trouble-free operation of 2 x 500 MW New Thermal Power Plant at Neyveli, Tamilnadu for Neyveli Lignite Corporation Limited.

2. CODES AND STANDARDS

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

IS 3646 (Part I to III)	:	Code of Practice For Interior Illumination
CBIP Manual	:	Substation Equipment, Illumination and Layouts
IES (Illuminating Engineering Society of North America)	:	Application and Reference Volume
IEC 60598	:	Luminaires
IEC 60081	:	Double Capped Fluorescent Lamps
IEC 60920 & 60921		Ballast for Tubular Fluorescent Lamps
IEC 60400		Lampholder for Tubular Fluorescent Lamps & Starter Holder
IEC 60064		Tungsten Filament Lamp for Domestic And Similar General Purpose
IEC 60188		High Pressure Mercury Vapor Lamps

Indian Electricity Rule (IE) 1956 as amended up to date.

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

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

Scope: Elevator Machine room, Shaft etc.

Areas to be covered in TG package are entire Power House Building including BMCC room, Transformer Yard, Adjoining roads, DG Plant Building, Service Building, ACW Pump House, Switchgear/MCC rooms, piping gallery, CPU Regeneration plant, cable gallery, all roads within battery limit and area illumination of the above premises.

Any other area/premises not specifically mentioned here, but which fall under the battery limit of this package are included in the scope.

The following equipment and materials are broadly covered under this scope.

Lighting Transformers, Main lighting boards, Emergency lighting boards, Emergency DC lighting panels, Lighting panels/boards, Street lighting panels etc.

Lighting fixtures with lamps and accessories.

Street light poles and High Mast towers.

Ceiling fans, receptacles, switches, switchboards, portable emergency lights, portable 24V supply module including handset maintenance equipment and required extension cable etc.

Cable trays and supporting structures

Cables, wires, splicing/termination/connection accessories.

Conduit and accessories, junction and pull boxes, terminal blocks.

Grounding materials and connections.

All fittings, supports, brackets, anchors, clamps and connections.

Steel for field fabrication of supports and brackets

Welding sockets with Welding DB

3. DESIGN CRITERIA

The illumination system shall provide lighting supply to all plant areas. In addition, it shall also provide emergency lighting to selected areas during plant emergency conditions, as described below.

The entire illumination system shall be installed in an adverse industrial environment. Fixtures / Accessories in some areas shall be subject to vibration, coal dust, oil/water vapors as prevalent in a Thermal Power Plant.

The design shall be such so to ensure the minimum lighting levels as specified for different areas.

The illumination system shall comprise of following sub-systems:

Normal A.C. Lighting

This shall be provided by A.C. lighting fixtures distributed throughout the plant. These lights shall be ON as long as the station A.C. supply is available. A.C. lighting fixtures shall be fed from respective area A.C. Lighting Panels, which in turn shall be connected to Main Lighting Distribution Boards (MLDB). The Main Lighting Distribution Boards shall be fed from through 415V/433V Lighting transformers.

In CPU regeneration Plant area, MLDB shall be fed from respective LT switchgear/MCC.

Emergency A. C. Lighting

On failure of normal AC supply, emergency AC lighting shall be provided in selected areas of the Powerhouse, TG areaand some other areas close to the powerhouse for general visibility, safe movements & operation of major equipment and auxiliaries. Emergency AC lighting fixtures shall be fed from respective Emergency AC Lighting Panels. These panels shall be fed from the Emergency AC Lighting Distribution Board (ELDB). The Emergency Lighting Distribution Board (ELDB) shall be fed from 415V Emergency switchgear having D.G system backup through 415V/433V lighting transformers.

20% of the total fittings shall be fed from Emergency lighting for areas such as TG Area,control rooms etc.

Two nos 415 V feeders shall be made available from the 415 V Emergency (N/E) switchgear.

Emergency D.C. Lighting

The Emergency DC Lighting System shall be located strategically in critical operating areas and at emergency exits. Emergency DC lighting shall also be provided in the Control rooms, Switchgear/ MCC rooms and other strategically important areas. These fixtures shall be fed from respective Emergency DC Lighting Panels. The Emergency DC Lighting Boards (DCELDB) shall be fed from 220V DC Distribution Boards (DCDB). 10% of the total fittings shall be fed from Emergency D.C. Lighting. for areas such as TG area, area and Control rooms etc.

These lights shall remain ~~normally OFF but on failure of AC supply these lights shall be automatically~~ ON. Tube lights with Electronic choke suitable for 230 V, AC / DC operation or other Energy Efficient Lamps may be used for DC emergency lighting.

~~24 V Maintenance Sockets~~ with necessary step-down Transformer shall be provided at Strategic locations such as ~~TG Hall areas and Switchgear~~ rooms etc.,

~~**Emergency Lighting with self contained batteries**~~

This system ~~shall be~~ provided by portable self-contained battery / automatic charger / inverter fed ~~compact~~ fluorescent lamps in isolated buildings / areas where station D.C. supply is not ~~available.~~ These portable emergency light units shall be switched on automatically on loss of ~~normal~~ AC supply. Battery packs for portable emergency lights shall be rated for minimum ~~two~~ and half hour duty.

Watch Tower / Street Lighting /Area Lighting

Time-switch and/or photocell shall be used for controlling street lights/area lights with provision for manual over-ride.

Illumination Calculation

Standard Lumen method shall be adopted for interior and exterior lighting in order to determine the number of lighting fixtures for obtaining the desired average level of illumination.

The coefficient of utilization shall be considered to take care of Lumen loss due to:

a) Effect of room dimensions.

b) Absorption of light in luminaries.

c) Absorption of light at various room surfaces i.e. ceiling wall etc.

d) Floor cavity, ceiling cavity.

e) Mounting height.

Moreover a maintenance factor shall also be considered to account for the fall of illumination due to aging, pollution like dust deposits etc.

Voltage drop at the fixture terminals from the MLDB bus shall not exceed 3%. Circuit loading of each lighting Panel shall be done in such a way that almost balanced loading in all the phases i.e. R, Y and B is achieved. At least two sub circuits shall be used for illumination of a particular area. Sub circuit loading of each lighting panel shall be restricted to 2000 Watts.

Design of lighting system shall be such that the average lux level specified is achieved. . These lights shall remain normally off , but on failure of AC supply these lights shall be automatically on. Maintenance light (24 Volt) would be used for maintenance purpose.

Hand lamps

10 nos. 24 V halogen lamps with reflector along with 1100 V, twin core PVC sheathed, 2.5 mm2 stranded copper wire of 20 m lengths as handset shall be supplied loose.

ILLUMINATION LEVELS AND CHOICE OF LIGHTING FIXTURES

The area-wise average illumination levels and type of luminaries shall be as indicated below:

S No.	Location	Lighting Fixture Type	Lux Level
1	Control Rooms	Energy Efficient FTL in Decorative fittings with wide angle mirror optic antiglare reflector. Decorative Compact fluorescent tube (CFL) fitting with internal mirror reflector with mounting bracket suitable for 1x18W/ 1 x 22W/ 1x25W lamps.	400
2	Testing Laboratories	Energy Efficient FTL in Decorative fittings with wide angle mirror optic antiglare reflector. Decorative Compact fluorescent tube (CFL) fitting with internal mirror reflector with	

S No.	Location	Lighting Fixture Type	Lux Level
		mounting bracket suitable for 1x18W/ 1 x 22W/ 1x25W lamps.	400
3	Turbine Hall	400W HV SV high beam flame proof well glass fixture	200
4	Compressor Plant	Energy efficient 2x40 W FTL industrial type with vitreous enamel finish (pendant / bracket mounting	200
5	DG Room	Energy efficient 2x40 W FTL industrial type with vitreous enamel finish (pendant / bracket mounting	200
6	Pump House	Energy efficient 2x40 W FTL industrial type with vitreous enamel finish (pendant / bracket mounting	200
7	Battery Room	Energy efficient 2X40 W FTL industrial type corrosion proof with vitreous enamel finish (pendant / bracket mounting	250
8	Air Conditioning Plant Room	Energy efficient 2x40 W FTL industrial type with vitreous enamel finish (pendant / bracket mounting	200
9	AHU Room	Energy efficient 2x40 W FTL industrial type with vitreous enamel finish (pendant / bracket mounting	200
10	Switchgear/MCC/Electrical & Electronic equipment Rooms	Energy efficient 2x40 W FTL industrial type with vitreous enamel finish (pendant / bracket mounting	250
11	Elevator M/C Room	Energy efficient 2x40 W FTL industrial type with vitreous enamel finish (pendant / bracket mounting	200
12	Office room	Decorative recessed type energy efficient 2 x 40 FTL with mirror reflector Decorative Compact fluorescent tube (CFL) fitting with internal mirror reflector with mounting bracket suitable for 1x18W/ 1 x 22W/ 1x25W lamps. For rooms without false ceiling, surface mounted fixtures shall be used.	300
13	Cable spreader Area	Energy efficient 2x40 W FTL industrial type with vitreous enamel finish	100
14	Oil Room and indoor hazardous areas	1 x 70 W HPMV Flame proof well glass fixture	150
15	Passage, Indoor Stair case , Toilet etc	Energy efficient 2x40 W FTL industrial type with vitreous enamel finish	100

28W FL, Industrial type with vitreous enamel reflector. fluorescent fixtures will be energy efficient type (28W T5 fluorescent cool day light tube)

S No.	Location	Lighting Fixture Type	Lux Level
16	Outdoor/Semi outdoor stairs	Dust & weather proof 70 W HPSV well glass fitting with reflector and integral mounted control gear.	70
17	Street & periphery lighting	150W HPSV street light fittings	20
18	Other areas	Energy efficient 2x40 W FTL industrial type with vitreous enamel finish	

4. SPECIFIC REQUIREMENTS

4.1 Equipment and Material

- Equipment and material shall comply with description, rating, type and size as detailed in this specification.
- Equipment and materials furnished shall be complete and operative in all details.
- All accessories, control devices, internal wiring, fittings, supports, hangers, anchor bolts etc. which form part of the equipment or which are necessary for safe and satisfactory installation and operation of the equipment shall have to be furnished.
- All parts shall be made accurately to standard gauges so as to facilitate replacement and repair. All corresponding parts of similar equipment shall be inter-changeable.

4.2 Lighting Fixtures and Lamps

- Fluorescent fixtures with electronic ballast shall be generally provided for a room height upto 5m. Type of fixture shall be industrial type with gasket, clear acrylic cover and enamelled reflector or decorative type to suit the aesthetics. For areas with false ceiling , recessed mounted decorative fixtures with mirror optic louvres shall be used. In control room / computer rooms, decorative mirror optic fluorescent light fittings with antiglare features shall be provided. The surface finish shall be smooth, unobtrusive and scratch resistant.
- Reflector shall be of sheet steel or aluminium, minimum 20 SWG thick and securely fixed by fastening device of captive type.
- Fixture shall be suitable for 19 mm conduit entry and 16 SWG GI earth wire connection.
- Fixture shall be furnished complete with lamps and integrally mounted accessories. These shall include holders, ballast, capacitor, starter, ignitors (separate type) etc.

- For corrosive areas, corrosion proof lighting fixture shall be provided. For hazardous areas, light fittings, conduits, junction boxes etc. shall have to meet the corresponding area classification requirement.
- Medium bay or high bay type of lighting fixtures with HPMV/HPSV lamps shall be used depending on the mounting heights for indoor areas having room height more than 5m. Medium/ High bay fixtures shall be provided with vibration damper wherever required.
- For areas like boiler and outdoor areas such as roads, street, transformer areas and open yards, weatherproof HPSV flood/ street lighting fixtures shall be used. For areas like boiler platforms, weatherproof well glass type HPSV fixtures with wire guards shall be used.
- All type of fluorescent lamps including Compact Fluorescent Lamp (CFL) shall be bi-pin rotary type and either cool daylight or white.
- Mercury / Sodium vapour lamp shall be colour corrected type with screwed cap.
- Lamps shall be suitable for use in position and capable of withstanding small vibrations.
- Ballasts shall be of heavy duty, low loss and polyester-filled type with copper winding.
- Ballasts for Mercury / Sodium vapour lamps shall be provided with suitable tappings to set the voltage within range specified.
- Ballasts shall be free from hum. Ballasts which produce humming sound shall be replaced, free of cost.
- In multi-lamp fixture, each lamp shall be provided with individual ballast.

4.3 Receptacles

- Receptacles shall be heavy duty, complete with individual plug and switch as described below:

Sl.No.	Type	Description
1.	RA	5A, 230V, 2 Pole, 3 Pin with third pin earthed - Suitable for flush mounting in office areas and control room. The switch shall also be flush mounting piano type.
2.	RB	15A, 230V, 2 Pole, 3 Pin with third pin earthed - Wall/ column mounted, metal clad gasketed construction, suitable for 19 mm conduit entry, screwed metal cover tied with metal chain, weatherproof construction suitable for indoor/outdoor installation. This shall be provided at an interval of 30m, or minimum one in each room.
3.	RC	63A, 415V, 3 Phase, 5 pin interlocked plug and switch with fifth pin earthed. Wall/column mounted, metal clad gasketed construction weather proof, suitable for loop in/ loop out connection of 4 Core 35 sq.mm AYWY cable. These receptacles shall be provided at an interval of 50m throughout the

Sl.No.	Type	Description
		Plant Area.
4.	RD	100A, 415V, 3 phase, 5 Pin interlocked plug and switch with fifth pin earthed Wall/column mounted metal clad gasketed construction weather proof, suitable for loop in/ loop out connection of 3.5 Core, 95 sq.mm AYWY cable.

- The conduit box of the receptacle shall be provided with earthing screws with washer and nuts welded on the surface for grounding with 16 SWG GI wire. Arrangement shall be provided inside the conduit box for grounding of third pin.
- Shrouded type plug shall be provided with corresponding matching arrangement at sockets to prevent accidental contact with finger during plug insertion.
- ~~Lighting Distribution Boards and~~ Lighting Panels shall be so constructed as to permit free access to the terminal connections and easy replacement of parts. Front access doors shall have padlocking arrangements.

4.4 Main Lighting Distribution Boards/Lighting Panel / Distribution Boards

- The Main Lighting Distribution board shall be fed from Lighting Service Switchgear through 415V/433V lighting transformers with off circuit taps ± 5% in steps of 2.5%. The lighting transformer shall be encapsulated cast resin dry type and shall be housed in a suitable enclosure. The main lighting distribution boards shall consist of two incoming MCCB/SFU with a bus coupler and required number of out going feeders consisting of triple pole and neutral SFUs/MCCB. The board shall be designed for the required short circuit level of 20 kA. All the distribution boards shall be sheet steel metal clad, dust and vermin proof, cubicle type with degree of protection conforming to IP-52. Outdoor panels shall be weather proof type with IP-54 protection. The thickness of sheet steel enclosures shall be 2 mm minimum for load bearing and 1.6 mm for other members.
- The lighting panels shall be rated for 415 V, 3 phase, 4 wire, AC with neutral bus and suitable for either wall/column mounting. Indoor panels shall have degree of protection of IP 52 and the outdoor panels shall have a degree of protection of minimum IP 55. Additionally, all outdoor panels shall be provided with detachable canopy at the top with regular slope towards the rear to prevent accumulation of rain water.
- The panel bus bars shall be of electrolytic grade Hard drawn Aluminium, sized for a maximum temperature of 40°c over the ambient temperature, colour coded for easy identification of phase and neutral bus bars. Minimum size shall be 25x6mm
- The cable/conduit entry may be either from the top or bottom (for Indoor Panels) / from bottom only (for Outdoor Panels) with removable cable gland plates and shall be terminated in suitable separate terminal blocks.

Necessary double compression type brass cable glands, tinned copper cable lugs are to be provided.

- Provision shall be made for earthing the panel at two points. A copper earth bus shall run along the length of the panel. The front access door of the panels shall have padlocking arrangement.
- The incoming to each Normal and Emergency AC Lighting Panel shall be provided with a triple pole MCB with neutral isolating facility and one earth leakage circuit breaker. Combined type triple pole MCB and earth leakage circuit breaker (ELCB) are also acceptable for incomers to Lighting Panels.
- Normal and Emergency AC lighting panels shall have outgoing MCBs having thermal elements for overload protection and an instantaneous magnetic trip to protect against severe faults. All MCBs provided shall be suitable for breaking capacity of 9 kA (minimum) at 230 V AC.
- The Emergency DC Lighting Panels shall have Incoming and outgoing feeders with HRC Switch fuse units or MCB units with back up fuse as required.
- The Lighting Panels shall be of double door type with the outer enclosure made of sheet steel having a minimum thickness of 2 mm with a hinged door and suitable locking arrangement.
- Each of the MLDBs/ ELDBs shall be provided with voltmeter and ammeter along with selector switches, 'SUPPLY ON' indicating lamps, etc.
- The incomers of Main and Emergency AC Lighting Distribution Boards (MLDB & ELDB) shall be provided with energy (kWh) meter for measurement of energy consumed by the lighting loads. The energy meters shall be 3 phase, 4-wire type suitable for measurement of unbalanced loads.
- Each outgoing MCB shall be of 15 A, but load to be limited to 2 kW or maximum 10 nos. fittings to be connected to one MCB.
- Individual control in office buildings shall be through single pole flush type switches. In those areas where group controls are required, rotary switches/MCBs shall be provided.
- Lighting panels feeding the boiler area shall be provided with contactors for control from a remote point. Lighting fixtures of boiler area platforms shall be fed from different circuits such that all the lights in the area are not 'On' all the time. The lights connected to a circuit or few circuits shall be 'ON' automatically through photocell. Provision shall be made for switching 'ON' for rest of the lights. In heat zones, ie; in the areas where ambient temperature is 60 deg C and above, heat resistant control cables shall be used in hot dip galvanized rigid steel surface
- Each Lighting Distribution Board shall be complete with designation and caution notice plates fixed at front cover and a directory plate fixed inside the front cover. This directory plate shall contain details of the lighting panels being fed from the Distribution Board including their designation, location, loading etc. Each Lighting Panel shall be complete

with designation and caution notice plates fixed on front cover and a circuit directory plate fixed on inside of the front cover. Circuit directory plate shall contain details of the points to be controlled by each circuit including the location of the point controlled, rating of the protective units and loading of the circuit. The plates shall be of anodised aluminium with inscriptions indelibly etched on it. Each Lighting Distribution Boards shall be painted as stated in Clause No. 4.15. For street lighting, 3-phase power from MLDB shall be supplied by 3 nos. single pole MCB. The circuit shall be looped in and out at each lighting pole through a Junction box and Tee off shall be provided with single pole MCB for supply of power to the fixture of that lighting pole.

- Number of outgoing feeders in MLDB's, SLDB's shall be provided as per requirement. Feeders for Purchaser's use and 20% spare feeders of each type and rating shall be provided in MLDB, LDBs/SLDBs.
- Two nos. feeders shall be provided in the Main Lighting Distribution Board (MLDB) and one no feeder from ELDB for Chimney Package Lighting.

4.5 Lighting Transformer

- Lighting transformers shall be three phases, delta/star, 415 V/433 V, air cooled, Encapsulated epoxy cast resin insulated dry type. Secondary neutral shall be solidly earthed.
- Lighting transformers shall be provided with Off load tap switch/link with change of ± 5% in step of 2.5% tapping full capacity. Insulation class shall be 'F' with temperature rise limited to Class B.
- KVA rating : 100 KVA (min)

  Vector Group : Dyn11

  Maximum Temperature rise over

  50 Deg C ambient in winding by resistance : 90 Deg.C

  Neutral : Solidly grounded.

- The secondary neutral of the transformer shall be brought out for getting a grounded 4 wire supply. Each transformer shall be routine tested in the presence of Purchaser or his representative. Type test conducted for similar type of Transformers shall be furnished for approval.
- The transformer shall be liable for rejection if the tolerance on the quoted values of losses, impedance, temperature rise, etc. exceeds the specified values of relevant standard.
- The transformer shall be mounted inside sheet steel enclosure with IP23 protection.

4.6 Fittings and accessories for lighting Transformers

Each transformer shall be equipped with fittings and accessories as listed below 50 mm dia. winding temperature indicator with maximum reading pointer and electrically separate sets of contacts for trip and alarm.

Handling and lifting lugs both for enclosure and core-coil assembly.

Jacking pad for core-coil assembly.

Inspection cover for cable end box.

Door handle operated safety limit switch with 1NO + 1NC contact.

Necessary earthing.

Rating and terminal marking plates.

Note: All indication, alarm, trip contacts provided shall be rated for 0.5A at 220 V D.C. and 5A at 240 V A.C

4.7 Fans and Regulators

- The fans shall have three well balanced blades, double ball bearings and shall be reasonably free from noise. Fan motor shall be totally enclosed type with copper winding and class-E insulation. Sweep shall be given as 1200 /1400 mm.
- Regulators shall have minimum five steps. Electronic Regulators with smooth control shall be provided.

4.8 Switch and Switchboard

- All switch boards/boxes shall be of folded steel sheet construction, fabricated of 14 SWG MS sheet with 6 mm thick Bakelite front cover and brass fixing screws.
- Each Switchboards shall be painted in accordance to Clause No. 4.15
- Switchboards/boxes located in control room and office areas shall be flush mounted type on brick wall with only the switch knob projecting outside.
- Switch boards/boxes shall have conduit knock outs on the sides. Adequate provision shall be available for ventilation of these boxes.
- At least one 5/15A flush type receptacle shall be provided in each switchboard and so located that only the plug projects outside.
- Switches shall have quick-make and quick-break mechanism operated by a suitable external handle complete with position indicator.

4.9 Lighting Poles / Towers

Street Light Poles

Street light poles shall be swaged and welded steel pole, complete with fixing brackets, weather-proof junction box and all other accessories.

5.3 Lighting Cables and Wires

- Lighting Cable shall be heavy duty, 660/1100 Volt grade, multicore stranded aluminium conductor, XLPE insulated, extruded PVC inner sheath, single round GI wire armoured and overall FRLS PVC sheathed to IS 7098 Part I.
- Lighting wires shall be 660/1100 Volt grade, PVC insulated, stranded conductor, inner sheathed, single core cable to IS 694: Minimum size of cable/wires shall be 2.5 mm sq. copper.

5.4 Conduits and Accessories

16 SWG will also work as per IS.

- Conduits shall be of rigid steel, hot-dip galvanized, furnished in standard length of 3 meters, threaded at both ends.
- Conduits upto and including 25mm shall be of 14 SWG. Minimum size of conduits shall be 19 mm.
- Each piece of conduits shall be straight, free from blister and other defects and covered with capped bushings at both ends.
- Flexible conduits shall be made with bright, cold rolled annealed and electro-galvanized mild steel strips and coated with PVC.

5.5 Lighting Junction Box

- The junction boxes shall be of sheet metal, dust and damp proof, generally conforming to IP 55.
- The junction boxes shall be complete with gasketted inspection cover, conduit knock out/ threaded hub/ cable entry and terminal blocks.
- Junction boxes for outdoor use shall weatherproof IP-55 and those for hazardous location shall be flame proof type.
- Junction Boxes shall have following indelible markings:

a. Circuit nos. on top.

b. Circuit nos. with ferrules (inside) as per drawing.

c. Danger sign in case of 415V circuit.

5.6 Terminals

- Multiway terminal blocks complete with screws, nuts, washers and marking strips shall be furnished for connection of incoming/outgoing wires in the junction boxes.
- Each terminal shall be suitable for connection up to two (2) nos. 2.5 mm2 copper conductors.

5.7 Name Plate

Name plates shall be furnished for identification of devices and circuits. All switches, controls and indications shall be permanently and legibly marked in english regarding the functions.

5.8 Painting

All surfaces shall be sand blasted, pickled and grounded as required to produce a smooth, clean surface free of scale, grease and rust.

After cleaning, the surfaces shall be given a phosphate coating followed by 2 coats of high quality primer and stoved after each coat.

The equipment shall be finished in approved color shade by owner with two coats of epoxy based powder coated paint. The coating shall be done electro statically followed by stoving.

Sufficient quantity of touch-up paint shall be furnished for application at site.

5.9 Hot Dip Galvanizing

Wherever applicable, the minimum weight of the zinc coating shall be 900 gm/sq.m and minimum thickness of coating shall be 85 microns for items thicker than 6 mm. For items lower than 6mm thickness requirement of coating thickness shall be as per relevant ASTM. For surface, which shall be embedded in concrete, the zinc coating shall be 900-gm/sq. minimums.

The galvanized surfaces shall consist of a continuous and uniform thick coating of zinc, firmly adhering to the surface of steel. The finished surface shall be clean and smooth and shall be free from defects like discolored patches, bare spots, unevenness of coating, spelter which is loosely attached to the steel globules, spiky deposits, blistered surface, flaking or peeling off, etc. The presence of any of these defects noticed on visual or microscopic inspection shall render the material liable to rejection.

After galvanizing no drilling or welding shall be performed on the galvanizing parts of the equipment except that nuts may be threaded after galvanizing. Sodium dichromate treatment shall be provided to avoid formation of white rust after hot dip galvanization.

The galvanized steel shall be subjected to six one-minute dips in copper sulphate solution as per IS-2633. Sharp edges with radii less than 2.5 mm shall be able to withstand four immersions of the Standard Preece test. All other coatings shall withstand six immersions. The following galvanizing tests should essentially be performed as per relevant Indian Standards.

- Coating thickness
- Uniformity of zinc
- Adhesion test
- Mass of zinc coating

Galvanized material must be transported properly to ensure that galvanized surfaces are not damaged during transit. Application of zinc rich paint at site shall not be allowed.

5.10 Samples

Owner reserves the right to call for samples if considered necessary and the same shall be submitted free and without any obligation.

6. TESTS

6.1. Shop Tests

All equipment shall be completely assembled, wired, adjusted and routine tested as per relevant IEC Standards at manufacturer's works.

Tests on Lighting Distribution Boards / Panels shall include:

a) Wiring continuity tests.

b) High voltage and insulation tests.

c) Operational tests.

6.2. Test Witness

All tests shall be performed in presence of owner's representative, if so desired by the owner.

The Bidder shall give an advance notice of shop tests and tests.

6.3. Test Certificates

- Certified copies of all tests carried out at works and at site shall be furnished in requisite no. of copies for approval of the Owner.
- The equipment shall be dispatched from works only after receipt of Owner's written approval of shop test reports.
- Valid Type test certificate on any equipment (within last 5 years), if so desired by the Owner, shall be furnished. Otherwise the equipment shall have to be type tested, free of charge, to prove the design.

7. DRAWINGS, DATA & MANUALS

Drawings, data and manuals shall be submitted in quantities and procedures as specified in the General Condition of Contract and/or elsewhere in this specification for approval and subsequent distribution after the issue of Letter of Intent.

Drawings, Data and Manuals to be submitted for approval

Detail dimensional drawing showing constructional features, cable/ conduit entry, grounding, fixing arrangement etc. of:

a) Lighting panels & distribution boards.

b) Receptacles & Junction boxes.

c) Street light poles & towers.

d) Lighting fixture complete with lamps and accessories.

e) Non-integral/separate type control gear box for lighting fixtures, as applicable.

f) Lux level calculations for each area.

g) Data sheets for lighting fixture, lamps, accessories with light distribution curves, co-efficient of utilization charts etc. Type and routine test certificates of transformer and cables.

h) Control schematic and wiring diagram of 415V AC/220V DC lighting panel with automatic changeover from AC to DC and vice-versa, 415V normal AC street/area lighting panel with automatic ON/OFF feature.

i) Technical leaflets and data sheet on each piece of equipment/ device such as MCB, switch, fuse, receptacle etc. Type and routine test certificates of transformer and cables.

j) QAP and relevant test certificates

k) Lighting layouts showing the disposition of fixtures, lighting panels/boards, circuit distributions, conduit & wire routing.

l) Key Single Line Diagram for lighting distribution, board wise single line diagram with feeder loading, cable schedule and interconnection chart, design calculation for lighting.

- AS-BUILT lighting layout and erection drawings, properly incorporating the changes/alterations/field modifications, if any, as carried out at field along with circuit distribution schemes of all lighting panels, conduit and cable routing and as acceptable to the Owner.
- Any other relevant drawings, data and manuals necessary for satisfactory installation, operation and maintenance.

- The Bidder may note that the drawings, data and manuals listed are minimum requirement only. The Bidder shall ensure that all other necessary write-ups, curves and information required to fully describe the equipment offered are submitted.

ANNEXURES

ANNEXURE-I

LIST OF MAKES

1.0.0 Bidder to note that Make of various items shall subject to approval of BHEL / Customer during detail engineering stage without any commercial implication at contract stage.

ANNEXURE-II

VOLUME-VI MANDATORY SPARES AND TOOLS & TACKLES

1.0 GENERAL

1.1 Scope

This section covers the general requirements regarding the mandatory spares and tools and tackles for all the equipment and systems in the power plant.

1.2 Mandatory Spares

The Contractor shall supply in his scope mandatory spares as specified in this Volume.

The supply of mandatory spares shall be started with the consignments of the first unit and completed before the provisional take over of the first unit.

1.3 Tools and Tackles

The Contractor shall supply the Special Tools & Tackles as listed in this Volume.

The supply of special tools and tackles shall be started with the consignment of first unit and completed before the provisional take over of the first unit.

1.4 Prices

The itemised Prices of the mandatory spares and special tools and tackles shall be indicated and the sum total price of mandatory shall be indicated in the respective price table in Volume I B of the Specification

2.0 DETAILED GUIDELINES FOR MANDATORY SPARES AND TOOLS AND TACKLES

1. The contractor shall supply the mandatory spares and tools and tackles as listed.
2. The contractor shall give itemized unit price for the spare parts, tools and tackles while submitting the bid. The Purchaser reserves the right to modify or delete the items/quantity of the spares/tools & tackles. The quoted price for taxes & duties, transport, insurance etc. shall get reduced proportionately to the extent of the value of ordered spares/tools and tackles. The list of such spares/tools and tackles to be ordered by the Purchaser shall be finalised by the Purchaser before signing of the Contract.
3. In case the description / nomenclature of any of the items of spares/tools and tackles is differing from the description / nomenclature indicated in

the list of mandatory spares/tools and tackles, the bidder shall offer functionally equivalent part in lieu of the listed item.

4. In case if such items of spares/tools & tackles indicated as "not applicable", are found applicable at a later date during execution of the project, such items of spares/tools & tackles are to be supplied within the ordered cost of the mandatory spares.

5. If any of the items of spares/tools & tackles ordered is found to be not applicable during detailed engineering stage/execution stage, the contractor shall have to supply alternative items of spares/tools & tackles. The alternative items of spares/tools & tackles are to be mutually agreed between the PURCHASER and CONTRACTOR.

6. In respect of quantity mentioned as 'Set' means the total quantity of all the components/items used in particular equipment unless otherwise specified.

   Example-1

   One set of spare part which is having four different items of which first item is having 2 similar parts, second one is having 3 similar parts and other two are having one part each, then one set means, combination of 2 similar parts of first item and 3 similar parts of second and one each of 3rd & 4th items.

   Example-2

   If the quantity of particular spare part is more than one, set means the total no. of similar parts.

7. Wherever % is indicated for the mandatory spares, the quantity shall be calculated for % of supply for total quantity for 2 units of 2 x 500 MW, unless otherwise specified. The quantity to be reckoned for % indicated shall be rounded off to the next higher whole number. For example if the % arrived is 0.2 the quantity to be supplied shall be 1 and if the % arrived is 5.1 the quantity to be supplied shall be 6.

8. All relevant drawings to identify of spares/tools & tackles are to be furnished when called for by the PURCHASER.

Sl.No	Description	Unit	Qty.	Remarks
14.0	**ELEVATORS (To be repeated for each type and make of elevator)**			
14.1	Machine and Brake Packing Unit	No.	1	
14.2	Brake lining with rivet	Set	1	
14.3	Door bushings	Set	2	
14.4	Door drive belt	Set	2	
14.5	Brake coil	No.	1	
14.6	Selectors complete	Nos.	2	
14.7	Hoist way limit switch	Nos.	4	
14.8	Down/Up limit switch	Nos.	4	
14.9	Door operator complete with bumper packing, gland, Micro switch etc.	No.	1	
14.10	Door hangers complete with bearing, Rollers, sockets Screw etc.	Set	1	
14.11	Hoist way lock complete with spring Rollers, Contacts etc.	Set	3	
14.12	415V AC 3 Phase contactors of each rating complete with auxiliary contacts	Nos.	2	
14.13	DC contactors of each rating complete with auxiliary contacts	Nos.	2	
14.14	VVVF drive unit	No.	1	

Sl.No	Description	Unit	Qty.	Remarks
14.15	Fuses of each rating- Power	Nos.	6	
14.16	Fuses of each rating-Control	Nos.	12	
14.17	Switches of each type	No.	1	
14.18	Control Push button.	Nos.	3	
14.19	Auxiliary Relays complete of each type	No.	1	
14.20	Motor each type & rating	No.	1	
14.21	Bearing of each type & size for each motor.	Nos.	1	
14.22	Car position indicator and direction indicator	Seteach	1	
14.23	Indicator at intermediate boards	Set	1	
14.24	Micro switches of each type	No.	1	
14.25	Landing button	No.	1	
14.26	Landing door contact	No.	1	
14.27	Door safety edge contact	No.	1	
14.28	Car button each type	No.	1	
14.29	Transformers of each type & function	No.	1	
14.30	Electronic cards of each type/function	No.	1	
14.31	Charger card of each type	No.	1	
14.32	Rectifier Unit	No.	1	
14.33	MCBs of each type and rating	Nos.	5	
14.34	Diodes	Nos.	5	

ANNEXURE-III

LIST OF TOOLS AND TACKLES

ANNEXURE-III

List of Tools & tackles for elevator.

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

ANNEXURE-IV

Drawing document submission schedule

S.N0.	Description	Schedule
1	First submission of dwg/ docs as per MDL	Within two (2) weeks from placement of LOI.
2	Every repeat submission	Within one (1) week.
3	Response time by BHEL	Within three (3) weeks after receiving of drawing.

Drawing / documents for submission & distribution List

All documents & drawings shall be in English and in metric units

SI		LII	NLC (HQ)	NLC-SITE	BHEL SITE	PMG BHEL	PEM/ UNITS/ PSSR	REMARKS
1	Master list of drawings / document (duly indicating schedule of submission)	Soft copy	Soft copy	Soft copy		Soft copy	Soft copy (S)	
2	Drawings / document for Approval/Information (First Submission)	Soft copy + 2 prints	Soft copy + 3 prints	Soft copy + 1 print		Soft copy	Soft copy (S)	
3	Return with comments/approval	Soft copy (S)	Soft copy	Soft copy		Soft copy	Soft copy	
4	Drawings / Documents for approval (second & subsequent submissions till approval)	Soft copy	Soft copy	Soft copy		Soft copy	Soft copy (S)	
5	Drawings / documents for distribution (Approved by NLC, in cat. 1 or Received for Information)	Soft copy + 2 print (HQ+ Site)	Soft copy + 3 prints	Soft copy + 3 prints	Soft copy + 5 prints	Soft copy	Soft copy (S)	
6	Erection Drawings / documents	-	Soft copy + 1 print	Soft copy + 3 prints	Soft copy + 5 prints	Soft copy	Soft copy (S)	
7	As built Drawings / documents	Soft copy + 1 print	Soft copy + 1 print	Soft copy + 3 prints	Soft copy + 5 prints	Soft copy	Soft copy (S)	
8	Operation & Maintenance Manual	-	Soft copy + 1 print	Soft copy + 10 prints	Soft copy + 5 prints	Soft copy	Soft copy (S)	
9	Type Test Certificate	Soft copy	Soft copy + 1 print	Soft copy + 3 prints	Soft copy + 5 prints	Soft copy	Soft copy (S)	

NOTES:

1. The above schedule of submission does not include Docs/Drgs. of quality assurance/inspection and delivery/dispatches. QAP documents to be submitted as per distribution schedule.
2. Date of submitting soft copy is to be taken as date of submission.
3. S – Source for generation of document.

4.0 The above are the minimum quantity of drawings/documents required. the exact requirement shall be informed to the successful bidder during detail engineering satge for which no commercial implication shall be entertained by bhel.

5.0 Bidder to note that BHEL reserves the right for drawing/document submission through web based Document Management System. Bidder would be provided access to the DMS for drawing/document approval and adequate training for the same. Detailed methodology would be finalized during the kick-off meeting. Bidder to ensure following at their end.

- Internet explorer version - Minimum Internet Explorer 7.
- Internet speed - 2 mbps (Minimum preferred).
- Pop ups from our external DMS IP (124.124.36.198) should not be blocked.
- Vendor's internal proxy setting should not block DMS application's link (http://124.124.36.198/wrenchwebaccess/login.aspx).

ANNEXURE-V

MDL FOR ELEVATOR

S.N0.	BHEL DOC No	TITLE	APP. CAT
1	PE-V0-402-502-A001	GAD OF ELEVATOR FOR TG BUILDING	A
2	PE-V0-402-502-A002	GAD OF ELEVATOR FOR SERVICE BUILDING	A
3	PE-V0-402-502-A101	DATA SHEET OF ELEVATOR FOR TG BUILDING	A
4	PE-V0-402-502-A102	DATA SHEET OF ELEVATOR FOR SERVICE BUILDING	A
5	PE-V0-402-502-A003	MQP (COMMON FOR TG & SERVICE) OF ELEVATOR	A
6	PE-V0-402-502-A004	O&M MANUAL	I

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

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

2. PURPOSE OF STORAGE & PRESERVATION

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

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

a) GENERAL STORAGE REQUIREMENTS

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

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

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

b) GENERAL PRESERVATION REQUIREMENTS

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

10. All the electrical equipment such as motors, generators, etc. shall be tested for insulation resistance at least once in three months and a record of such measured insulation values shall be maintained.

11. Following preservatives/preservation methods can be used depending upon type of equipment

    a. Rust preventive fluid (RPF)

    b. Rust protective paints

    c. Tarpaulin covers, in case of outdoor storage

    d. De-oxy aluminate for weld-ments

c) GENERAL INSPECTION REQUIREMENTS

1. Period inspection of materials with specific reference to –

    - Ingress of moisture and corrosion damages.
    - Damage to protective coating.
    - Open ends in pipes, vessels and equipment -
        - In case any open ends are noticed, same shall be capped.

2. Any damages to equipment / materials.

    - In case of any damages, these shall be promptly notified and in all cases, the repairs / rectification shall be carried out.
    - Any items found damaged or not suitable as per project requirements shall be removed from site. If required to store temporarily, they shall be clearly marked and stored separately to prevent any inadvertent use.

4. TYPE OF STORAGE FOR VARIOUS EQUIPMENT

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

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

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

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

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

iii Open storage (O)

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

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

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

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

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

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

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

Sl. No.	Description of the equipment	Type of Storage	Check for	Remarks
51.	Elevators(CONTAINERIZED)	O	Damage , packing, corrosion	
52.	Chillers/VA machines	S	Damage , packing	
53.	Air handling Unit/Package unit	S	Damage , packing	
54.	Chlorinators & Evaporators	C	Damage , packing	
55.	Ejectors	C	Damage , packing	
56.	Electrolyser	C	Damage , packing	
Miscellaneous items like chain pulley blocks, hoists etc.				
57.	Chain pulley blocks	S	Damage, Packing	
58.	Electric hoists	S	Damage, Packing	
59.	Fire extinguishers	C	Damage, expiry date	
60.	Fork Lift Truck	S	Damage, Packing	
61.	Hydraulic Mobile Crane	O	Damage, Packing	
62.	Mobile Pick Up & Carry Crane	O	Damage, Packing	
63.	Motor boats	O	Damage, Packing	
64.	Safety showers	S	Damage, Packing	
65.	Diffusers/dampers	S	Damage, Packing	
Chemicals and consumables (acid, alkali, paints, oils, reagents and special chemicals)				
66.	Hydro Chloric Acid (HCl)	Store in canes/ storage tank in dyke area	Date of production/ leakage/fumes	hazardous chemical
67.	Sulphuric acid (H_2SO_4)	Store in canes/ storage tank in dyke area	Date of production/ leakage/fumes	hazardous chemical

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

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

5. CONCLUSION

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

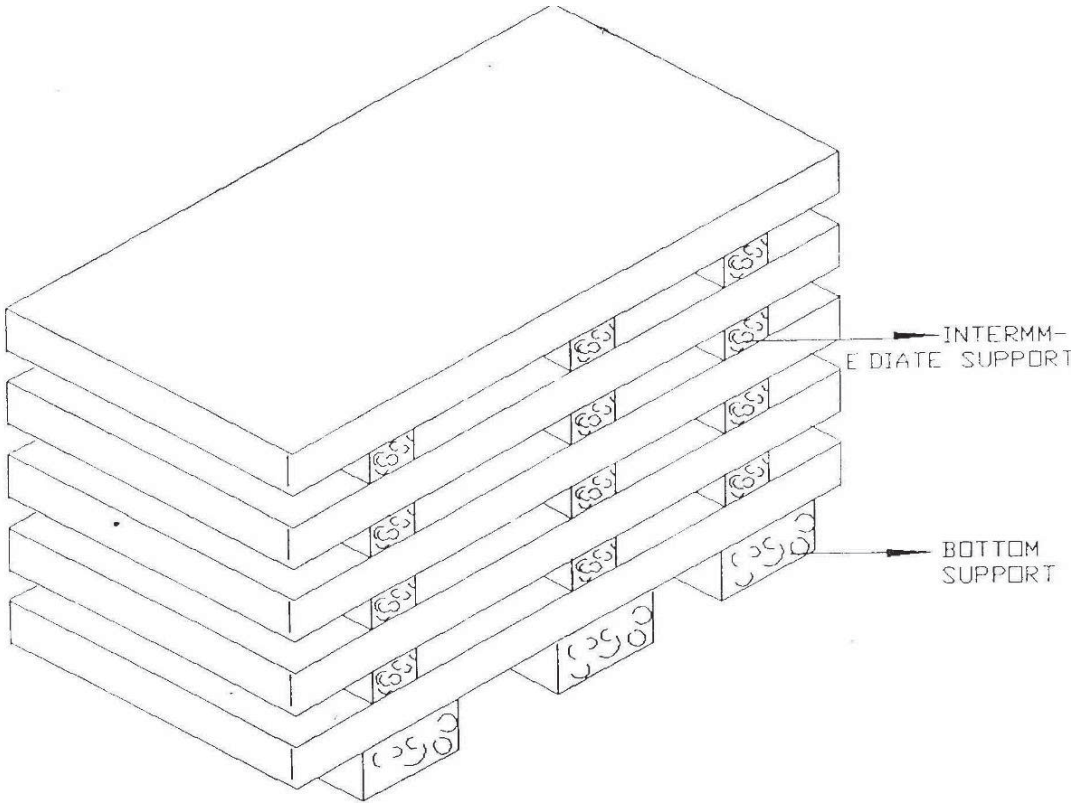

Figure – 1 – PLATE STACKING ARRANGEMENT

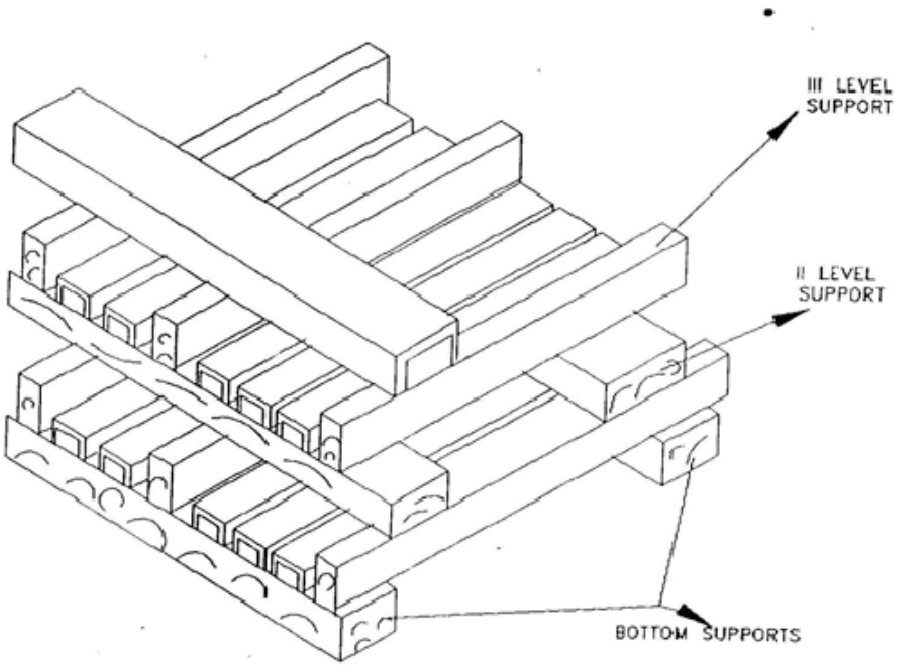

Figure – 2 – STRUCTURAL STEEL STACKING ARRANGEMENT

CIVIL INPUT DETAILS.

Project: 2 X 500 MW NNTPS.
Job No. 402
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	D		
TG Building.	2 Nos.	1088	Conventional	Goods cum Passenger Elevator	2500 (ENTRANCE)	2100	Clay Brick or concrete with plastered and white washed shaft walls from inside.	As per manufacturer's recommendation, fly ash brick not to be used.
Service Building	1 No.	680	Panoramic	Passenger Elevator	Bidder to furnish the plan of elevator shaft and pit detail.			

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 bidder to note that TOC of pit for all elevators shall be (-)1.6 m. RCC pedestals for buffers for car and counter weight(in pit) & traction machine (in machine room) and cutouts & pockets in machine room shall be furnished after finalization of order.
3. Shaft construction shall be done with RCC or clay bricks (230 mm thk) only, which shall be confirmed during contract stage.

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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.

4) Signed and stamped copy of :
   a) "Specific-Electrical Equipment Specification for elevator.
   b) "Electrical Scope between BHEL and Vendor" sheet.
   c) Compliance to /duly filled "Electrical Load Data" sheet.

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.

Note 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.

LOAD TITLE	RATING (KW)		UNIT (U)/STN (S)	Nos.		VOLTAGE CODE*	FEEDER CODE**	EMER. LOAD (Y)	CONT.(C)/ INTT.(I)	STARTING TIME >5 SEC (Y)	LOCATION	BOARD NO.	CABLE		BLOCK CABLE DRG. No.	CONTROL CODE	REMARKS	LOAD No.
	NAME PLATE	MAX. CONT. DEMAND (MCR)		RUNNING	STANDBY								SIZE CODE	NOs				
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
TG HALL ELEVATOR																		
ELEVATOR MOTOR		16.5	U	1	0	D	S	-	C		TG HALL Elevator Machine room							
2 T A/C FOR TG HALL M/C ROOM AND LIGHTING FOR ELEVATOR M/C ROOM & SHAFT AND MAINTENANCE AND INSTALLATION REQUIREMENT.		7	U	1	0	D	S	-	C		TG HALL Elevator Machine room							
SERVICE BUILDING ELEVATOR																		
ELEVATOR MOTOR		16.5	S	1	0	D	S	-	C		Elevator Machine room of Service Building.							
2 T A/C FOR SERVICE BUILDING ELEVATOR M/C ROOM AND LIGHTING FOR ELEVATOR M/C ROOM & SHAFT AND MAINTENANCE AND INSTALLATION REQUIREMENT		7	S	1	0	D	S	-	C		Elevator Machine room of Service Building.							

Note:

1) **No other single phase or 3 phase supply shall be provided for elevator erection / operation etc**.
2) **Only two (3 phase) supply feeders per elevator shall be provided, one feeder shall be dedicated to elevator motor and other 3 phase supply feeder shall be provided by BHEL for air conditioner, machine room and shaft lighting and maintenance / installation requirement. Bidder to consider CT for stepping down the voltage as per their requirement.**

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

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

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

BHEL	**LOAD DATA (ELECTRICAL)**	JOB NO.	402	ORIGINATING AGENCY		PEM (ELECTRICAL)
		PROJECT TITLE	2X500 MW NNTPS	NAME		DATA FILLED UP ON
		SYSTEM / S	ELEVATOR	SIGN.		DATA ENTERED ON
		DEPTT. / SECTION	MAUX / MH	SHEET 1 OF 1	REV. 00	DE'S SIGN. & DATE

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.

PRE-BID CLARIFICATION SCHEDULE

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

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

SIGNATURE: _____

NAME: _____

DESIGNATION: _____

COMPANY: _____

DATE: _____

COMPANY SEAL

DEVIATION SHEET (COST OF WITHDRAWL)

PROJECT:- 2x500MW NNTPP, NEYVELI

PACKAGE:- ELEVATOR

TENDER ENQUIRY REFERENCE:-

NAME OF VENDOR:-

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

PARTICULARS OF BIDDERS/ AUTHORISED REPRESENTATIVE

NAME	**DESIGNATIONS**	**SIGN & DATE**	

NOTES:

1. For self manufactured items of bidder, cost of withdrawl of deviation will be applicable on the basic price (i.e. excluding taxes, duties & freight) only.
2. For directly dispatchable items, cost of withdrawl of deviation will be applicable on the basic price including taxes, duties & freight.
3. All the bidders have to list out all their Technical & Commercial Deviations (if any) in detail in the above format.
4. Any deviation not mentioned above and shown separately or found hidden in offer, will not be taken cognizance of.
5. Bidder shall submit duly filled unpriced copy of above format indicating "quoted" in "cost of withdrawl of deviation" column of the schedule above along with their Techno-commercial offer, wherever applicable.
6. Bidder shall furnish price copy of above format along with price bid.
7. The final decision of acceptance/ rejection of the deviations quoted by the bidder shall be at discretion of the Purchaser.
8. Bidders to note that any deviation (technical/commercial) not listed in above and asked after Part-I opening shall not be considered.
9. 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 withdrawl 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 withdrawl of deviation shall be taken as NIL.
10. Any deviation mentioned in priced copy of this format, but not mentioned in the un-priced copy, shall not be accepted.
11. 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.
12. Cost of withdrawl is to be given seperately for each deviation. In no event bidder should club cost of withdrawl of more than one deviation else cost of withdrawl of such deviations which have been clubbed together shall be considered as NIL.
13. In case nature of cost of withdrawl (positive/negative) is not specified it shall be assumed as positive.
14. In case of descrepancy in the nature of impact (positive/ negative), positive will be considered for evaluation and negative for ordering.