NTPC-BHEL POWER PROJECT PRIVATE LIMITED

(A Joint Venture Company of NTPC & BHEL)

FGUTPP-STAGE IV (1X500 MW) AT UNCHAHAR (UP)

VOLUME - II B & III

TECHNICAL SPECIFICATION
FOR
ELEVATOR

SPECIFICATION NO. PE –TS – 401- 502 – A001

BHARAT HEAVY ELECTRICALS LIMITED

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

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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 passenger elevator for 1X500 MW FG UNCHAHAR TPP at Raebareli district, Uttar Pradesh and necessary accessories including supply of, erection and commissioning spares, special maintenance tools and tackles etc.

1.2 The contractor shall be responsible for providing all material, equipment & services, which are required to fulfil the intent of ensuring operability, maintainability, reliability and complete safety of the complete work covered under this specification, irrespective of whether it has been specifically listed herein or not. Omission of specific reference to any component / accessory necessary for proper performance of the equipment shall not relieve the responsibility of providing such facilities to complete the supply, erection and commissioning of the **Elevators** and its accessories.

1.3 It is not the intent to specify herein all the details of design and manufacture. However, the equipment shall conform in all respects to high standards of design, engineering and workmanship and shall be capable of performing the required duties in a manner acceptable to purchaser who will interpret the meaning of drawings and specifications and shall be entitled to reject any work or material which in his judgement is not in full accordance herewith.

1.4 The extent of supply under the contract includes all items shown in the drawings, notwithstanding the fact that such items may have been omitted from the specification or schedules. Similarly, the extent of supply also includes all items mentioned in the specification and /or schedules, notwithstanding the fact that such items may have been omitted in the drawing.

1.5 The general term and conditions, instructions to tenderer and other attachment referred to elsewhere are made part of the tender specification. The equipment materials and works covered by this specification is subject to compliance to all attachments referred to in the specification. The bidder shall be responsible for and governed by all requirements stipulated herein.

1.6 While all efforts have been made to make the specification requirement complete & unambiguous, it shall be bidders' responsibility to ask for missing information, ensure completeness of specification, to bring out any contradictory / conflicting requirement in different sections of the specification and within a section itself to the notice of BHEL and to seek any clarification on specification requirement in the format enclosed under Vol-III of the specification**.** In absence of any such clarifications, in case of any contradictory requirement, the more stringent requirement as per interpretation of Purchaser/Customer shall prevail and shall be complied by the bidder without any commercial implication on account of the same. Further in case of any missing information in the specification not brought out by the prospective bidders as part of pre-bid clarification, the same shall be furnished by Purchaser/ Customer as and when brought to their notice either by the bidder or by purchaser/ customer themselves. However, such requirements shall be binding on the successful bidder without any commercial & delivery implication.

1.7 The bidder's offer shall not carry any sections like clarification, interpretations and /or assumptions.

1.8 Deviations, if any, should be very clearly brought out clause by clause in the enclosed schedule; otherwise, it will be presumed that the vendor's offer is strictly in line with NIT specification.

1.9 In case all above requirements are not complied with, the offer may be considered as incomplete and would become liable for rejection.

1.10 Unless specified otherwise, all through the specification, the word contractor shall have same meaning as successful bidder /vendor and Customer/ Purchaser/Employer will mean BHEL and /or customer including their consultant as interpreted by BHEL in the relevant context.

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

1.00.00 **BACKGROUND**

Feroze Gandhi Unchahar Thermal Power Station, FGUTPS was conceived as a Load Centre coal based Power Station of 1050 MW capacity by UPSEB. The land for the project was acquired and stage-I (2x210MW) was implemented by UPSEB. The 2x210 MW Unchahar station was taken over by NTPC from Uttar Pradesh Rajya Vidyut Utpadan Nigam of Uttar Pradesh in 1992. Thereafter, NTPC implemented Stage- II (2x210 MW) and Stage-III (1X 210 MW).

The present expansion proposal is to install one additional unit of 500 MW under Stage-IV thus making the ultimate capacity of the FGUTPP 1550 MW.

1.01.00 **LOCATION AND APPROACH**

The plant is located in Raebareli district of Uttar Pradesh, having latitude and longitude of 25°54'50"N and 81°19'50"E respectively. It is bounded by villages Khnapur, Faridpur and Khaliqpur Khurd. Mustafabad town is located at a distance of about 3 Kms from the plant. Unchahar railway station on Allahabad-Raebareli broad gauge (BG) section of Northern Railway (NR) is 2 Kms away. The nearest airport is located at Lucknow a distance of approximately 110 km from the project site.

Vicinity Plan of the project is placed at **Annexure-I**

1.02.00 **LAND REQUIREMENT**

During the implementation of FGUTPS, Stage-I, II & III total area of about 2203 acres of land was acquired. The plant facilities, ash disposal and township for this expansion Stage-IV (1x500 MW) would be accommodated within the available land with dismantling and relocation of some buildings. No additional land has been envisaged to be acquired for this expansion project.

1.03.00 **WATER**

As per agreement between NTPC & Irrigation department, 105 Cusec of water is supplied through S.S Canal to NTPC-Unchahar. The Stage-IV (500MW) consumptive water requirement shall be accommodated within the existing commitment of water to FGUTPP. Sharda sahayak canal and Dalmau Pump House (DPH) on Purwa Branch Canal are available sources of water for the project and therefore, the make up water requirement for the plant is proposed to be drawn from these sources.

1.04.00 **COAL AVAILABILITY AND TRANSPORTATION**

1.04.01 **Coal Availability**

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The coal requirement shall be about 2.7 Million tonnes per year.

The matter has been taken up with Ministry of Coal, Govt. of India for Long Term Coal Linkage for Stage-IV (1x500 MW)..Coal requirement for FGUTPP, Stage-I ,II & III is being met from North Karanpura Coal fields of CCL. For FR purposes, coal from North Karanpura Coal fields of CCL has been considered.

1.04.02 **Coal Transportation**

The envisaged mode of coal transportation from the coal mines to the power plant is by Indian Railways rakes. The rakes shall be unloaded at the track hopper.

1.04.03 **Coal Quality Parameters and Fuel Oil Characteristics**

The Coal quality parameters and Fuel Oil Characteristics are enclosed as **Annexures-II-1 and II-2** to this subsection.

1.05.00 **CAPACITY & POWER EVACUATION**

Stage- I	:	2x210 MW	Under Commercial Operation
Stage-II	:	2x210 MW	Under Commercial Operation
Stage-III	:	1x210 MW	Under Commercial Operation
Stage-IV		1x 500 MW	Present proposal

The existing capacity of plant is 1050 MW Step up/ power evacuation voltage for station is 220 KV. Presently 1000 MW is already being evacuated at 220 KV, addition of another 500 MW at 220 KV may cause overloading of 220 KV systems and lead to increase in fault levels at 220 KV system. Considering this 400 KV has been considered as step-up/power evacuation voltage for Stage-IV. Power Generated from FGUTPP- Stage IV, 500 MW unit would be stepped up to the evacuation voltage level through suitably rated Generator Transformer.

The power generated from Stage-IV is envisaged to be absorbed by Northern Region beneficiaries. For finalisation of Associated Transmission System (ATS) of the project, the matter would be taken up with Power Grid Corporation of India Ltd. (PGCIL)/CEA/appropriate authority depending on the various routes/options of power sale envisaged for the project.

1.06.00 **METEOROLOGICAL DATA**

Important meteorological data from nearest observatory at **Allahabad** is placed at **Annexure - III.**

1.07.00 **PLANT WATER SCHEME**

	The Plant water scheme is described below.
1.07.01	**Source of Water** The source of water for the project is normally from the Allahabad branch canal of the Sharda Sahayak link canal. During the canal closure period, water will be drawn from the Dalmau canal.
1.07.02	**Water Requirement** Normal Make up water requirement for this project would be about 2000 Cu.M/hr with ash water re-circulation system in operation. However, whenever ash water system needs to be operated in once thru mode, water drawl shall be of the order of 3300 cum/hr.
1.07.03	**Raw Water System** Raw water shall be drawn from the source by a gravity channel upto raw water pump house located inside the plant. It is envisaged to provide three (3) numbers (3 x 50 % Capacity) of raw water pumps for supplying water to Water PT Plant in the raw water pump house. In addition two (2) numbers (2 x 100% capacity) of pumps shall be provided to supply raw water for ash handling plant which shall be operated as and when required. Separate set of pipelines of carbon steel construction shall be provided from respective raw water pumps to Water treatment plant and Ash Water tanks.
1.07.04	The quality of Raw water and Clarified water is enclosed with this sub-section
1.08.00	**Criteria for Wind Resistant Design of Structures and Equipment** All structures and equipment of the power plant, including plant auxiliary structures and equipment, shall be designed for wind forces as given in Sub-Section- D-01, Part-B, Section-VI, i.e. Technical Specification for Civil and Structural Works.
1.09.00	**Criteria for Earthquake Resistant Design of Structures and Equipment** All power plant structures and equipment, including plant auxiliary structures and equipment shall be designed for seismic forces as given in Sub-Section- D-01, Part-B, Section-VI, i.e. Technical Specification for Civil and Structural Works.

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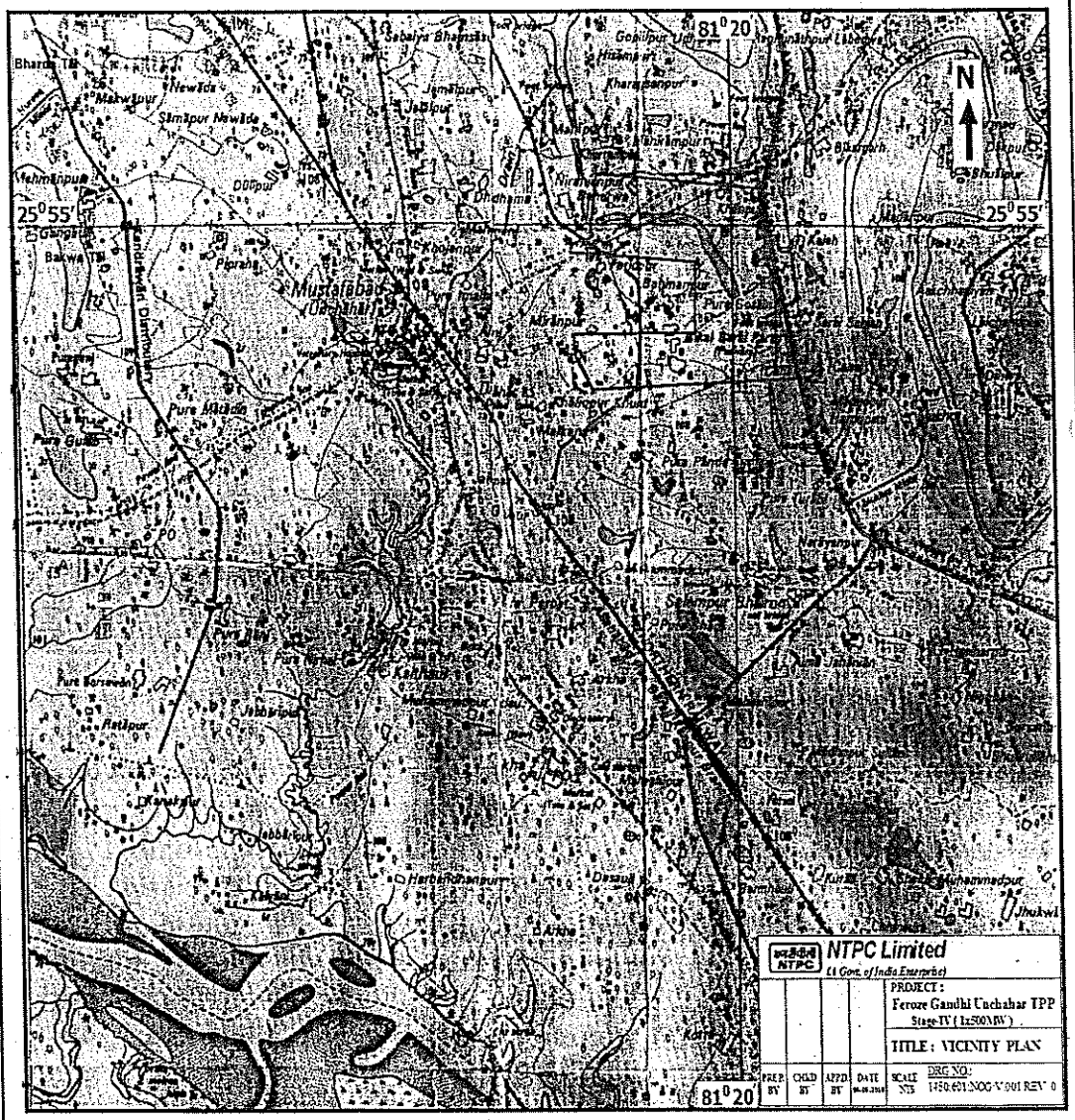
VICINITY PLAN

ANNEXURE- I



SECTION – C
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 1x500 MW FG UNCHAHAR TPP. to facilitate movement of operating and maintenance personnel.

2.0 Scope of equipment supply and services

2.0.1 Design, Engineering, Manufacture, Inspection & Testing at manufacturer's works or at their sub-vendor's works, Painting at manufacturer's or at their sub-vendor's works, duly packed for transportation to site, delivery to site, storage and handling at site, Erection & Commissioning, carrying out trial run and Acceptance / functional tests at site & final painting of Passenger Elevators for 1 x 500 MW FG UNCHAHAR TPP as listed below:-

Sl. no	Building	No. of elevators	Capacity	No. of landings	Total rise	Type	Speed
1	TG building	1 No.	884 Kg	Six including ground (0.0m, 8.5m, 16.5m, 23.5m, 31.25m & 35.5m,)	35.5.0M	Conventional (passenger elevator)	1.0 M/s
2	Service Building	2 Nos.	884 Kg	Five including ground (0.0m, 4.25m, 8.5m, 12.0m & 17.0m,)	17.0M	Conventional (passenger elevator)	1.0 M/s

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

1) Elevator car with SS 304, 1.5 mm (min) thick sheet of bright 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 bright 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.

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 cable conduit fixtures, switches 3 pin or as required by bidder during erection / maintenance purpose at every 3 m.

23) Mirror for the car rear panel.

24) Floor announcement cum music system to be provided.

25) Special maintenance tools and tackles along with un-priced list with the offer.

26) Recommended spares for three (3) years of trouble operation. Bidder to furnish un-priced list along with the offer.

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

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

29) Scaffolding for erection.

30) Automatic rescue device with battery drive - Modern advanced electronic drive system of rescuing passenger trapped in an elevator shall be provided.

31) 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.

32) All steel embedment for fixing landing doors / indicators etc. to the elevator well shaft and fascia plate shall be supplied by the bidder

33) Guide rails complete with supporting brackets for the car and counter weights.

34) 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. Bidder shall provide hoist and hoisting beam in the machine room ceiling.

35) Any other steel works as well as all other accessories / components not specified in the technical specification but necessary for making the elevator complete.

36) 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.

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) Any other requirement stipulated by state statuary body and prevailing local lift act requirement shall also to be included by bidder in their scope.

NOTES:

1) Flooring for all elevators shall be vitrified ceramic tiles of mat finish 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 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 layout attached in the specification for different buildings.

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 requirement 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 be responsible for obtaining all necessary approval from statutory and regulatory body and lift inspector. However, purchaser will furnish required information time to time basis, if required.

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

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

20) 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) Electrical load list for each elevator
2) Deviation schedule (if any)
3) GA of elevator with Pit, shaft, M/c room details and motor power calculation for all types and capacities of elevator
4) Signed and stamped copy of Electrical scope matrix and electrical specification
5) Signed and stamped copy of Compliance cum confirmation sheet.
6) Capacity of air conditioner for machine room and hoist.

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

3.0 SCOPE OF SERVICES

Scope of services will broadly include the followings:-

1) Complete erection, testing and commissioning including all testing and commissioning materials, consumables and other tools and tackles required for erection of complete elevator package.

2) Painting of all equipments / items within the battery limit.

3) Unloading, storage, handling and transportation at site for all items of elevator.

4) Minor civil and structural works shall be carried out by the bidder if required at site for which no additional commercial implication shall be entertained by BHEL.

5) Necessary consumables and instrumentation as required for inspection and testing at works as well as at site including pre-commissioning activities, if any, shall be arranged by the successful bidder at their own cost.

6) Functional testing of complete elevator package.

7) Preparation of civil input drawings including elevator pit, shaft, machine room etc.

8) Preparation of all necessary drawings / data sheets / documents / calculations as required for obtaining necessary local administration permits / approval from statutory authority and make arrangements for inspection and tests required thereby for necessary approval on behalf of the customer. Fees as required for obtaining approval from statutory bodies shall also be included in the scope of work of the bidder.

9) Any other service as required for making the installation complete in all respect and satisfactory erection and commissioning of the system.

10) Relevant requirements as per GCC, ECC & SCC.

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 the heat load calculation and capacity of air conditioner after considering all actual heat loads of elevator machine room during detail engineering stage for selection of final capacity of air conditioner.

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

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

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

h) All other safety / protection / operation interlocks as required by IS – 14665 (all parts) latest edition.

6.0 Electric Motor

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

7.0 Controls

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

8.0 Cables and wirings

The cables used in the elevator installations shall conform to the latest edition of IS 4289. All wiring / cabling between the equipments in the lift machine room and that between the machine room and equipment in the lift well and at the landing shall be wired in HDP conduits / galvanised steel conduits to be supplied by the bidder. 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 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 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 three (3) makes.

17) Bidder to assess the capability of their sub-vendors in terms of preparation of drawings, calculations, documents, quality assurance, supply of material etc. as per project schedule before placing the order on them. No deviations shall be entertained.

18) Bidder to furnish prices and unit price of each item of proposed system as per BHEL's price format only along with the final price bid.

19) Bidder shall check that specifications of all the items are available in the NIT specification. However, in the event of absence of specification for any item, bidder will approach BHEL to furnish the specification of missing items and new specification will be adhered by the bidder for which no commercial implication shall be entertained by BHEL.

20) Bar chart, list of drawings and documents including data sheet, manual calculation, quality plan, field quality plan, PG test procedure, list of sub – vendors (mechanical, C & I and erection and commissioning), technical specification and material of construction, painting specification / schedule, dispatch schedule etc. of various items as required by BHEL / customer / consultant shall be submitted to BHEL / customer / consultant during detail engineering stage for approval and the approved drawings / documents shall be adhered by the bidder without any commercial implication.

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

22) "Technical deviations" shall be clearly indicated in bidder's offer in "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.

24) Commercial implication includes price implication as well as delivery implication.

SECTION – C
DATA SHEET A

S. No.	DESCRIPTION	PASSENGER ELEVATOR	
1.	Elevator	**TG building**	**Service building**
2.	Type of Service	Passenger elevator, Conventional Type	Passenger elevator, Conventional Type
3.	Rated Load on Elevator	884 KG (13 Person)	884 KG (13 Person)
4.	Quantity	1 Nos. (One no)	2 Nos. (Two nos)
5.	Rated Speed of Lift	1.0 M/Sec	1.0 M/Sec
6.	Total Travel	35.5 M	17 M
7.	Nos. of floors to be served	Six (6) 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	Vitrified ceramic tiles of mat finish	
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), 3 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
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	Provided

	Drive)	
41.	Trailing cables	FRLS type
42.	Design seismic coefficient	According to IS 1893 - 1977
43.	Window Air condition in machine room	As per Machine room area (not less than 2T Capacity).
44.	1/2 Kg CO2/suitable type Fire extinguisher with fixing arrangement.	Provided.

2.00.00	**ELEVATOR**
2.01.00	**Passenger Elevators for TG Building, Service Building** The Passanger elevators for Service building, TG Building and shall be as under. (i) Two (2) nos. conventional type elevator having capacity of 13 persons (884kg.), for service building. (ii) One (1) no. conventional type elevator having capacity of 13 persons (884 kg.), for TG Building .
2.01.01	The scope shall include all items / accessories, service alongwith all electrical equipment etc. required to meet all design, installation, operation, safety, protection and other requirements of IS:14665 (latest edition) (all parts), 'Lift' and service lifts'. This scope shall include all items / devices needed to comply with the requirements indicated elsewhere in the specification. The scope shall include but not limited to the following : a) 1 No. fireman's switch. b) Machinery supporting Beam. c) Air conditioning of machine room.
2.01.02	The passenger Lifts shall be supplied as per IS:14665 (all 5 parts) latest edition). The outline dimensions of Electric lists shall meet the requirement of IS:14665 (latest edition).

2.01.03	The location of Elevators shall be as per TG building & Service building Drawings enclosed with the specification. To obtain necessary local administration permits / approvals and make arrangements for inspection and tests required thereby.

CLAUSE NO.	FUNCTIONAL GUARANTEES AND LIQUIDATED DAMAGES	एनटीपीसी NTPC
2.03.17	Elevators	
	a) Check for average speed and load capacity	
	b) Leveling accuracy	
	c) Trouble free smooth operation	
	d) Satisfactory operation of controls and limit switches	
	e) Unmanned tests of safety devices like brakes etc.	
	f) Testing as per manufacturer's PG Test Procedure given in Annexure-I	
2.03.18	Movable belt feeder	
	a) Demonstration of remote, local and manual actuation.	
	b) Check for travel, brake and operation of limit switches.	

BHEL POWER PROJECTS PRIVATE LIMITED NTPC NEPPL

2.00.00 **SERVICE ELEVATORS**

2.01.00 **DESIGN CRITERIA AND OPERATIONAL SPECIFICATION**

2.01.01 **Design**

Elevator shall be of conventional enclosure type for TG building, Service Building & The elevator shall meet the quality of international standard.

2.01.02 No. of floors to be served shall be as per the specification of the Employer. Bidders shall quote variation in price for addition/deletion of one landing level in the relevant schedule of Forms and Procedures. However, bidder shall quote for above indicated landing levels in his base offer. No of floors and landing elevations are tentative only. The final landing elevations for all buildings shall be subject to approval by the Employer after award.

2.01.03 Elevators shall be designed based on following criteria:

i)	Design/construction/installation codes.	:	Latest edition of IS: 14665 (all parts)
ii)	Load carrying capacity	:	a) 884 Kgs (equivalent to 13 persons) for passenger elevator for TG building. b) 884 Kgs (equivalent to 13 persons) for passenger elevator for service building.
iii)	Rated speed	:	1.0 m/sec.

iv)	Position of machine room	:	Directly above the elevator shaft.
v)	Machine room	:	Machine room and window air conditioner of minimum 2T capacity per elevator shall be provided by bidder.

2.02.00 **CONSTRUCTION**

Construction of the elevators shall specifically meet all requirements of the codes indicated and shall have following additional features:

i)	Flooring of Cabin	:	Vitrified ceramic tiles of mat finish.
ii)	Car enclosure & car panels	:	Stainless Steel
iii)	Handrails on 3 sides		Mirror Stainless Steel
iv)	False ceiling		Powder painted
v)	Car opening & Hoist way opening		Protected by central opening sliding Stainless Steel door
vi)	CABIN ACCESSORIES		The following accessories shall be provided : a) Recessed fluorescent light fittings on car floor. b) Car control station c) Emergency stop switch. d) 5/15A, 3 pin plug socket with switch on top of lift car.

1. AUTOMATIC RESCUE DEVICE (ARD)-(BATTERY DRIVE):

Bidder to provide a modern Advanced electronic drive system of "RESCUING Passenger Trapped in a ELEVATOR".

07018

CLAUSE NO.	TECHNICAL REQUIREMENTS
	2. EMERGENCY SAFETY DEVICES: The lift shall be provided with safety Device attached to the lift car frame and placed beneath the car. The safety device shall be capable of stopping and sustaining the lift car up at governor tripping speed with full rated load in car.
2.02.01	All steel embedment for fixing landing doors/indicators etc. to the Elevator well shaft and fascia plate shall be supplied by the Bidder.
2.02.02	Guide rails complete with supporting brackets for the car and counter weights.
2.02.03	Elevator drive machines complete with electric motor, reduction gear unit, suspension ropes, buffers for the cars and the counter weights and other drive and control mechanism. All foundation anchor bolts, sleeves, anchoring steel 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. Bidder shall provide hoist and hoisting beam in the machine room ceiling.
2.02.04	Any other steel works as well as all other accessories/components not specified in the specification but necessary for making the Elevator complete shall be provided by the bidder.
2.02.05	All minor building work including the supply of steel items, associated with installation of equipment in the machine room hoist way, hoist way door, frames and Elevator pit, shall form part of bidders scope of service, Employer 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 R.C.C. floor slab with necessary pockets for anchor bolts and slots.
2.03.00	**OPERATION**
2.03.01	Elevator shall have provisions to meet following operational requirements : a) Selective Duplex collective/ Simplex collective as the case may be, 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 & hands free speaker telephone set with suitable battery, charger & controls.

d) Bidder shall provide automatic rescue device to bring the elevator to nearest landing and to operate the car and landing doors in case of power failure.

e) Bidder shall provide electronic door detector (Infra red curtain type).

f) Two push buttons, one for upward movement and the other for downward movement at each intermediate landing and one 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) For facilitating the movement of visually & hearing impaired persons, landing indicators and floor announcement aid shall be provided in service building, and TG building

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

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

j) All other safety/protection/operation interlocks as required by IS:14665 (latest edition).

2.04.00 **Elevator Electricals:**

2.04.01 **Electric motor:**

The driving motors shall conform to I.S 325 and suitable for the Variable Voltage Variable Frequency (VVVF) application. All motors shall be squirrel cage induction type, suitable for operation at 415V (+/- 10% variation) , 3 phase, 3 wire, 50HZ (+3% to -5% variation) supply. Motors shall be provided with **thermal class 130 (B) or better insulation**

2.04.02 **Controls:**

The controls shall be Variable Voltage and Variable frequency type and shall provide smooth and constant acceleration and retardation under all conditions of operation. Suitable control panel shall be provided in the machine room.

07020

CLAUSE NO.	TECHNICAL REQUIREMENTS	एनटीपीसी NTPC
2.04.03	**Cables and wiring:** All the cables except trailing cables shall be as per IS:1554-1 or IS-7098-I. the PVC outer sheath of these cables shall be flame retardant, low smoke (FRLS) type with the following FRLS properties. a) Oxygen index of min. 29 (as per IS:10810 Part-58) b) Acid gas emission of max. 20% (as per IEC-754-I). c) Smoke density rating shall not be more than 60% (as per ASTMD-2843). The circular trailing cables shall be either in accordance with IS 4289 Part-I (Elastomer insulated) or IS-4289 Part-II (PVC insulated). The flat type trailing cables if offered shall be in accordance with IEC-60227-6. All wiring / cabling between the equipments in the lift machine room and that between the machine room and equipments in the lift well and at the landings shall be wired in HDP conduits/ galvanized steel conduits to be supplied by the contractor. Alternatively armored cables may be used.
2.04.04	**Earthing:** The elevator structures and all Electrical equipment, including metal conduits shall be effectively earthed with the earth conductors provided in the machine room as per IS: 3043.

BHEL POWER PROJECTS PRIVATE LIMITED NTPC NBPPL

DATA SHEET

i)	Type of services	:	Passenger
ii)	Type	:	Conventional type- One each for TG building, Service building and
iii)	Load carrying capacity	:	13 persons (884 Kg) for TG building, 13 persons (884 Kg) for Service building,
iv)	Rated speed		One (1) meter/second
v)	Total Travel	:	35.5M for TG building 17M for Service building and
vi)	No. of floor to be served	:	TG building -Six (6) nos. Service building -Five (5) nos.
vii)	Method of control	:	Variable voltage variable frequency (VVVF)
viii)	Position of M/c room	:	Directly above lift shaft
ix)	Size of platform	:	As per IS14665 & manufacturer's standard latest.
x)	Size of lift well	:	-do-

07022

CLAUSE NO.	TECHNICAL REQUIREMENTS	एनटीपीसी NTPC

xi)	Specification code	:	As per IS:14665 (5 parts) (Latest Edition).
xii)	Design seismic co-efficient	:	According to the IS 1893-1977

BHEL POWER PROJECTS PRIVATE LIMITED NBPPL

CLAUSE NO.	TECHNICAL REQUIREMENTS

ELEVATORS (ELECTRICALS)

1.00.00 **CODES AND STANDARDS** **IS:4722, IS:325**

2.00.00 **ELECTRIC MOTOR:**

The driving motors shall conform to I.S 325 and suitable for the Variable Voltage Variable Frequency (VVVF) application. All motors shall be squirrel cage induction type, suitable for operation at 415V (+/- 10% variation) , 3 phase, 3 wire, 50HZ (+3% to -5% variation) supply. Motors shall be provided with **thermal class 130 (B) or better insulation**

3.00.00 **CAR ELECTRICAL ACCESSORIES**The following accessories shall be provided :

i) Recessed fluorescenet light fittings for illumination level of 100 lux on car floor.

ii) Portable light and alarm bell with battery and charger ventilation fan with control.

iii) Car control station with position indicator inside the car and at landing platforms.

iv) Emergency stop switch.

v) 3 pin plug socket with switch on top of lift car.

vi) Hand free speaker telephone set connected to plant network.

4.00.00 **CONTROLS:**

The controls shall be Variable Voltage and Variable frequency type and shall provide smooth and constant acceleration and retardation under all conditions of operation . Suitable control panel shall be provided in the machine room.

5.00.00 **CABLES AND WIRING:**

All the cables except trailing cables shall be as per IS:1554-1 or IS-7098-I. the PVC outer sheath of these cables shall be flame retardant, low smoke (FRLS) type with the following FRLS properties.

a) Oxygen index of min. 29 (as per IS:10810 Part-58)

b) Acid gas emission of max. 20% (as per IEC-754-I).

c) Smoke density rating shall not be more than 60% (as per ASTMD-2843).

The circular trailing cables shall be either in accordance with IS 4289 Part-I (Elastomer insulated) or IS-4289 Part-II (PVC insulated). The flat type trailing cables if offered shall be in accordance with IEC-60227-6.

CLAUSE NO.	TECHNICAL REQUIREMENTS
	All wiring / cabling between the equipments in the lift machine room and that between the machine room and equipments in the lift well and at the landings shall be wired in HDP conduits/ galvanized steel conduits to be supplied by the contractor. Alternatively armored cables may be used.
6.00.00	**EARTHING:**
	The elevator structures and all Electrical equipment, including metal conduits shall be effectively earthed with the earth conductors provided in the machine room as per IS: 3043.

CLAUSE NO.	QUALITY ASSURANCE	एनटीपीसी NTPC

SERVICE ELEVATORS
PASSENGER/ SERVICE ELEVATORS AND LIFTS

TESTS /CHECKS / Items	Material Test	DPI/MPI	Ultrasonic Test	Dimensions/Physical	Functional/ Operational Test/ Run Test	Performance Test	Other Tests	All routine tests as applicable standard	Plain shade, thickness & adheston	Assembly/fit up
Shaft/ Rack/Gears	Y	Y	Y	Y						
Geared Machine					Y					
VVVF Panel				Y	Y		Y3	Y	Y	
Electrical motor				Y	Y			Y		
Complete Lift/ Elevator				Y	Y	Y1	Y2			Y

Y1 –TEST TO BE DONE AT SITE

Y2 - LOAD/OVERLOAD TEST TO BE DONE AT SITE AS APPLICABLE.

Y3 – Burn in test on electronic card

NOTE: 1. This is an indicative list of tests/checks. The manufacturer is to furnish a detailed quality plan indicating the applicable practices and procedures followed along with relevant supporting documents during QAP finalization.

2. Makes of all bought out items shall be subject to NTPC approval.

Service Elevators
Passenger/ Service Elevators and Lifts

TESTS /CHECKS / Items	Material Test	DPI/MPI	Ultrasonic Test	Dimensions/Physical	Functional/ Operational Test/ Run Test	Performance Test	Other Tests	All routine tests as applicable standard	Plain shade, thickness & adhesion	Assembly/fit up
Shaft/ Rack/Gears	Y	Y	Y	Y						
Geared Machine					Y					
VVVF Panel				Y	Y		Y3	Y	Y	
Electrical motor				Y	Y			Y		
Complete Lift/ Elevator				Y	Y	Y1	Y2			Y
Power, Control & Trailing Cables								Y		

Y1 –TEST TO BE DONE AT SITE

Y2 - LOAD/OVERLOAD TEST TO BE DONE AT SITE AS APPLICABLE.

Y3 – Burn in test on electronic card

NOTE: 1. This is an indicative list of tests/checks. The manufacturer is to furnish a detailed quality plan indicating the applicable practices and procedures followed along with relevant supporting documents during QAP finalization.

2. Makes of all bought out items shall be subject to NTPC approval.

ELEVATORS (E)

ELECTRICAL PORTION OF PASSENGER / SERVICE ELEVATORS AND LIFTS

Attributes / Characteristics / Items/Components /Sub-Assembly	General physical Inspection / Dimensions	Functional/ Operational Test	Burn in Test on electronic cards	Pre-treatment in seven tank for sheet steel , Painting	Pain shade, thickness & adhesion	All Routine tests as per relevant standard
Electrical Motor IS 325 / IS 4722	Y	Y				Y
PLC (IEC 1131)	Y	Y	Y			Y
VVVF Panel	Y	Y	Y	Y	Y	Y

Note :

1) This is an indicative list of tests/checks. The manufacture is to furnish a detailed Quality Plan indicating the practices & Procedure followed alongwith relevant supporting documents during QP finalisation.

2) Make of all major Bought Out Items will be subject to Employer's approval.

Passenger/ Service Elevators

TEST /CHECK / ITEM	Material Test	DPI/MPI	Ultrasonic Test	Dimensions/Physical	Functional/ Operational Test/ Run Test	Performance Test	Other Tests	All routine tests as per applicable standard	Plain shade, thickness & adhesion	Assembly/fit up
Shaft/ Rack/Gears	Y	Y	Y	Y						
Plates	Y			Y						
Wire rope				Y			Y5			
Safety device								Y		
Geared Machine					Y					
VVVF Drive					Y		Y3	Y		
Power, Control & Trailing Cables								Y4		
Control Panel				Y					Y	
ARD System					Y			Y		
Electrical motor								Y		
Complete Elevator				Y	Y	Y1	Y2			Y

Y1 –TEST TO BE DONE AT SITE

Y2 - LOAD/OVERLOAD TEST TO BE DONE AT SITE AS APPLICABLE.

Y3 – Burn in test on electronic card

Y4 – Routine tests including FRLS tests as per Tech. Spec.

Y5- Test report as per relevant std.

NOTE: 1. This is an indicative list of tests/checks. The manufacturer is to furnish a detailed quality plan indicating the applicable practices and procedures followed along with relevant supporting documents during QAP finalization.

2. Makes of all bought out items shall be subject to NTPC approval

Drawing / documents for submission 11626

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS (Annexure-VI of Part-C to Amendment No.01) NTPC

S.NO	DESCRIPTION OF DOCUMENTS	NO OF PRINTS	NO. OF CD-ROMs
1.	PLANT DEFINITION MANUAL	2 Sets	4 CD-ROMs
2.	Drawings "FOR APPROVAL"		
	i) Layout drawings / P&IDs	6	2 CD – ROMs
	ii) Other drawings	2	2 CD - ROMs
3.	Drawings "FOR INFORMATION"	2	2 CD – ROMs
4.	Drawings "FINAL DRAWING"	15	4 CD-ROMs
5.	Drawings "AS BUILT"	15	4 CD-ROMs
6	DATASHEETS, DESIGN CALCULATIONS, PURCHASE SPECIFICATIONS, etc. and Other type of documents		
	(i) For Approval	2	2 CD – ROMs
	(ii) FINAL	15	4 CD-ROMs
	(iii) Analysis reports of equipments/ piping/ structures components/ systems employing software packages as detailed in the specifications	2	2 CD - ROMs
7.	Erection manual "1st Submission"	4 Sets	2 CD – ROMs
8	Erection manual "FINAL"	4 Sets	4 CD ROMs
9	Operation & Maintenance manual "1st submission"	4 Sets	2 CD - ROMs
10	Operation & Maintenance manual "FINAL"	4 Sets	4 CD-ROMs
~~11~~	~~Plant Hand Book "1st Submission"~~	~~4 Sets~~	~~2 CD ROMs~~
~~12~~	~~Plant Hand Book "FINAL"~~	~~4 Sets~~	~~4 CD ROMs~~
13	Commissioning and Performance Procedure manual "1st Submission"	4 Sets	2 CD-ROMs
14	Commissioning and Performance Procedure manual "FINAL"	4 Sets	4 CD ROMs

S.NO	DESCRIPTION OF DOCUMENTS	NO OF PRINTS	NO. OF CD-ROMs
15	Performance and Functional GURANTEES TEST REPORT	4 Sets	4 CD ROMs
16	Project completion report	15	4 CD ROMs
17	QA programme including Organisation for implementation and QA system manual (with revision-servicing)	1	1 CD ROM
18	Vendor details in respect of proposed vendors including contractor's evaluation report.	1	1 CD ROM
19	Manufacturing QPs, Field QPs, Field welding schedules and their reference documents like test procedures, WPS, PQR etc.		
	(i) For review/comment	2	2 CD-ROMs
	(ii) For final approval	2	2 CD ROMs
20	Welding Manual, Heat Treatment Manuals, Storage & preservation manuals		
	1st Submission	4 Sets	2 CD ROMs
	Final	4 Sets	4 CD ROMs
21	QA Documentation Package for items / equipment manufactured and despatched to site	2 Sets	4 CD ROMs
22	QA Documentation Package for field activities on equipment / systems at site	2 Sets	4 CD ROMS

Note: 1.0 The above are the minimum quantity of drawings/documents required. the exact requirement shall be informed to the successful bidder during detail engineering satge for which no commercial implication shall be entertained by bhel.

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

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

Electrical

Specifics Technical Requirements.

TECHNICAL SPECIFICATION

FOR

ELEVATOR

(ELECTRICAL PORTION)

1.0 **EQUIPMENT & SERVICES TO BE PROVIDED BY BIDDER:**

a) Services and equipment as per "Electrical Scope between BHEL and Vendor".
b) Any item/work either supply of equipment or erection material which have not been specifically mentioned but are necessary to complete the work for trouble free and efficient operation of the plant shall be deemed to be included within the scope of this specification. The same shall be provided by the bidder without any extra charge.
c) Supply of mandatory spares as specified in the specifications of mechanical equipments.
d) Erection and Commissioning spares.
e) Erection & Maintenance tools & tackles.
f) Electrical load requirement for EOT CRANE.
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, data sheets as per required format, Quality plans, calculations, test reports, test certificates, operation and maintenance manuals etc shall be furnished as specified at contract stage. All documents shall be subject to customer/BHEL approval without any commercial implication to BHEL.
j) Motor shall meet minimum requirement of motor specification.
k) LT power & control cables shall meet minimum requirement of LT power & control cables specification.
l) Cabling, earthing & lightning protection shall meet minimum requirement of cabling, earthing & lightning protection specification.

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 two signed and stamped copies of the following shall be furnished by the bidder as technical offer:

a) A copy of this sheet "Electrical equipment Specification for "ELEVATOR" 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 :

a) Electrical scope between NBPPL & vendor.
b) Technical specification, datasheets & quality plans for 415V Electric motors.
c) Technical Specification, datasheets & quality plans for LT power & control cables.
d) Technical Specification, datasheets & quality plans for cabling, earthing & lightning protection.
e) Electrical Load data format.

5.0 In case of conflict between any requirement mentioned in case of "General technical requirements for LV motors"(Doc No. - PE-SS-999-506-E101 Rev 00) / Technical Datasheet-A & "NTPC specification of motor", mentioned clause in NTPC specification shall prevail.

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

PACKAGE : ELEVATORS

S. NO	DETAILS	SCOPE SUPPLY	SCOPE E&C	REMARKS
1	415V Local Starter Panel	Vendor	Vendor	BHEL will provide two/one number 415 V & 240 V in Machine Room for elevators.
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.

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.

1.0	Design ambient temperature		:	50 ^{o}C
2.0	Maximum acceptable kW rating of LV motor		:	200 KW
3.0	Installation (Indoors/ Outdoors)		:	As required
4.0	Details of supply system			
	a)	Rated voltage (with variation)	:	415V ± 10%, 11/3.3kV ± 6%,
	b)	Rated frequency (with variation)	:	50 Hz ± 5%
	c)	Combined voltage & freq. variation	:	10% (sum of absolute values)
	d)	System fault level at rated voltage	:	40 kA for 1 sec for 11kV & 3.3kV 45 kA for 1 sec for 415V system
	e)	LV System grounding	:	Solidly
5.0	Class of insulation		:	Class 'F', with temp rise limited to Class B.
6.0	Minimum voltage for starting (As percentage of rated voltage)		:	80% of rated voltage
7.0	Power cables data		:	Details attached
8.0	Earth Conductor Size & Material		:	Details attached
9.0	Space heater supply		:	240 V, 1¢ , 50 Hz
10.0	Rating up to which Single phase motor		:	Acceptable below 0.2 kW
11.0	Locked rotor current			
	a)	Limit as percentage of FLC	:	Details as per spec attached
	b)	Permissible tolerance, if any	:	±20%
12.0	Energy Efficient Motors		:	Details as per spec attached
13.0	Additional tests		:	As per QP
14.0	Flame-proof motor			
	a)	Enclosure suitable (As per IS:2148)	:	As per requirement
	b)	Classification of Hazardous area (As per IS: 5572 part-I)	:	As per requirement
15.0	Makes		:	ABB/ Bharat Bijlee/ CGL / KEC/ NGEF/Siemens/ALSTOM (SUBJECT TO CUSTOMER APPROVAL DURING DETAILED ENGG)

Note: **Motor name plate rating at 50^{o}C shall have at least 10% margin over input power requirement at rated duty point unless otherwise stated in driven equipment specification**

LT CONTROL CABLES

1.00.00 CODES & STANDARDS

1.01.00 All standards, specifications and codes of practice referred to herein shall be the latest editions including all applicable official amendments and revisions as on date of opening of bid. In case of conflict between this specification and those (IS : codes, standards, etc.) referred to herein, the former shall prevail. All the cables shall conform to the requirements of the following standards and codes:

IS :1554 - I	PVC insulated (heavy duty) electric cables for working voltages upto and including 1100V.
IS : 3961	Recommended current ratings for cables
IS : 3975	Low carbon galvanised steel wires, formed wires and tapes for armouring of cables.
IS : 5831	PVC insulation and sheath of electrical cables.
IS : 8130	Conductors for insulated electrical cables and flexible cords.
IS : 10418	Specification for drums for electric cables.
IS : 10810	Methods of tests for cables.
ASTM-D –2843	Standard test method for density of smoke from the burning or decomposition of plastics.
IEC-754 (Part-I)	Tests on gases evolved during combustion of electric cables.
IEC-332	Tests on electric cables under fire conditions. Part-3: Tests on bunched wires or cables (Category-B).

2.00.00 TECHNICAL REQUIREMENTS

2.01.00 The cables shall be suitable for laying on racks, in ducts, trenches, conduits and under ground buried installation with chances of flooding by water.

2.02.00 Cables shall be flame retardant, low smoke (FRLS) type designed to withstand all mechanical, electrical and thermal stresses develop under steady state and transient operating conditions as specified elsewhere in this specification.

2.03.00 Conductor of control cables shall be made of stranded, plain annealed copper.

2.04.00 PVC insulation shall be suitable for continuous conductor temperature of 70 deg C and short circuit conductor temperature of 160 deg. C.

2.05.00 The cable cores shall be laid up with fillers between the cores wherever necessary. It shall not stick to insulation and inner sheath. All the cables, other than single core unarmoured cables, shall have distinct extruded PVC inner sheath of black colour as per IS: 5831.

2.06.00 For multicore armoured cables, the armouring shall be of galvanised steel as follows:

Calculated nominal dia of cable under armour	Size and Type of armour
Upto 13 mm	1.4mm dia GS wire
Above 13 upto 25 mm	0.8 mm thick GS formed wire / 1.6 mm dia GS wire
Above 25 upto 40 mm	0.8mm thick GS formed wire / 2.0mm dia GS wire
Above 40 upto 55mm	1.4 mm thick GS formed wire/2.5mm dia GS wire
Above 55 upto 70 mm	1.4mm thick GS formed wire / 3.15mm dia GS wire
Above 70mm	1.4 mm thick GS formed wire / 4.0 mm dia GS wire

The gap between armour wires / formed wires shall not exceed one armour wire / formed wire space and there shall be no cross over / over-riding of armour wire / formed wire. The minimum area of coverage of armouring shall be 90%. The breaking load of armour joint shall not be less than 95% of that of armour wire / formed wire. Zinc rich paint shall be applied on armour joint surface.

2.07.00 Outer sheath shall be of PVC as per IS: 5831 and grey in colour. In addition to meeting all the requirements of Indian Standards referred to, outer sheath of all the cables shall have the following FRLS properties.

(a.) Oxygen index of min. 29. (As per IS 10810 Part-58)

(b.) Acid gas emission of max. 20% (As per IEC-754-I)

(c.) Smoke density rating shall not be more than 60% during Smoke Density Test as per ASTMD-2843.

2.08.00 Cores of the cables of upto 5 cores shall be identified by colouring of insulation. Following colour scheme shall be adopted.

1 core - Red, Black, Yellow or Blue

2 core - Red & Black

3 core - Red, Yellow & Blue

4 core - Red, Yellow, Blue and Black

5 core - Red, Yellow, Blue, Black and Grey

2.09.00 For cables having more than 5 cores, core identification shall be done by numbering the insulation of cores sequentially, starting by number 1 in the inner layer (e.g. say for 10 core cable, core numbering shall be from 1 to 10). The number shall be printed in Hindu-Arabic numerals on the outer surfaces of the

	cores. All the numbers shall be of the same colour, which shall contrast with the colour of insulation. The colour of insulation for all the cores shall be grey only. The numerals shall be legible and indelible. The numbers shall be repeated at regular intervals along the core, consecutive numbers being inverted in relation to each other. When the number is a single numeral, a dash shall be placed underneath it. If the number consists of two numerals, these shall be disposed one below the other and a dash placed below the lower numeral. The spacing between consecutive numbers shall not exceed 50 mm.
2.10.00	In addition to manufacturer's identification on cables as per IS, following marking shall also be provided over outer sheath: (a.) Cable size and voltage grade - To be embossed (b.) Word 'FRLS' at every 5 metre - To be embossed (c.) Sequential marking of length of the cable in metres at every one metre - To be embossed / printed. The embossing / printing shall be progressive, automatic, in line and marking shall be legible and indelible.
2.11.00	All cables shall meet the fire resistance requirement as per Category-B of IEC-332 Part-3.
2.12.00	Allowable tolerances on the overall diameter of the cables shall be +\-2 mm maximum over the declared value in the technical data sheets.
2.13.00	In plant repairs to the cables shall not be accepted. Pimples, fish eye, blow holes etc. are not acceptable.
2.14.00	Cable selection & sizing Control cables shall be sized based on the following considerations: (a) The minimum conductor cross-section shall be 1.5 sq.mm. (b) The minimum number of spare cores in control cables shall be as follows:

No. of cores in cable	Min. No. of spare cores
2C, 3C	NIL
5C	1
7C-12C	2
14C & above	3

2.14.01	Cable lengths shall be considered in such a way that straight through cable joints are avoided.

2.14.02 Cables shall be armoured type if laid in switchyard area, CHP area or directly buried.

3.00.00 CONSTRUCTIONAL FEATURES

3.01.00 1.1 KV Grade Control Cables shall have stranded copper conductor and shall be multicore PVC insulated, PVC inner sheathed, armoured / unarmoured, FRLS PVC outer sheathed conforming to IS: 1554. (Part-I).

4.00.00 CABLE DRUMS

(a.) Cables shall be supplied in non returnable wooden or steel drums of heavy construction. The surface of the drum and the outer most cable layer shall be covered with water proof cover. Both the ends of the cables shall be properly sealed with heat shrinkable PVC/ rubber caps secured by 'U' nails so as to eliminate ingress of water during transportation, storage and erection. Wood preservative anti-termite treatment shall be applied to the entire drum. Wooden drums shall comply with IS: 10418.

(b.) Each drum shall carry manufacturer's name, purchaser's name, address and contract number, item number and type, size and length of cable and net gross weight stenciled on both the sides of the drum. A tag containing same information shall be attached to the leading end of the cable. An arrow and suitable accompanying wording shall be marked on one end of the reel indicating the direction in which it should be rolled.

(c.) The standard drum length for control cables shall not be less than 1000 metres. The length per drum shall be subjected to a maximum tolerance of +/- 5% of the standard drum length. The Employer shall have the option of rejecting cable drums with shorter lengths. For each size, the variance of total quantity, adding all the supplied drum lengths, from the ordered quantity, shall not exceed +/- 2%.

5.00.00 **TESTS**

All equipments to be supplied shall be of type tested design. During detailed engineering, the contractor shall submit for Owner's approval the reports of all the type tests as listed in this specification and carried out within last ten years from the date of bid opening. These reports should be for the test conducted on the equipment similar to those proposed to be supplied under this contract and the test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client.

However if the contractor is not able to submit report of the type test(s) conducted within last ten years from the date of bid opening, or in the case of type test report(s) are not found to be meeting the specification requirements, the contractor shall conduct all such tests under this contract at no additional cost to the owner either at third party lab or in presence of client /owners representative and submit the reports for approval.

All acceptance and routine tests as per the specification and relevant standards shall be carried out. Charges for these shall be deemed to be included in the equipment price

The type test reports once approved for any projects shall be treated as reference . For subsequent projects of NTPC, an endorsement sheet will be furnished by the manufacturer confirming similarity and "No design Change". Minor changes if any shall be highlighted on the endorsement sheet.

5.01.00 TYPE TESTS

5.01.01 The reports for the following type tests shall be submitted for one size of control cables. Size shall be decided by the employer during detailed engineering

S. No.	Type Test	Remarks
	For Conductor	
1.	Resistance test	
	For Armour Wires / Formed Wires (If applicable)	
2.	Measurement of Dimensions	
3.	Tensile Test	
4.	Elongation test	
5.	Torsion test	For round wire only
6.	Wrapping test	For aluminium wires / formed wires only.
7.	Resistance test	
8(a).	Mass of zinc Coating test	For GS wires/formed wires only
8(b).	Uniformity of zinc coating	For GS wires/formed wires only
9.	Adhesion test	For GS wires/formed wires only
	For PVC insulation & PVC Sheath	
10.	Test for thickness	
11.	Tensile strength and elongation test	before ageing and after ageing
12.	Ageing in air oven	

S. No.	Type Test	Remarks
13.	Loss of mass test	For PVC insulation and sheath only
14.	Hot deformation test	For PVC insulation and sheath only
15.	Heat shock test	For PVC insulation and sheath only
16.	Shrinkage test	
17.	Thermal stability test	For PVC insulation and sheath only
18.	Oxygen index test	For outer sheath only
19.	Smoke density test	For outer sheath only
20.	Acid gas generation test	For outer sheath only
	For completed cables	
21.	Insulation resistance test(Volume resistivity method)	
22.	High voltage test	
23.	Flammability test as per IEC-332 Part-3 (Category-B)	

5.02.00 **I**ndicative list of tests/checks, Routine and Acceptance tests shall be as per Quality Assurance & Inspection table of Control Cables enclosed with this chapter

LT POWER CABLES

1.00.00 **CODES & STANDARDS**

1.01.00 All standards, specifications and codes of practice referred to herein shall be the latest editions including all applicable official amendments and revisions as on date of opening of bid. In case of conflict between this specification and those (IS : codes, standards, etc.) referred to herein, the former shall prevail. All the cables shall conform to the requirements of the following standards and codes:

IS :1554 - I	PVC insulated (heavy duty) electric cables for working voltages upto and including 1100V.
IS : 3961	Recommended current ratings for cables
IS : 3975	Low carbon galvanised steel wires, formed wires and tapes for armouring of cables.
IS : 5831	PVC insulation and sheath of electrical cables.
IS:7098 (Part -I)	Cross linked polyethylene insulated PVC sheathed cables for working voltages upto and including 1100V.
IS : 8130	Conductors for insulated electrical cables and flexible cords.
IS : 10418	Specification for drums for electric cables.
IS : 10810	Methods of tests for cables.
ASTM-D -2843	Standard test method for density of smoke from the burning or decomposition of plastics.
IEC-754 (Part-I)	Tests on gases evolved during combustion of electric cables.
IEC-332	Tests on electric cables under fire conditions. Part-3: Tests on bunched wires or cables (Category-B).

2.00.00 **TECHNICAL REQUIREMENTS**

2.01.00 The cables shall be suitable for laying on racks, in ducts, trenches, conduits and under ground buried installation with chances of flooding by water.

2.02.00 Cables shall be flame retardant, low smoke (FRLS) type designed to withstand all mechanical, electrical and thermal stresses developed under steady state and transient operating conditions as specified elsewhere in this specification.

2.03.00 Aluminium conductor used in power cables shall have tensile strength of more than 100 N/ sq.mm. Conductors shall be stranded.

2.04.00 XLPE insulation shall be suitable for a continuous conductor temperature of 90 deg. C and short circuit conductor temperature of 250 deg C. PVC insulation shall be suitable for continuous conductor temperature of 70 deg C and short circuit conductor temperature of 160 deg. C.

2.05.00 The cable cores shall be laid up with fillers between the cores wherever necessary. It shall not stick to insulation and inner sheath. All the cables, other than single core unarmoured cables, shall have distinct extruded PVC inner sheath of black colour as per IS : 5831.

2.06.00 For single core armoured cables, armouring shall be of aluminium wires/ formed wires. For multicore armoured cables, armouring shall be of galvanised steel as follows :

Calculated nominal dia. of cable under armour	Size and Type of armour
Upto 13 mm	1.4mm dia GS wire
Above 13 & upto 25mm	0.8 mm thick GS formed wire / 1.6 mm dia GS wire
Above 25 & upto 40 mm	0.8mm thick GS formed wire / 2.0mm dia GS wire
Above 40 & upto 55mm	1.4 mm thick GS formed wire /2.5mm dia GS wire
Above 55 & upto 70 mm	1.4mm thick GS formed wire / 3.15mm dia GS wire
Above 70mm	1.4 mm thick GS formed wire / 4.0 mm dia GS wire

2.06.01 The aluminium used for armouring shall be of H4 grade as per IS: 8130 with maximum resistivity of 0.028264 ohm mm^2 per meter at 20 deg C. The sizes of aluminium armouring shall be same as indicated above for galvanized steel.

2.06.02 The gap between armour wires / formed wires shall not exceed one armour wire / formed wire space and there shall be no cross over / over-riding of armour wire / formed wire. The minimum area of coverage of armouring shall be 90%. The breaking load of armour joint shall not be less than 95% of that of armour wire / formed wire. Zinc rich paint shall be applied on armour joint surface of G.S.wire/ formed wire.

2.07.00	Outer sheath shall be of PVC as per IS: 5831 & black in colour. In addition to meeting all the requirements of Indian standards referred to, outer sheath of all the cables shall have the following FRLS properties. (a.) Oxygen index of min. 29 (as per IS 10810 Part-58). (b.) Acid gas emission of max. 20% (as per IEC-754-I). (c.) Smoke density rating shall not be more than 60 % (as per ASTMD-2843).
2.08.00	Cores of the cables shall be identified by colouring of insulation. Following colour scheme shall be adopted: 1 core - Red, Black, Yellow or Blue 2 core - Red & Black 3 core - Red, Yellow & Blue 4 core - Red, Yellow, Blue and Black
2.09.00	For reduced neutral conductors, the core shall be black.
2.10.00	In addition to manufacturer's identification on cables as per IS, following marking shall also be provided over outer sheath. (a.) Cable size and voltage grade - To be embossed (b.) Word 'FRLS' at every 5 metre - To be embossed (c.) Sequential marking of length of the cable in metres at every one metre -To be embossed / printed The embossing shall be progressive, automatic, in line and marking shall be legible and indelible.
2.11.00	All cables shall meet the fire resistance requirement as per Category-B of IEC 332 Part-3.
2.12.00	Allowable tolerances on the overall diameter of the cables shall be +\-2 mm maximum, over the declared value in the technical data sheets.
2.13.00	In plant repairs to the cables shall not be accepted. Pimples, fish eye, blow holes etc. are not acceptable.
2.14.00	Cable selection & sizing
2.14.01	Cables shall be sized based on the following considerations: (a) Rated current of the equipment

(b) The voltage drop in the cable, during motor starting condition, shall be limited to 10% and during full load running condition, shall be limited to 3% of the rated voltage

(c) Short circuit withstand capability

This will depend on the feeder type. For a fuse protected circuit, cable should be sized to withstand the letout energy of the fuse. For breaker controlled feeder, cable shall be capable of withstanding the system fault current level for total breaker tripping time inclusive of relay pickup time.

2.14.02 Derating Factors

Derating factors for various conditions of installations including the following shall be considered while selecting the cable sizes:

a) Variation in ambient temperature for cables laid in air

b) Grouping of cables

c) Variation in ground temperature and soil resistivity for buried cables.

2.14.03 Cable lengths shall be considered in such a way that straight through cable joints are avoided.

2.14.04 Cables shall be armoured type if laid in switchyard area, CHP area or directly buried.

2.14.05 All LT power cables of sizes more than 120 sq.mm. shall be XLPE insulated and preferable sizes are 1Cx150, 1Cx300, 1Cx630, 3Cx150 & 3Cx240 sq.mm.

3.00.00 **CONSTRUCTIONAL FEATURES**

3.01.00 1.1 KV Grade Power Cables

(a) 1.1 KV grade XLPE power cables shall have compacted aluminium conductor, XLPE insulated, PVC inner-sheathed (as applicable), armoured/ unarmoured, PVC outer-sheathed conforming to IS:7098. (Part-I).

(b) 1.1KV grade PVC power cables shall have aluminium conductor(compacted type for sizes above 10 sq.mm), PVC Insulated, PVC inner sheathed (as applicable) armoured/ unarmoured, PVC outer-sheathed conforming to IS:1554 (Part-I).

(c) 1.1 KV grade Trailing cables shall have tinned copper(class 5)conductor, insulated with heat resistant elastomeric compound based on Ethylene Propyline Rubber(EPR) suitable for withstanding 90 deg.C continuous conductor temperature and 250deg C during short circuit, inner-sheathed with heat resistant elastomeric compound, nylon cord reinforced, outer-

sheathed with heat resistant, oil resistant and flame retardant heavy duty elastomeric compound conforming to IS 9968.

3.00.00 CONSTRUCTIONAL FEATURES

(a.) **1.1 KV grade XLPE power cables** shall have compacted aluminium conductor, XLPE insulated, PVC inner sheathed (as applicable), armoured/ unarmoured, FRLS PVC outer sheathed conforming to IS:7098. (Part-I).

(b.) **1.1KV grade PVC power cables** shall have aluminium conductor (compacted type for sizes above 10 sq.mm), PVC Insulated, PVC inner sheathed, armoured/ unarmoured, FRLS PVC outer sheathed conforming to IS:1554 (Part-I).

4.00.00 CABLE DRUMS

(a) Cables shall be supplied in non returnable wooden or steel drums of heavy construction. The surface of the drum and the outer most cable layer shall be covered with water proof cover. Both the ends of the cables shall be properly sealed with heat shrinkable PVC/ rubber caps secured by 'U' nails so as to eliminate ingress of water during transportation, storage and erection. Wood preservative anti-termite treatment shall be applied to the entire drum. Wooden drums shall comply with IS: 10418.

(b) Each drum shall carry manufacturer's name, purchaser's name, address and contract number, item number and type, size and length of cable and net gross weight stencilled on both sides of the drum. A tag containing same information shall be attached to the leading end of the cable. An arrow and suitable accompanying wording shall be marked on one end of the reel indicating the direction in which it should be rolled.

(c) The standard drum length for power cables shall not be less than 500 meters. The length per drum shall be subjected to a maximum tolerance of +/- 5% of the standard drum length. The Employer shall have the option of rejecting cable drum with shorter lengths. For each size, the variance of total quantity, adding all the supplied drum lengths, from the ordered quantity, shall not exceed +/- 2%.

5.00.00 TESTS

1.0 All equipments to be supplied shall be of type tested design. During detailed engineering, the contractor shall submit for Owner's approval the reports of all the type tests as listed in this specification and carried out within last ten years from the date of bid opening. These reports should be for the test conducted on the equipment similar to those proposed to be supplied under this contract and the test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client.

2.0 However if the contractor is not able to submit report of the type test(s) conducted within last ten years from the date of bid opening, or in the case of type test report(s) are not found to be meeting the specification requirements,

the contractor shall conduct all such tests under this contract at no additional cost to the owner either at third party lab or in presence of client /owners representative and submit the reports for approval.

3.0 All acceptance and routine tests as per the specification and relevant standards shall be carried out. Charges for these shall be deemed to be included in the equipment price.

4.0 The type test reports once approved for any projects shall be treated as reference . For subsequent projects of NTPC, an endorsement sheet will be furnished by the manufacturer confirming similarity and "No design Change". Minor changes if any shall be highlighted on the endorsement sheet.

5.01.00 **Type Tests**

5.01.01 The reports for the following type tests shall be submitted for one size each of LT XLPE and LT PVC Power cables. Size shall be decided by the employer during detailed engineering:

S.No.	Type test	Remarks
	For Conductor	
1.	Resistance test	
2.	Tensile test	For circular non-compacted conductors only
3.	Wrapping test	For circular non-compacted only
	For Armour Wires/ Formed Wires	
4.	Measurement of Dimensions	
5.	Tensile Test	
6.	Elongation test	
7.	Torsion test	For round wires only
8.	Wrapping test	For aluminium wires / formed wires only.
9.	Resistance test	
10(a)	Mass of zinc coating test	For GS Formed wires/wires only
10(b)	Uniformity of zinc coating	For GS Formed wires /wires only
11.	Adhesion test	For GS Formed wires/wires only

	For PVC/XLPE insulation & PVC Sheath	
12.	Test for thickness	
13.	Tensile strength & elongation tests	before ageing and after ageing
14.	Ageing in air oven	
15.	Loss of mass test	For PVC insulation and sheath only
16.	Hot deformation test	For PVC insulation and sheath only
17.	Heat shock test	For PVC insulation and sheath only
18.	Shrinkage test	
19.	Thermal stability test	For PVC insulation and sheath only
20.	Hot set test	For XLPE insulation only
21.	Water absorption test	For XLPE insulation only
22.	Oxygen index test	For outer sheath only
23.	Smoke density test	For outer sheath only
24.	Acid gas generation test	For outer sheath only
	For completed cables	
25.	Insulation resistance test (Volume resistivity method)	
26.	High voltage test	
27.	Flammability test as per IEC-332 Part-3 (Category-B)	

Indicative list of tests/checks, Routine and Acceptance tests shall be as per Quality Assurance & Inspection table of LT power cables enclosed with this chapter.

CLAUSE NO.	TECHNICAL REQUIREMENTS

STATION LIGHTING

1.00.00 GENERAL

1.01.00 This specification covers the general description of design, manufacture and construction features, testing, supply, installation and commissioning of the Station Lighting system equipment.

2.00.00 CODES AND STANDARDS

2.01.00 All standards and codes of practice referred to herein shall be the latest edition including all applicable official amendments & revisions as on date of bid opening. In case of conflict between this specification and those (IS codes, standards etc.) referred to herein, the former shall prevail. All work shall be carried out as per the following standards & codes.

2.02.00 Lighting Fixtures and Accessories

IS:1913	**General and safety requirements for luminaries.**
IS:2148	**Flame proof enclosures of electrical apparatus.**
IS:418	Tungsten filament general service electric lamps.
IS:1258	Bayonet lamp holders.
IS:1534	Ballast for fluorescent lamps.
IS:1569	Capacitors for use in tubular fluorescent, high pressure mercury vapour and low pressure sodium vapour discharge lamp circuit.
IS:1777	Industrial luminaire with metal reflectors.
IS:2149	Luminaire for Street lighting.
IS:2215	Starters for fluorescent lamps.
IS:2418	Tubular fluorescent lamps for general lighting services.
IS:3323	Bi-pin lamp holders for tubular fluorescent lamps.
IS:3324	Holders for starters for tubular fluorescent lamps.
IS:3646	Code of practice for interior illumination.
IS:4013	Dust-tight electric lighting fittings.
IS:6616	Ballasts for high pressure mercury vapour lamps.
IS:8224	Electric Lighting fittings for Division 2 areas.

CLAUSE NO.	TECHNICAL REQUIREMENTS	
	IS:9900	High Pressure mercury vapour lamps.
	IS:9974	High Pressure Sodium vapour lamps.
	IS:10276	Edison screw lamp holders.
	IS:10322	Luminaires.
	IS:13021	AC Supplied Electronic Ballasts for tubular fluorescent lamps.
2.03.00	**Lighting Panels, Switch-boxes, Receptacles and Junction Boxes**	
	IS:13947	Degree of protection provided by enclosures for low-voltage switchgear and control gear.
	IS:1293	Plugs & socket outlets of rated voltage upto and including 250volts & rated current upto and including 16 Amps.
	IS:2551	Danger notice plates.
	IS:13947	Low voltage switchgear and controlgear
	IS:3854	Switches for domestic and similar purposes.
	IS:6875	Control switches (switching devices for control and auxiliary circuits including contactor relays) for voltages upto and including 1000 V AC and 1200 V DC.
	IS:13703	Low voltage fuses for voltages not exceeding 1000V AC or 1500 V DC.
2.04.00	**Conduits, Pipes and Accessories**	
	IS:2667	Fittings for rigid steel conduit for electrical wiring.
	IS:3837	Accessories for rigid steel conduits for electrical wiring.
	IS:9537	Conduits for electrical installations.
2.05.00	**Lighting Wires/Cables**	
	IS:694	PVC insulated cables for working voltages upto and including 1100 V
	IS:3961	Recommended current ratings for cables.(PVC Insulated and PVC sheathed heavy duty cables and light duty cables).
	IS:8130	Conductors for insulated electric cables and flexible cords.
	IS:10810	Methods of tests for cables.

CLAUSE NO.	TECHNICAL REQUIREMENTS	
2.06.00	**Electrical Installation Practices & Miscellaneous**	
	IS:1944	Code of practice for lighting of public thorough fare
	IS:3646	Code of practice for interior illumination.
	IS:5572	Classification of Hazardous areas (other than Mines)having flammable gases and Vapours for electrical installation
	IS:6665	Code of practice for industrial lighting.
	.	National Electrical Code
	.	Indian Electricity Rules.
		Indian Electricity Act
	IS:5	Colour for ready mixed paints & enamels.
	IS:280	Mild steel wires for general engineering purposes.
	IS:374	Electric ceiling type fans & regulators.
	IS:732	Code of practice for electrical wiring installations.
	IS:1255	Code of practice for installation and maintenance of power cables Upto and including 33KV rating.
	IS:2062	Steel for general structural purposes
	IS:2629	Recommended practice for hot-dip galvanizing of iron and steel.
	IS:2633	Methods for testing uniformity of coating of zinc coated articles.
	IS:2713	Tubular steel poles for overhead power lines.
	IS:3043	Code of practice for earthing
	IS:5216	Guide for safety procedures and practices in electrical work.
	IS:5571	Guide for selection of electrical equipments for hazardous areas.
	IS:802	Code of practice for use of structural steel in overhead transmission line towers-Fabrication Galvanising, inspection & packing.
	BS:6121	Mechanical cable glands
	IS: 8623	Low voltage switchgear and control gear assemblies
	IS: 8828	Circuit Breakers for overcurrent protection for household and similar installation.

CLAUSE NO.	TECHNICAL REQUIREMENTS

4.00.00 EQUIPMENT DESCRIPTION

4.01.00 Lighting Fixture, Lamps & Accessories

a) All lighting fixtures and accessories shall be designed for continuous operation for its life under atmospheric conditions existing at site.

b) AC lighting fixtures and accessories shall be suitable for operation on 240 V, AC, 50 Hz supply with supply voltage variation of +/-10%, frequency variation of +/- 5% and combined voltage and frequency variation (absolute sum) of 10% DC lighting fixtures and accessories shall be suitable for operation on 220 V, with variation between 190 V & 240 V.

c) Power factor of fluorescent lamp fixtures shall be not less than 0.90 for FH type fixture & 0.95 with electronic ballast for other florescent fixtures and that of High Pressure Sodium Vapour and Mercury Vapour (HPSV & HPMV) lamp fixtures shall not be less than 0.85. Suitable power factor improvement capacitors shall be provided for this purpose. Capacitors shall be hermetically sealed to prevent seepage of moisture.

d) All lighting fixtures shall be complete with lamp(s), lamp holder (s), terminal blocks, clamps, locking arrangements, fixing brackets etc. Control gears shall be provided as applicable / specified. The fixtures

shall be fully wired upto terminal block. The internal wiring of the fixtures shall be done with suitable thermo-plastic or silicon rubber insulated copper conductor wires of suitable size and type. However, the normal cross section of conductor shall be not less than 0.5 Sq. mm and minimum thickness of insulation shall be 0.6 mm. The wiring shall be capable of withstanding the maximum temperature to which it will be subjected under specified service conditions without deterioration and affecting the safety of the luminaire when installed and connected to the supply. All fixing /locking screws, washers, nuts, brackets, studs etc, shall be zinc plated and passivated.

e) All fluorescent fixtures shall be provided with terminal blocks of ELMEX-EP/or Equivalent make inside the fixture for loop in loop out at Fixture. The terminal block shall be suitable for 4 sq. mm. Wire termination.

f) All lighting fixtures shall be provided with an external, brass/GI earthing terminal suitable for connecting 14 SWG, GI earthing wire. All metal or metal enclosed parts of the housing and accessories shall be bonded and connected to the earthing terminal as so to ensure satisfactory earthing continuity through out the fixture.

g) The lighting fixtures shall be designed for minimum glare. The finish of the fixtures shall be such that no bright spots are produced either by direct light source or by reflection.

h) Generally all lighting fixtures (except for street light & post top lantern type fixture) shall be provided with 20 mm dia. Conduit knock-out for connection to the incoming supply.

i) Twin fluorescent lamp fixtures shall be wired in lead lag circuit to minimise stroboscopic effect.

j) High bay fixtures shall be suitable for pendant mounting and provided with safety chain. Flood lights shall have suitable base plate/frame/mounting brackets for mounting on structural steel members.

k) The reflectors shall be manufactured from CRCA sheet steel or aluminium as specified. The aluminium reflectors shall be made of high purity aluminium sheet, polished electrochemically brightened and anodized or proven alternate arrangement of anodizing.

l) Lamp holders for fluorescent tubes shall be of spring loaded, low contact resistance, bi-pin rotor type, resistant to wear and suitable for holding in normal position under condition of shock and vibration. Live parts of the lamp holder shall not be exposed during insertion or removal of the lamp or after the lamp has been taken out. Lamp holders for incandescent, HPMV & HPSV lamps shall be of porcelain screwed type.

m) Starters shall have bi-metal electrodes and high mechanical strength. Starters shall be replaceable without disturbing the reflector or lamps and without use of any tool. Starter shall have brass contacts and radio

interference suppressing capacitor.

Lamps

a) Incandescent, HPMV & HPSV lamps shall be provided with screwed type caps.

b) The lamps shall be capable of withstanding small vibrations and the connections at lead-in wires and filaments/electrodes shall not break under such circumstances.

c) Incandescent (GLS) lamps shall be of 'clear' type unless otherwise specified.

d) All fluorescent fixtures shall have 'T5' type fluorescent lamps except for 'FH' type. The louvers of these fixtures shall be designed for 'T5' type fluorescent lamps. All fluorescent lamps shall have 'cool day light' color designation. The mirror optics type fluorescent fixtures shall have no irridescence effect. The life of T5 fluorescent fixture shall be rated for 18,000 burning hours.

e) High pressure mercury vapour (HPMV) lamps shall be of elliptical shape, colour corrected type with special fluorescent coating to increase lumen out put and improve colour rendition.

f) High pressure sodium vapour (HPSV) lamps shall be of elliptical shape and provided with external ignitor for rapid restart facility. However for street light & flood light fixture type SF1 & SF4, lamps shall be of tubular shape & provided with external ignitor for rapid restart facility. Halogen lamps shall be of tungsten filament, quartz glass type with ceramic base.

4.02.00 Ballasts

a) All HPSV and HPMV lamp fixtures shall be provided with wire-wound ballasts. All fluorescent/CFL fixtures except for Class-I, Div-II fittings/ increased safety fittings (Div-II/Hazardous Area) type fixtures shall be provided with electronic ballasts.

b) VOID

c) Wire-wound Ballasts shall have annealed copper wire wound coil, electrical grade silicon sheet steel laminations and hermetically sealed with suitable insulating compound housed in sheet steel enclosure finished stove enameled grey outside. Class of insulation shall be suitable for temp. rise of winding. End connections and taps shall be brought out in a suitable terminal block rigidly fixed to the ballast enclosure. Ballast shall be suitable for use on nominal voltage of 240 V +/- 10%, 50 Hz supply. Ballast for HPSV and HPMV

CLAUSE NO.	TECHNICAL REQUIREMENTS
	lamps shall be provided with tap settings of 220 & 240 V. Separate ballast shall be provided for each lamp in case of multi-lamp fixtures. Ballasts shall be free from hum. d) Electronic ballasts shall be capable of satisfactory performance in adverse environment like that of thermal power station. Electronic ballasts shall consist s of AC/DC Convertor, high frequency power oscillator and low pass filter. The ballast shall be suitable for use on nominal voltage of 240 V+ 10%, 50 Hz supply. The filter circuit shall suppress the feed back of high frequency signals to the mains. The ballast shall be rated for 2x14W, 2x28W, 1x28W fluorescent fixtures & 2x18W CFL fixture. e) Ignitors for HPSV lamps shall be of solid state electronic type f) Controlgear box compartment for HPSV & HPMV fixtures shall be complete with ballast, capacitor, electronic ignitor (for HPSV lamps only) etc. fully wired upto terminal block, housed in cast aluminium or CRCA sheet steel enclosures as specified, finished powder coated grey shade RLA9002. The box shall be provided with hinged door and neoprene/synthetic rubber gasket to achieve IP-54 degree of protection & shall have loop in loop out facility suitable for 20 mm conduit entry.
4.03.00	Lighting fixtures of Philips/Bajaj/Crompton Greaves make shall be acceptable. Fixtures of any other make shall be subject to Employer's approval
4.04.00	Neoprene/EPOM/synthetic rubber gasket shall be provided to achieve specified degree of protection.
4.05.00	Flood light fixtures shall be provided with graduated disc facilities for aiming angle of luminaries.
4.06.00	Brief descriptions of various types of lighting fixtures, alongwith type of installation, make & type and areas of application etc. are enclosed at Appendix - A to this Section.
4.07.00	VOID
4.08.00	VOID

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4.12.00 **Switch Box**

Switch boxes shall be made of 1.6 mm thick, MS sheet with 3 mm. thick decorative, perspex cover. Switchbox shall be hot dip galvanized

(a) Provided with earthing terminal, mounting holes and screws, specified number of conduit knockouts on both the top and the bottom sides etc. The switch boxes shall be suitable for surface/flush mounting.

(b) Switches shall be decorative Piano Key Type single pole, quick make quick break, suitable for operation on 240 V AC supply, However for SWB5 switch board, switches with base plate shall be of modular type. These shall be of reputed make subject to employer's approval.

(c) Sockets shall be decorative and of 3 or 5pin type, suitable for 240 V AC supply. However for SWB5 switch board, sockets with base plate shall be of modular type. These shall be of reputed make subject to employer's approval.

(d) Switch box shall be adequately sized to accommodate switch/fan regulators/sockets and terminal blocks. All switch box mounted items shall be fully wired upto terminal blocks located inside the box by 1100 V grade PVC insulated flexible copper wire.

(e) Terminal blocks provided for all incoming and outgoing wires shall be of 650 V grade, moulded in melamine, suitable for loop-in loop-out of 10 sq. mm. stranded aluminium wire and tap off of 1.5 sq.mm. copper wire.

(f) Switch boxes shall be of following types :

NBPL Type	NTPCTYPE No.	Switch	Fan	Regulator*	Socket
SWB1	SWB 1	5 A - 2 Nos.	-		-
SWB2	SWB 2	5 A - 3 Nos.	-		5A - 1.No.
SWB3	SWB 3*	5 A - 5 Nos.	1		5A - 1.No
SWB4	SWB 4*	5 A - 7 Nos	3		5A - 1.No.
SWB5	SWB 5**	5 A - 5 Nos	-		5A - 1.No.

* Space provision shall be kept for fan regulator in switch boxes.

** Shall have the provision for mounting the 16 A contactor.

4.13.00 Receptacles:

a) Receptacle boxes shall be fabricated out of die-cast aluminium alloy of thickness not less than 2.5 mm. The boxes shall be provided with two nos. earthing terminals, and gasket to achieve degree of protection, terminal block for loop-in loop-out, of wire/cable of specified size, mounting brackets suitable for surface mounting on wall/column/structure, conduit entry/gland plate etc. IP-55 degree of Protection shall be applicable to receptacles Type 'RA' only.

(b) The On/OFF switches shall be rotary type, heavy duty, double break, AC 23 category, suitable for AC supply.

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(c) Plug & socket shall be of shrouded die-cast aluminium. Socket shall be provided with lid safety cover.

(d) Robust mechanical interlock shall be provided for receptacles type RA such that the switch can be put ON only when the plug is fully engaged and plug can be withdrawn only when the switch is in Off position.

(e) Wiring inside the box shall be carried out with 1100 V grade PVC insulated stranded aluminium/copper wire of adequate size

(f) Terminal block shall be of 750 V grade, clip on stud type, moulded in Malamine, suitable for terminating specified cable size. All the terminals shall be shrouded.

(g) Receptacles shall be of following types :

NBPL Type	NTPC Type	Switch rating	Socket & plug rating	Type & make of plug & Socket	Terminal Block size
RA	RA	20 A, SP240V AC(Industrial)	20A, 3 pin240 V AC	NTPC appd. make	1-4 way, suitable for loop-in loop- out of 10 sq.mm. Al. Conductor
RB	RB	16A, S.P240V AC	6A+16A6 Pin decorative Piano-key Type Switch	NTPC appd.make	

4.14.00 **Junction boxes**

4.14.01 Junction box shall be made of fire retardant material. Material of JB shall be Thermoplastic or thermosetting or FRP type. The box shall be provided with the terminal blocks, mounting bracket and screws etc. The cable entry shall be through galvanized steel conduits of 20mm diameter. The JB shall have suitable knockouts on four sides of conduits or drilled during execution. The JB shall be suitable for surface mounting on ceiling/structures. The JB cover shall be either hinged or chain supported. The JB shall be of grey color RAL 7035. All the metal parts shall be corrosion protected. Terminal block shall be stud type suitable for loop-in loop-out of up to 2 numbers of 10 sq.mm aluminium conductors and tap off of 1.5 sq. mm copper conductors. The JB shall have internal provision to maintain earth continuity of connected metal conduits and shall have provision for lighting fixture earthing. Junction box surface should be such that it is free from crazings, blisterings, wrinkling, colour blots/striations. There should not be any mending or repair of surface. JB's will be provided with captive screws so that screws don't fall off when cover is opened. JB's mounting brackets should be of powder coated MS. Type test reports shall be furnished for the following Type tests.

(a) Impact resistance for impact energy of 2 Joules (IK07) as per BS EN50102

(b) Thermal ageing at 70deg C for 96 hours as per IEC60068-2-2Bb.

(c) Class of protection shall be IP 55.

(d) HV test.

NTPC Type No	Terminal block size	Remarks
JB-F	**1No-2 way, suitable for loop-in loop-out upto 2 numbers 10 sq.mm. aluminum conductor and tap off of 1.5 Sq. mm. Copper conductor**	

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4.14.02	VOID
4.14.03	Fuses shall be HRC, plug in type, complete with bakelite fuse fittings. ON/OFF switch shall be TPN, rotary type, load break suit able for 415V AC system.
4.14.04	Terminal blocks shall be of 750 V grade clip-on, stud type moulded in melamine. The terminals shall be shrouded and numbered.
4.15.00	**Conduits, Fittings & Accessories** Conduits, Pipes and Accessories Galvanised heavy duty steel conduits for normal area and galvanised heavy duty steel conduits with an additional epoxy coating of minimum 50 microns thickness for corrosive area shall be offered. Alternatively glass reinforced epoxy conduits with comparable compressive and impact strength with that of heavy duty steel conduits may be offered.
4.15.01	Rigid Steel Conduits (a.) Rigid steel conduits shall be heavy duty type, hot dip galvanised conforming to IS : 9537 Part-I & II shall be suitable for heavy mechanical stresses, threaded on both sides and threaded length shall be protected by zinc rich paint. Conduits shall be smooth from inside and outside. It shall be possible to pass wooden ball in a straight length of conduit. Diameter of ball shall be 2 mm less than the internal dia of conduit. Conduit shall be plugged by PVC caps for storage and transportation.

(b.) Outside and inside surfaces of conduits shall be hot dip galvanized and shall have high protection against corrosive and polluting substances

(c.) Fittings and accessories for conduits shall also be hot dip galvanised. However for corrosive areas accessories & fittings shall have additional epoxy coating

(d.) Salient Dimensional parameters of conduit fittings and accessories shall be as follows with symbolic alphabets bearing the meaning as given in respective IS.

Sl.No	Conduit Fitting & Accessories	Size of the Conduit(In mm)		
		20	25	40
1	Lock Nuts-	5	5	5
	Thickness (mm)			
	Width across flat (mm)	27	33	50
2	Coupler Length (mm)	35	43	43
3	Inspector bends	15	19	19
	Length of threaded Portion (mm)			
4	Normal Bend Radius (mm)	60	69.5	130
	- Straight length (mm)	30	50	60
5	Circular Boxes (Pull out boxes)			
	Dimension B (Cl) (mm)	20	25	45
	Dimension D (mm)	18	19	19
	Dimension E (mm)	16.5	18	18
	Dimension F (mm)	25	28	44
	Dimension G (mm)	60	60	75
	Dimension H (mm)	50	50	64
	Dimension I (Cl) (mm)\	3	3	2.5

CLAUSE NO.	TECHNICAL REQUIREMENTS			
	6 Saddles			
	Dimension A (CI) (mm)	53	60	65
	Dimension B (CI) (mm)	20	25	40
	Dimension C (CI) (mm)	0.71	0.71	1.22
	Dimension D (CI) (mm)	4	4	5
	Dimension E (CI) (mm)	15.5	18	20
	Dimension G (CI) (mm)	40	46	67
4.15.02	**Flexible Steel Conduits** Flexible conduit shall be water proof and rust proof made of heat resistant lead coated steel. Conduit diameter shall be uniform throughout its length. Internal surface of the conduit shall be free form burrs and sharp edges. Conduit shall be complete with necessary accessories for proper termination of the conduit with junction boxes and lighting fixtures.			
4.16.00	**Pull-out Boxes** Pull out boxes shall be provided at approximately 6 (six) metre interval in a conduit run .Boxes shall be suitable for mounting on Walls, Columns, Structures, etc. The bolts, nuts, screws, etc. required for the installation shall be included in the installation rates. Pull-out boxes shall have cover with screw and shall be provided with good quality gasket lining. Pull out boxes used outdoor shall be weather proof type suitable for IP: 55 degree of protection and those used indoor shall be suitable for IP: 52 degree of protection. Pull out box & its cover shall be hot dip galvanised. Bidder shall include the cost of pull out boxes in the installation rates for conduits & accessories.			
4.17.00	**Lighting Wires** Lighting wires shall be 1100 V grade, light duty PVC insulated unsheathed, stranded copper/aluminium wire for fixed wiring installation. colour of the PVC insulation of wires shall be Red, Yellow, Blue and Black for R,Y,B phases & neutral, respectively and white & grey for DC positive & DC negative circuits, respectively. Minimum size of wire shall not be less than 1.5.sq.mm. for copper and 4 sq.mm. for aluminium.			

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).

1.00.00 GENERAL REQUIREMENTS

1.01.00 For the purpose of design of equipment/systems, an ambient temperature of 50 deg. Centigrade and relative humidity of 95% (at 40 deg C) shall be considered. The equipment shall operate in a highly polluted environment.

1.02.00 All equipments shall be suitable for rated frequency of 50 Hz with a variation of +3% & -5%, and 10% combined variation of voltage and frequency unless specifically brought out in the specification.

1.03.00 Contractor shall provide fully compatible electrical system, equipments, accessories and services.

1.04.00 All the equipment, material and systems shall, in general, conform to the latest edition of relevant National and international Codes & Standards, especially the Indian Statutory Regulations.

1.05.00 The auxiliary AC voltage supply arrangement shall have 11kV, 3.3 kV and 415V systems. It shall be designed to limit voltage variations as given below under worst operating condition :

(a) 11kV, 3.3 kV +/- 6%

(b) 415/240V +/- 10%

1.06.00 The voltage level for motors shall be as follows :-

a) Upto 0.2KW : Single phase 240V AC / 3 phase 415V AC

b) Above 0.2KW and upto 200KW : 3 phase 415V AC

c) Above 200KW and upto 1500 KW: 3.3 kV

d) Above 1500 KW : 11 kV

Voltage rating for special purpose motors viz. screw compressors and those with VFD shall be as per manufacturer standard.

For CHP conveyor's motor above 160KW rating 3.3KV, three phase AC supply is to be used. However all the motors on the Stacker/ Reclaimer machine shall be on 415V AC only.

1.07.00 Fault level shall be limited to 40kA RMS for 1 second for 11kV & 3.3 kV system and 45 kA RMS 1 second for 415V system. 415V system shall be solidly grounded and 220 VDC system shall be isolated type.

1.08.00 Paint shade shall be as per RAL 5012 (Blue) for indoor and outdoor equipment.

1.09.00 The responsibility of coordination with electrical agencies and obtaining all necessary clearances shall be of the contractor.

1.10.00 Degree of Protection

Degree of protection for various enclosures as per IS:4691, IEC60034-05 shall be as follows :-

i)	Indoor motors	-	IP 54
ii)	Outdoor motors	-	IP 55
iii)	Cable box-indoor area	-	IP 54
iv)	Cable box-Outdoor area	-	IP 55

2.00.00 CODES AND STANDARDS

1)	Three phase induction motors	:	IS:325, IEC:60034
2)	Single phase AC motors	:	IS:996, IEC:60034
3)	Crane duty motors	:	IS:3177, IEC:60034
4)	DC motors/generators	:	IS:4722
5)	Energy Efficient motors	:	IS 12615

3.00.00 TYPE

3.01.00 **AC Motors:**

a) Squirrel cage induction motor suitable for direct-on-line starting.

b) Continuous duty LT motors upto 160 KW Output rating (at 50 deg.C ambient temperature), shall be Energy Efficient motors, Efficiency class-Eff 1, conforming to IS 12615.

c) Crane duty motors shall be slip ring/ squirrel cage Induction motor as per the requirement.

3.02.00 DC Motors Shunt wound.

4.00.00 RATING

(a) Continuously rated (S1). However, crane motors shall be rated for S4 duty, 40% cyclic duration factor.

(b) Whenever the basis for motor ratings are not specified in the corresponding mechanical specification sub-sections, maximum continuous motor ratings

	shall be at least 10% above the maximum load demand of the driven equipment under entire operating range including voltage and frequency variations.
	(c) For BFP motor the starting MVA shall be restricted to 58 MVA.
5.00.00	**TEMPERATURE RISE**
	Air cooled motors
	70 deg. C by resistance method for both thermal class 130(B) & 155(F) insulation.
	Water cooled
	80 deg. C over inlet cooling water temperature mentioned elsewhere, by resistance method for both thermal class 130(B) & 155(F) insulation.
	41 deg.C over inlet cooling water maximum temperature of 39 deg.C for thermal class Y wet wound Boiler circulation pump motor.
6.00.00	**OPERATIONAL REQUIREMENTS**
6.01.00	**Starting Time**
6.01.01	For motors with starting time upto 20 secs. at minimum permissible voltage during starting, the locked rotor withstand time under hot condition at highest voltage limit shall be at least 2.5 secs. more than starting time.
6.01.02	For motors with starting time more than 20 secs. and upto 45 secs. at minimum permissible voltage during starting, the locked rotor withstand time under hot condition at highest voltage limit shall be at least 5 secs. more than starting time.
6.01.03	For motors with starting time more than 45 secs. at minimum permissible voltage during starting, the locked rotor withstand time under hot condition at highest voltage limit shall be more than starting time by at least 10% of the starting time.
6.01.04	Speed switches mounted on the motor shaft shall be provided in cases where above requirements are not met.
6.02.00	**Torque Requirements**
6.02.01	Accelerating torque at any speed with the lowest permissible starting voltage shall be at least 10% motor full load torque.
6.02.02	Pull out torque at rated voltage shall not be less than 205% of full load torque. It shall be 275% for crane duty motors.

6.03.00	**Starting voltage requirement** (a) 85% up to 1500KW (except for AOP motor which is 80%) (b) 80% from 1501 KW to 4000KW (c) 75% > 4000KW
7.00.00	**DESIGN AND CONSTRUCTIONAL FEATURES**
7.01.00	Suitable single phase space heaters shall be provided on motors rated 30KW and above to maintain windings in dry condition when motor is standstill. Separate terminal box for space heaters & RTDs shall be provided. However for flame proof motors , space heater terminals inside the main terminal box may be acceptable.
7.02.00	All motors shall be either Totally enclosed fan cooled (TEFC) or totally enclosed tube ventilated (TETV) or Closed air circuit air cooled (CACA) type. However, motors rated 3000KW or above can be Closed air circuit water cooled (CACW). CW motors can be screen protected drip proof (SPDP) type. Motors located in hazardous areas shall have flame proof enclosures conforming to IS:2148 as detailed below (a) Fuel oil area : Group – IIB (b) Hydrogen generation plant area : Group - IIC (or Group-I, Div-II as per NEC)
7.03.00	Winding and Insulation (a) Type : Non-hygroscopic, oil resistant, flame resistant (b) Starting duty : Two hot starts in succession, with motor initially at normal running temperature. However the conveyor motor shall be suitable for 3 consecutive hot starts. (c) 11kV & 3.3 kV AC motors : Thermal class 155 (F) insulation. The winding insulation process shall be total Vacuum Presure Impregnated i.e resin poor method. The lightning Impulse & interturn insulation surge withstand level shall be as per IEC-60034 part-15 (d) 240VAC, 415V AC & 220V DC motors : Thermal Class(B) or better
7.04.00	Motors rated above 1000KW shall have insulated bearings to prevent flow of shaft currents.

7.05.00	Motors with heat exchangers shall have dial type thermometer with adjustable alarm contacts to indicate inlet and outlet primary air temperature.
7.06.00	Noise level for all the motors shall be limited to 85dB(A) except for BFP motor for which the maximum limit shall be 90dB(A). Vibration shall be limited within the limits prescribed in IS:12075 / IEC 60034-14 . Motors shall withstand vibrations produced by driven equipment. HT motor bearing housings shall have flat surfaces, in both X and Y directions, suitable for mounting 80mmX80mm vibration pads.
7.07.00	In HT motors, at least four numbers simplex / two numbers duplex platinum resistance type temperature detectors shall be provided in each phase stator winding. Each bearing of HT motor shall be provided with dial type thermometer with adjustable alarm contact and preferably 2 numbers duplex platinum resistance type temperature detectors.
7.08.00	Motor body shall have two earthing points on opposite sides.
7.09.00	HT motors can be offered with either elastimould termination or dust tight phase separated double walled (metallic as well as insulated barrier) cable boxes. In case elastimould terminations are offered, then protective cover and trifurcating sleeves shall also be provided. In case cable box is offered, then Employer shall provide termination kit. Removable gland plates of thickness 3 mm (hot/cold rolled sheet steel) or 4 mm (non magnetic material for single core cables) shall be provided in case of cable boxes.
7.10.00	The spacing between gland plate & centre of terminal stud shall be as per Table-I.
7.11.00	All motors shall be so designed that maximum inrush currents and locked rotor and pullout torque developed by them at extreme voltage and frequency variations do not endanger the motor and driven equipment.
7.12.00	The motors shall be suitable for bus transfer schemes provided on the 11kV, 3.3 kV /415V systems without any injurious effect on its life.
7.13.00	For motors rated 2000 KW & above, neutral current transformers of PS class shall be provided on each phase in a separate neutral terminal box.
7.14.00	11kV and 3.3 kV motor Terminal Box shall be suitable for fault level of 750MVA for 0.12 sec and 250 MVA for 0.12 sec respectively. Elastimould termination kit shall be suitable for fault level of 25 KA for 0.17 seconds.
7.15.00	The size and number of cables (for HT and LT motors) to be intimated to the successful bidder during detailed engineering and the contractor shall provide terminal box suitable for the same.
8.00.00	The ratio of locked rotor KVA at rated voltage to rated KW shall not exceed the following (without any further tolerance) except for BFP Motor.

	(a) Upto 110KW : 11.0 (For AOP motor it shall be 8.0) (b) Above 110KW & upto 1500KW : 10.0 (c) Above 1500KW & upto 4000KW : 9.0 (d) Above 4000KW : 6 to 6.5
9.00.00	CW Motor shall be desigined with minimum power factor of 0.8 at design point.
10.00.00	**TYPE TEST**
10.01.00	**HT MOTORS**
10.01.01	The contractor shall carry out the type tests as listed in this specification on the equipment to be supplied under this contract. The bidder shall indicate the charges for each of these type tests separately in the relevant schedule of Section - VII-(BPS) and the same shall be considered for the evaluation of the bids. The type tests charges shall be paid only for the test(s) actually conducted successfully under this contract and upon certification by the employer's engineer.
10.01.02	The type tests shall be carried out in presence of the employer's representative, for which minimum 15 days notice shall be given by the contractor. The contractor shall obtain the employer's approval for the type test procedure before conducting the type test. The type test procedure shall clearly specify the test set–up, instruments to be used, procedure, acceptance norms, recording of different parameters, interval of recording, precautions to be taken etc. for the type test(s) to be carried out.
10.01.03	In case the contractor has conducted such specified type test(s) within last ten years as on the date of bid opening, he may submit during detailed engineering the type test reports to the owner for waival of conductance of such test(s). These reports should be for the tests conducted on the equipment similar to those proposed to be supplied under this contract and test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client. The owner reserves the right to waive conducting of any or all the specified type test(s) under this contract. In case type tests are waived, the type test charges shall not be payable to the contractor.
10.01.04	Further the Contractor shall only submit the reports of the type tests as listed in "LIST OF TESTS FOR WHICH REPORTS HAVE TO BE SUBMITTED"and carried out within last ten years from the date of bid opening. These reports should be for the test conducted on the equipment similar to those proposed to be supplied under this contract and the test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client. However if the contractor is not able to submit report of the type test(s) conducted within last ten years from the date of bid opening, or in the case of type test report(s) are not found to be meeting the specification requirements, the contractor shall conduct all such tests under this

contract at no additional cost to the owner either at third party lab or in presence of client/owners representative and submit the reports for approval.

10.01.05 **LIST OF TYPE TESTS TO BE CONDUCTED**

The following type tests shall be conducted on each type and rating of HT motor

(a) No load saturation and loss curves upto approximately 115% of rated voltage

(b) Measurement of noise at no load.

(c) Momentary excess torque test (subject to test bed constraint).

(d) Full load test(subject to test bed constraint)

(e) Temperature rise test at rated conditions. During heat run test, bearing temp., winding temp., coolant flow and its temp. shall also be measured. In case the temperature rise test is carried at load other than rated load, specific approval for the test method and procedure is required to be obtained. Wherever ETD's are provided, the temperature shall be measured by ETD's also for the record purpose.

(f) Lightning Impulse withstand test on the sample coil shall be as per IEC-60034, part-15

(g) Surge-withstand test on interturn insulation shall be as per clause no. 5.1.2 of IEC 60034, part-15

10.01.06 **LIST OF TESTS FOR WHICH REPORTS HAVE TO BE SUBMITTED**

The following type test reports shall be submitted for each type and rating of HT motor

(a) Degree of protection test for the enclosure followed by IR, HV and no load run test.

(b) Terminal box-fault level withstand test for each type of terminal box of HT motors only.

10.02.00 **LT Motors**

10.02.01 LT Motors supplied shall be of type tested design. During detailed engineering, the contractor shall submit for Owner's approval the reports of all the type tests as listed in this specification and carried out within last *ten* years from the date of bid opening.

	These reports should be for the test conducted on the equipment similar to those proposed to be supplied under this contract and the test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client.
10.02.02	However if the contractor is not able to submit report of the type test(s) conducted within last ten years from the date of bid opening, or in the case of type test report(s) are not found to be meeting the specification requirements, the contractor shall conduct all such tests under this contract at no additional cost to the owner either at third party lab or in presence of client/owners representative and submit the reports for approval.
10.02.03	**LIST OF TESTS FOR WHICH REPORTS HAVE TO BE SUBMITTED** **The following type test reports shall be submitted for each type and rating of LT motor of above 50 KW only** 1. Measurement of resistance of windings of stator and wound rotor. 2. No load test at rated voltage to determine input current power and speed 3. Open circuit voltage ratio of wound rotor motors (in case of Slip ring motors) 4. Full load test to determine efficiency power factor and slip . 5. Temperature rise test . 6. Momentary excess torque test. 7. High voltage test . 8. Test for vibration severity of motor. 9. Test for noise levels of motor(Shall be limited as per clause no 7.06.00 of this section) 10. Test for degree of protection and 11. Overspeed test.
10.03.00	All acceptance and routine tests as per the specification and relevant standards shall be carried out. Charges for these shall be deemed to be included in the equipment price.
10.04.00	The type test reports once approved for any projects shall be treated as reference. For subsequent projects of NTPC, an endorsement sheet will be furnished by the manufacturer confirming similarity and “No design Change”. Minor changes if any shall be highlighted on the endorsement sheet.

TABLE - I

DIMENSIONS OF TERMINAL BOXES FOR LV MOTORS

Motor MCR in KW	Minimum distance between centre of stud and gland plate in mm
UP to 3 KW	**As per manufacturer's practice.**
Above 3 KW - upto 7 KW	85
Above 7 KW - upto 13 KW	115
Above 13 KW - upto 24 KW	167
Above 24 KW - upto 37 KW	196
Above 37 KW - upto 55 KW	249
Above 55 KW - upto 90 KW	277
Above 90 KW - upto 125 KW	331
Above 125 KW-upto 200 KW	203

For HT motors the distance between gland plate and the terminal studs shall not be less than 500 mm.

PHASE TO PHASE/ PHASE TO EARTH AIR CLEARANCE:

NOTE: Minimum inter-phase and phase-earth air clearances for LT motors with lugs installed shall be as follows:

Motor MCR in KW	Clearance
UP to 110 KW	10mm
Above 110 KW and upto 150 KW	12.5mm
Above 150 KW	19mm

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 ofr rotating electrical machnines
IS: 12065	Permissible limits of noise level for rotating electrical machines
IS: 12075	Mechnical vibration of rotatinf 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 fro three consecutive hot starts followed by one hour interval with maximum twenty starts per day and shall be sutable fro 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, mechnical 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 statedin 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 V 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/NBPPL SPEC./RELEVANT STANDARD	NBPPL SPEC. SAME AS COL.7	LOG BOOK	2	-	-	
3.0	TESTS	1.ROUTINE TEST INCLUDING SPECIAL TEST AS PER NBPPL SPEC.	MA	-DO-	100%	IS-325/ NBPPL 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

NBPPL	**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			REMARKS
									P	W	V	
1	2	3	4	5	6	7	8	9	10			11
		3.NAMEPLATE DETAILS	MA	VISUAL	100%	IS-325 & DATA SHEET	IS-325 & DATA SHEET	INSPN. REPORT	2	1	-	

NOTES:

1 ROUTINE TESTS ON 100% MOTORS SHALL BE DONE BY THE VENDOR. HOWEVER, NBPPL 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 NBPPL 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. NBPPL/CUSTOMER
2. VENDOR (MOTOR MANUFACTURER)
3. SUB-VENDOR (RAW MATERIAL/COMPONENTS SUPPLIER)

P. PERFORM
W. WITNESS
V. VERIFY

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

Volume – III

COMPLIANCE CUM 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.

DEVIATION SHEET (COST OF WITHDRAWL)

PROJECT:- 1x500MW FGUTPP UNCHAHAR Stage-IV

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.

S. No.	DESCRIPTION	PASSENGER ELEVATOR	
1.	**Elevator**	**TG Building.**	**Service Building.**
2.	Type of Service		
3.	Rated Load on Elevator (Kg)		
4.	Quantity		
5.	Rated Speed of Lift (m /s)		
6.	Total Travel (m)		
7.	Nos. of floors to be served		
8.	Method of control		
9.	Position of Machine Room		
10.	Car enclosure construction, design and finish car		
11.	Design, construction, installation codes including car size, door size, Shaft size, Size of platform and car entrance		
12.	Car and landing door		
13.	Flooring		
14.	Operation		
15.	Signal		
16.	Method of operation of car and landing doors.		
17.	Lighting & fan		
18.	Power supply : a) Power b) Lighting & fan		
19.	Other requirements		
20.	Additional requirements :-		
a)	Isolating cushion between car and car frame shall be provided.		
b)	Three pin plug with socket on car top		
c)	Car frame Material and type of construction		
d)	Landing Door		
e)	Type of operation		
f)	Door hanger tracks along with accessories shall be provided.		
g)	Safety shoes complete with accessories shall be provided.		
h)	Safety device for door operation shall be provided.		
i)	Handrails on three sides		
j)	False ceiling		
k)	Emergency stop switch		
21.	Control and operation		

	(a)Type of control	
	(b)Type of drive	
22.	Car operating panel	
	(a)Type of construction	
	(b)Push Buttons	
23.	Car position indicator	
	(a)Type of construction	
	(b)Type of display	
24.	Push button station and call registered tell tale lights at each landing	
	(a)Type of construction	
	(b)Push Buttons	
25.	Apron / Facia Plate provided as per IS 14665	
26.	Emergency Light	
27.	Terminal buffers, their types and number of buffers	
28.	Load plate	
29.	Counter weights frame	
30.	Counter weight fillers	
31.	Number of Limit Switches	
	a) Location	
	b) Type	
	c) Operation	
32.	Controller and type	
33.	Reverse phase relay and other protective devices	
34.	Car Safety & Governor	
	a) Stopping distance	
	b) Type and mode of operation of Over speed Governor device	
	c) Tripping speed and design code conforming to	
	d) Location	
35.	Motor details	
	(a) Type	
	(b) Type of Duty	
	(c) Motor Duty	
	(d) Duty Cycle of Motor	
	(e) Applicable standard	
	f) No. Of Starts Per Hour	
	g)Direction of rotation	
	h)Class of Insulation	
	i)Method of Starting	
36.	Door Motor	

	a) Equipment driven by Motor	
	b) Direction of rotation	
	c) Type of enclosures	
37.	Metallic Wire Mesh between Car & Counter Weight	
38.	Fire Man Switch	
39.	Sound Reducing Material	
40.	Automatic Rescue Device	
41.	Trailing cables	
42.	Design seismic coefficient	
43.	Window Air condition in machine room	
44.	½ Kg CO2 / Suitable type Fire extinguisher with fixing arrangement.	

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			S	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.			S	1	0	D	S	-	C		TG HALL Elevator Machine room							
SERVICE BUILDING ELEVATOR																		
ELEVATOR MOTOR			S	2	0	D	S	-	C		Each Machine room of Service Building Elevator							
2 T A/C FOR SERVICE BUILDING ELEVATOR M/C ROOM AND LIGHTING FOR ELEVATOR M/C ROOM & SHAFT AND MAINTENANCE AND INSTALLATION REQUIREMENT			S	2	0	D	S	-	C		Each Machine room of Service building Elevator							

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.**	**392**	**ORIGINATING AGENCY**		**PEM (ELECTRICAL)**
		PROJECT TITLE	**1X500MW FGUTPP UNCHAHAR**	**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**

S.N.	ITEM	UNIT OF MEASUREMENT	GURANTEED VALUE

We the undersigned hereby undertake to meet the performance guarantees as listed in the table above on the conditions as elsewhere specified. Any variation of the specified conditions during official test will be taken in to account by the customer.

PARICULARS OF BIDDER / AUTHORISED REPRESENTATIVE			
NAME	DESIGNATION	SIGN DATE	COMPANY SEAL

TITLE SCHEDULE OF EQUIPMENT MANUFACTURE DESPATCH TO SITE	SPEC. NO.: PE-TS-401-502-A001
	VOLUME III PART 'A'
	SHEET OF

S.N.	Equipment / Major Bought out Items	Time for manufacture/procurement from date of issue of letter of intent (weeks)	Time for test, dismantling, packing & ready for dispatch (weeks)	Time required for shipment to site (weeks)	Total time from date of issue of letter of intent to shipment to site (weeks)

Particulars of Bidders / Authorized Representative			
Name	Designation	Sign Date	Company seal

TITLE SCHEDULE OF WEIGHTS AND DIMENSIONS	SPEC. NO.: PE-TS-401-502-A001 VOLUME III PART A, SHEET OF

The bidder shall state below the weights and dimensions of various packages for shipment covering the complete scope.

Description of package(s)	Dimensions in (meter)	Weight (in tones)

PARICULARS OF BIDDER / AUTHORISED REPRESENTATIVE			
NAME	DESIGNATION	SIGN DATE	COMPANY SEAL

MDL FOR ELEVATOR

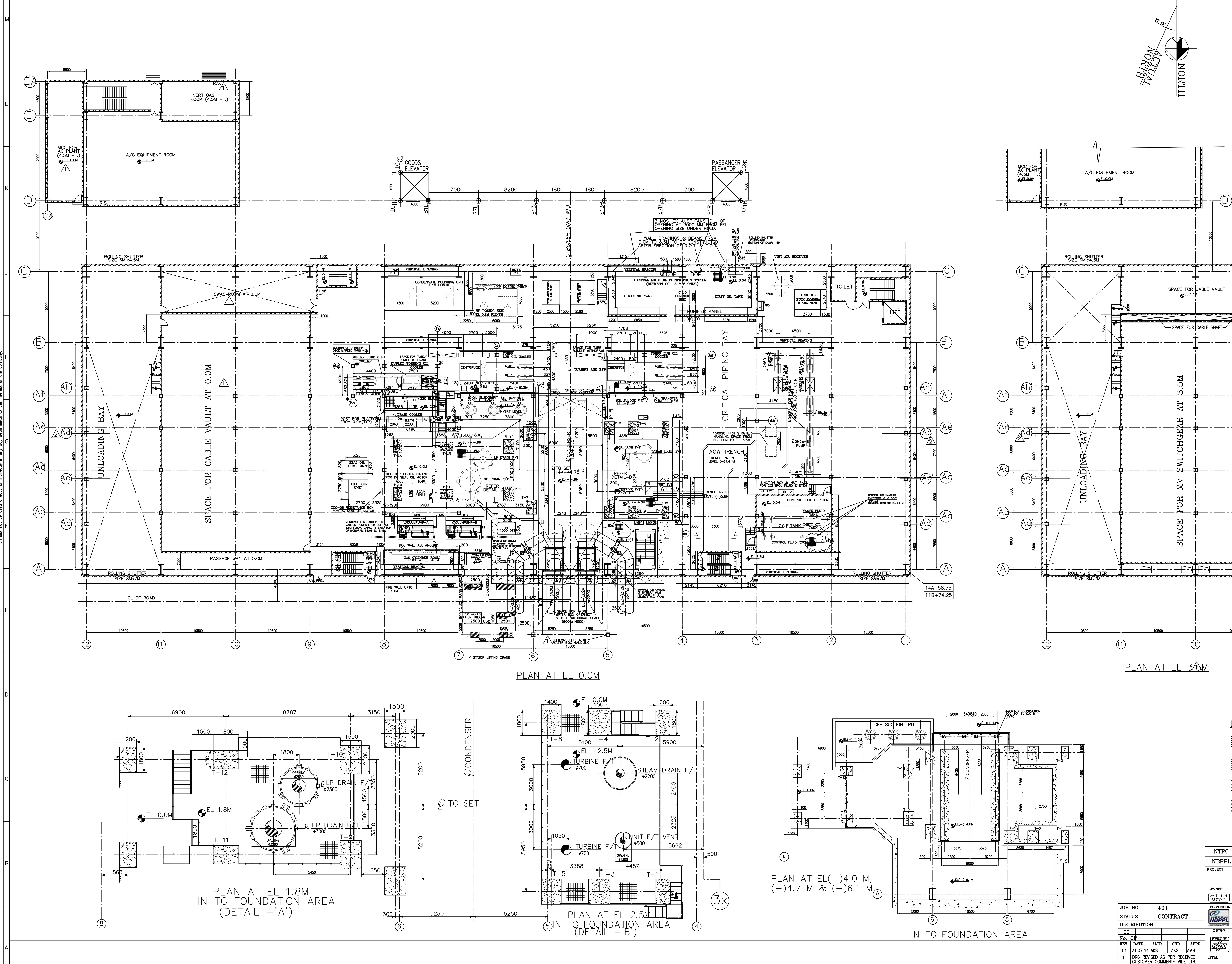
S.N0.	BHEL DOC No	TITLE	APP. CAT
1	PE-V0-401-502-A001	GAD OF ELEVATOR FOR TG BUILDING	A
2	PE-V0-401-502-A002	GAD OF ELEVATOR FOR SERVICE BUILDING	A
3	PE-V0-401-502-A101	DATA SHEET OF ELEVATOR FOR TG BUILDING	A
4	PE-V0-401-502-A102	DATA SHEET OF ELEVATOR FOR SERVICE BUILDING	A
5	PE-V0-401-502-A003	MQP (COMMON FOR TG & SERVICE) OF ELEVATOR	A
6	PE-V0-401-502-A004	O&M MANUAL COMMON FOR BOTH ELEVTAOR	I

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.

FIRST ANGLE PROJECTION

ALL DIMENSIONS ARE IN MM



NOTES:–

1. ALL ELEVATIONS MARKED ARE W.R.T.FINISHED FLOOR ELEVATION OF 0.0M WHICH CORROSPONDS TO RL. +107.0M.
2. FPD: FIRE PROOF DOOR
3. ALL CIVIL DETAILS SUCH AS DOORS/WALLS/CLADINGS/OPENINGS/TOILETS/STAIRCASES ETC. ARE INDICATIVE ONLY & FOR EXACT DETAILS REFER NTPC CIVIL/ARCHITECTURE DRAWINGS.
4. EQUIPMENTS & FACILITIES SHOWN FOR PACKAGES OTHER THAN TG PACKAGE ARE SUGGESTIVE ONLY. HOWEVER IT IS PREFERRED THAT SIMLAR DETAILS BE ENSURED FORM RESPECTIVE PACKAGE VENDORS.
5. SUPPLY OF MISCELLANEOUS PLATEFORM SHALL BE BY BHEL (AS PER APPLICABLE SCOPE OF CONTRACT).

REFERENCE DRAWING:

1. MAIN EQUIPMENT LAYOUT PLAN	PE-DG-401-100-M002
1. EQUIPMENT PLAN AT 8.5M	PE-DG-401-100-M004
2. EQUIPMENT PLAN AT 16.5M	PE-DG-401-100-M005
3. EQUIPMENT PLAN AT 23.5M, 31.25M, 35.5M & 47.0M	PE-DG-401-100-M006
4. MAIN PLANT CROSS SECTION	PE-DG-401-100-M007
5. GA OF CONDENSER (2 SHEETS)	01601070044C204
6. GENERATOR OUTLINE	–
7. GA OF CONTROL FLUID COOLER	–
8. CONTROL FLUID ROOM ARRANGEMENT	–
9. G.A.OF DRAIN COOLER	–
10. GA OF GLAND STEAM CONDENSER	–
11. GA OF CLEAN OIL TANK	–
12. GA OF DIRTY OIL TANK	–
13. GA OF HP FLASH TANK	–
14. GA OF LP FLASH TANK	–
15. GA OF SD FLASH TANK	–
16. GA OF UNIT FLASH TANK	–
17. GA OF OIL UNLOADING TANK	–
18. HP DOSING SKID	–

HOLD UPs:–

VACUUM PUMPS, DMCW PUMPS, CLO PURIFIER SKID

LEGEND:

- CHEQUERED PLATE FLOORING
- REMOVABLE CHEQUERED PLATE
- GRATED FLOORING
- REMOVABLE GRATING
- CONCRETE BLOCK
- CUT OUTS
- HAND RAILING
- PARAPET WALL
- GLASS PARTITION
- BRICK / RCC WALL

NTPC DRG. No. 1450–001R–TGPE–PVM–F–003

NBPPL DRG. No.

PROJECT: FEROZE GANDHI UNCHAHAR THERMAL POWER PROJECT STAGE–IV 1X500MW

OWNER: NTPC Limited (A GOVERNMENT OF INDIA ENTERPRISE)

EPC VENDOR: NTPC BHEL Power Projects Private Limited (A Joint Venture Company of NTPC & BHEL)
Y.S.R. Puram, Village Mannavaram, Sri Kalahasti Mandal, Distt. Chittoor - 517620 (A.P.)

QBTGM: BHARAT HEAVY ELECTRICALS LTD POWER SECTOR PROJECT ENGINEERING MANAGEMENT NOIDA

JOB NO. 401

STATUS CONTRACT

DISTRIBUTION

REV.	DATE	ALTD	CHD	APPD
01	21.07.14	AKS	AKS	AMH

1. DRG REVISED AS PER RECEIVED CUSTOMER COMMENTS VIDE LTR. REF.NO.CC:PE:1:368 DTD.13.05.14.
2. DRG GENERALLY UPDATWD & AS MARKED △1 .

DEPT CODE		NAME	SIGN	DATE
M	DRN	AKR	sd/–	22.04.2014
	DESN	RNT	sd/–	22.04.2014
	CHD	AMH	sd/–	22.04.2014
	APPD	AMH	sd/–	22.04.2014

TITLE: TG EQUIPMENT PLAN AT 0.0M

SCALE 1:150

DRAWING NO. PE–DG–401–100–M003

SHEET 1 OF 1 REV. 1

FORMAT SIZE A0

ELECTRONIC FILE NAME: 100_M003_R1


KEY PLAN
SERVICE BUILDING
NOTES :-
REF DWG:
Please submit Finishing Schedule and 'Doors & Windows Schedule' for the Service Building.
CONTRACT
XEROX
5500 x 2600
TOILET (M)
3750 x 5500
PANTRY
4000 x 2100
STORE
4000 x 1775
POTABLE WATER
3100 x 2150
SERVER
3250 x 1950
LOBBY
3890 x 5700
WELL FOR PASSENGER LIFT (13 PERSONS) AS PER IS:14665(1).
230 Thk. R.C.C.
AHU ROOM
10725 x 5500
ELEC. ROOM
3900 x 4000
TOILET (F)
3850 x 2700
TOILET (D)
1700 x 2700
FIRE ESCAPE
Sr. EXECUTIVE
6650 x 3500
RECORD
2550 x 1600
2 Nos TOILET
1800 x 1600
RECORD
2150x1500
TOILET
2200x1500
TOILET
1800 x 1500
CONFERENCE ROOM
10825 x 5800
ATRIUM
6050 x 8750
(52.94 Sqm.)
CUT - OUT
6000 x 9700
CUT - OUT
6450 x 14200
CORRIDOR 1500 WIDE
MEETING ROOM
6650 x 5800
TERRACE
9150x9210
42000 (Length)
29000 Width
1200 Ht. Masonry Wall with Glazing above upto False Ceiling
What is PP5. Give details of door schedule. Pl. refer comments made in earlier revisions Typ. for all floors)
Please take uniform title in drg and title in MDL are same. Pl. resubmit drg with correct title.
Refer Drawing No. 9661-322-01PE-PVC-G-412
Refer Drawing No. 9661-322-01PE-PVC-G-411