



**NLC TAMILANDU POWER LIMITED
(NTPL)**

2x500 MW COAL FIRED UNITS AT TUTICORIN

FLUE GAS DESULPHURIZATION SYSTEM (FGD) PACKAGE

VOLUME IIB & III

**TECHNICAL SPECIFICATION
FOR
ELEVATOR**

SPECIFICATION NO.: PE-TS-483-502-A001



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



TITLE
2X500 MW NLC TUTICORIAN TPS-FGD
ELEVATOR FOR FGD CONTROL BUILDING

SPECIFICATION NO. PE-TS-483-502-A001
 VOLUME: II B
 REV 00
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SCOPE OF ENQUIRY

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SCOPE OF ENQUIRY / INTENT OF SPECIFICATION

- 1.1 This specification includes, but not limited to design, engineering, material selection, manufacturing and assembly, inspection, testing at manufacturer's works, packing, forwarding and transportation to site, unloading, storage & handling at site, erection & commissioning, carrying out trial run and acceptance / functional guarantee test at site & final painting of passenger elevator for **2X500 MW NLC TUTICORIAN TPS- FGD Package, TAMILNADU STATE** and necessary accessories including supply of mandatory spares, erection and commissioning spares, special maintenance tools and tackles etc.
- 1.2 The contractor shall be responsible for providing all material, equipment & services, which are required to fulfil the intent of ensuring operability, maintainability, reliability and complete safety of the complete work covered under this specification, irrespective of whether it has been specifically listed herein or not. Omission of specific reference to any component / accessory necessary for proper performance of the equipment shall not relieve the responsibility of providing such facilities to complete the supply, erection and commissioning of the **Elevators** and its accessories.
- 1.3 It is not the intent to specify herein all the details of design and manufacture. However, the equipment shall conform in all respects to high standards of design, engineering and workmanship and shall be capable of performing the required duties in a manner acceptable to purchaser who will interpret the meaning of drawings and specifications and shall be entitled to reject any work or material which in his judgement is not in full accordance herewith.
- 1.4 The extent of supply under the contract includes all items shown in the drawings, notwithstanding the fact that such items may have been omitted from the specification or schedules. Similarly, the extent of supply also includes all items mentioned in the specification and /or schedules, notwithstanding the fact that such items may have been omitted in the drawing.
- 1.5 The general term and conditions, instructions to tenderer and other attachment referred to elsewhere are made part of the tender specification. The equipment materials and works covered by this specification is subject to compliance to all attachments referred to in the specification. The bidder shall be responsible for and governed by all requirements stipulated herein.
- 1.6 While all efforts have been made to make the specification requirement complete & unambiguous, it shall be bidders' responsibility to ask for missing information, ensure completeness of specification, to bring out any contradictory / conflicting requirement in different sections of the specification and within a section itself to the notice of BHEL and to seek any clarification on specification requirement in the format enclosed under 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.

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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.

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SECTION – 2

GENERAL PROJECT INFORMATION

2.0 GENERAL PROJECT INFORMATION

1	Owner / Purchaser	NLC Tamil Nadu Power Limited (NTPL) (A Joint Venture Between NLC INDIA LIMITED and Tamil Nadu Electricity Board)
2	Project Name	NTPL Tuticorin Thermal Power Project
3	Capacity and Configuration	1000 MW [2 x 500 MW]
4	Owner's Consultant	Development Consultants Private Limited
5	Geographical Location	Latitude 8°45'38.09"North Longitude 78°10'15.85"East At Tuticorin Taluk in Tuticorin district in the Southern Part of Tamil Nadu along the Bay of Munnar, India
6	Access to site	
6.1	Nearest Airport	Nearest airstrip is located at Pudukottai at a distance of 16.5 km
6.2	Nearest port	Tuticorin sea port is located adjacent to the plant.
6.3	Nearest Railway Station	The nearest railway station is Port Trust Railway Yard at a distance of 1.0 km
6.4	Nearest Town	Nearest town is Tuticorin, which is located 5.5 km away from the plant and nearest city is Pallayamkottai, away from 60 km from the plant.
6.5	Nearest Highway	National Highway No. 7A adjacent to plant
7	Meteorological data	
7.1	Site Elevation	The natural land profile of the site 1.46 m above mean sea level
7.2	Ambient Temperature DBT	
i.	Maximum DBT	36.5 °C

ii.	Minimum DBT	20.8 °C
iii.	Performance DBT	27 °C
7.3	RELATIVE HUMIDITY	
i.	Maximum	82 %
ii.	Minimum	35 %
iii.	Performance	50%
7.4	Earthquake Zone	Zone II
7.5	Predominant Wind direction	East to West
7.6	Wind velocity	Civil/structural design will be done considering IS 875 part 3
7.7	Rainfall	
i.	Annual	437 mm
7.8	Availability of Raw Water	Main source of water of the plant is sea water, which shall be taken from the Bay of Munnar.

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SECTION –I

SPECIFIC TECHNICAL REQUIREMENT

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SECTION –IA

SPECIFIC TECHNICAL REQUIREMENT (MECHANICAL)

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SCOPE OF SUPPLY & SERVICES, EXCLUSION AND TERMINAL POINTS.



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1.0 Introduction

Passenger elevator shall be provided for access to various operating floors / platforms in FGD CONTROL BUILDING for 2X500 MW NLC TUTICORIAN TPS-FGD Package 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 2 X 500 MW NLC TUTICORIAN TPS- FGD Package as listed below: -

Sl. no	Building	No. of elevators	Capacity	No. of landings	Total rise	Type	Speed
1	FGD Control Room Building	1 No.	680 Kg	Four including Ground. (0.0 m, 4.0 m, 9.6 m and last landing at 13.6 m),	13.6 M	Passenger Elevator Type.	1 M/s

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

- 1) Elevator car with SS 304, 1.5 mm (min) thick sheet of hair line finish for FGD Control building.
- 2) Guide rails for car and counterweights.
- 3) Counterweight.
- 4) DCEM brakes.
- 5) Spring buffer for car and counterweight.
- 6) Driving arrangement including motor, gear box, sheaves etc.
- 7) All electrical equipment including power cable, control cable, controller panel, safety devices including push buttons, limit switches, safety switches, indicators etc.
- 8) Isolating switch / MCBs.
- 9) Car doors, car ceiling and hoist way doors of SS 304, 1.5 MM (min) thick sheet of hair line finish.
- 10) Car operating panel, digital control, car position indicator at all floors, luminous hall buttons, auto door operating mechanism, alarm bell, car light & car fan.

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11)

Intercom connection through EPABX or PA which shall be finalized during contract stage.

12)

Ropes for hoisting.

13)

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

14)

Ladder in pits.

15)

Emergency light with rechargeable battery.

16)

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

17)

Fascia plates (750 mm minimum) & sill angels.

18)

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

19)

ELCB if required as per statutory requirement.

20)

Any other equipment required to meet the requirement of local statutory and regulatory body and prevailing lift etc.

21)

Car lighting, LED 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)

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

26)

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

27)

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

28)

Scaffolding for erection.

29)

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

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30) Emergency safety devices - The lift shall be provided with safety device attached to the lift car frame and sustaining the lift car up at governor tripping speed with full rated load in car.

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

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

33) Elevator drive machines complete with electric motor, reduction gear unit, suspension ropes, buffers for the cars and the counter weights and other drives and control mechanism. All foundation anchor bolts, sleeves, anchoring steels and any item required to complete the job satisfactorily shall be provided by the bidder. The bidder shall also provide for the grouting of anchor bolts, sleeves, anchoring steel etc. and other anchorages.

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

35) All minor building works including the supply of steel items, associated with installations of equipments in the machine room hoist way, hoist way door, frames and elevator pit, shall form part of bidder's scope of supply, BHEL / customer will provide the elevator well complete with foundation and brick walls around the lift well together with overhead machine room. The machine room will be provided with RCC floor slab with necessary pockets for anchor bolts and slots.

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

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

38) Bidder shall use latest IS 14665 (all parts) for outline dimensions of elevator & shaft, installation, operation, maintenance & inspection and testing and for elevator components design.

39) Mandatory Spares:

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

NOTES:

1) Flooring for all elevators shall be PVC tiles as indicated in the Data sheet.

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2) Functional Guarantee test shall be carried out at site for over speed test and over load test, travel and hoist speed checks as per latest IS. 3) Car, landing door and car ceiling shall be of SS-304 sheet with thickness (min) 1.5 mm. 4) Min dimensions as specified in applicable IS 14665 (all five parts) shall be considered / provided for lift shaft / pit / car / M/c Room. Safety requirement shall be as per latest IS 14665 (Relevant part). Bidder to refer the layout attached in the specification for different buildings. 5) Elevators pit shall be bare pit (i.e. pit without any RCC block / pedestal for buffer for CAR & CWT). Accordingly, MS structure & buffer required for elevator resting shall be provided by bidders. 6) All Equipment's / facilities needed for erection & commissioning shall be in bidder's scope. 7) Bidder to note that all LT Power cables (Fixed power and control cables etc), Trailing cable and instrument / signal cable for elevator shall be as per electrical specification. Trailing cable shall be FRLS type (with strain bearing member). 8) Make of various bought out items & QAP shall subject to approval of BHEL / Customer during detail engineering stage without any commercial implication at contract stage. 9) Bidder shall supply erection and commissioning spares as required during E&C stage without any commercial implication. 10) Car frame and structure (guide brackets, supports, MS structure for buffer for CAR & CWT etc) shall be painted with epoxy based paint for all elevators. 11) Protection class for motor shall be IP 54 and main control panel shall be min IP 54 and elevator control shall be VVVF type. Push buttons, Car operating Panel, Landing Operating Panel, Landing door motor and other equipment shall be IP-54. 12) Factor of safety for rope shall be 12 (min). 13) All Landing door shall be fire rated for at min 2 hour or as per latest IS / as per the state statutory requirement whichever is more stringent. 14) Motor shall be S4 / S5 duty with insulation class F & temp rise limited to class B. 15) Bidder shall submit the following documents (min) for BHEL/customer approval during detail engineering stage: - a) General arrangement of Elevator			

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- b) Technical data sheet of elevator
 - c) Technical data sheet of motor along with power, control and trailing cable details
 - d) Wiring schematic diagram
 - e) MQP for elevator along with test procedure of various components.
- 16) Bidder shall comply to the quality requirements as enclosed with specification. Quality plan shall be submitted by the successful bidder for approval during detail engineering.
 - 17) Bidder shall confirm that supply, installation and commissioning of elevator shall be completed within project schedule as indicated elsewhere from placement of intent / letter of intent.
 - 18) Bidder shall be responsible for obtaining all necessary approval from statutory and regulatory body and lift inspector. However, purchaser will furnish required information time to time basis, if required.
 - 19) Elevator shall be provided with AC VVVF type drive control system.

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

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

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

3.0 SCOPE OF SERVICES

Scope of services will broadly include the followings: -

- 1) Complete erection, testing and commissioning including all testing and commissioning materials, consumables and other tools and tackles required for erection of complete elevator package.
- 2) Painting of all equipments / items within the battery limit.
- 3) Unloading, storage, handling and transportation at site for all items of elevator.
- 4) Minor civil and structural works shall be carried out by the bidder if required at site for which no additional commercial implication shall be entertained by BHEL.
- 5) Necessary consumables and instrumentation as required for inspection and testing at works as well as at site including pre-commissioning activities, if any, shall be arranged by the successful bidder at their own cost.
- 6) Functional testing of complete elevator package.

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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) Split 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.



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- 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 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 cable s if offered shall be in accordance with IEC 60227-6. The voltage grade shall be 1100 V.

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



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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 in the specification- Electrical portion.

9.0 Earthing

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

10.0 DESIGN CRITERIA

The design criteria and equipment specification will be as follows:

- i) The rated speed will be 1.0 m/sec. Proper allowance will be made for impact and wear and the factor of safety for rope shall not be less than twelve (12) or as per IS 14665 (all parts). The suspension wire rope will confirm to IS-14665 or approved equivalent international standard.
- ii) The lift will be providing with automatic travelling device which will take care of overrun and under run of the car and rope stretch that the car floor is within 6.0 mm from the landing level at the floors while in operation.
- iii) The lift will be equipped with upper and lower terminal switches arranged to stop the car automatically within the limit of the top car clearance and bottom run-by, from the any normal operating speed.
- iv) The elevator car shall be provided with SS-304 sheet fabricated, hair line finished to approved shade (including landing doors of the car). PVC tile flooring as indicated in the data sheet - A, concealed fan and indirect lighting, emergency lighting, intercom, car position and travel direction indicator.
- v) As the elevator is to provide service in a power station, it is necessary for the equipment to be specially coated (painted). This will include application of anticorrosive paint as applicable. The electrical equipment will have enclosures meeting degree of protection as covered under electrical specification.
- vi) The elevator as a whole will comply with relevant Indian Standard i.e. 14665 or approved international standard. The outline dimensions of electric lift shall meet the requirements of IS 14665 (latest edition).
- vii) The elevator shall be provided with AC VVVF type drive control system.
- viii) Doors are automatic, center opening with emergency key opening at all landings, horizontal sliding type for car as well as for hoist way. Trap door for each elevator in machine room shall be provided by civil contractor as per IS-14665 (latest edition).

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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

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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.

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c) All drawings shall include / show plan, elevation, side view, cross - section, skin section, blow - up view, all major self manufactured and bought out items shall be labeled and included in BOQ / BOM in tabular form.

d) Specification / schedule of painting shall be made as a part of general arrangement drawing of each item indicating at least three (3) makes.

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

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

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

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

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

22) “Technical deviations” shall be clearly indicated in bidder’s offer in prescribed format only.

23) All drawings shall be prepared as per BHEL's title block and bear BHEL's drawing No. and customer / consultant’s drawing no; which will be forwarded to the successful bidder during detail engineering stage.



**Tender Specification
for
FGD Package**

**NLC Tamil Nadu Power Ltd.
2x500 MW Project
Tuticorin, Tamil Nadu**

**VOLUME : II-H
SECTION - III
ELEVATORS**



Development Consultants Pvt. Ltd.

**Vol. II-H/Section-III
Elevators**



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VOLUME : II-H

SECTION-III

ELEVATORS

1.00.00 INTRODUCTION

1.01.00 This section covers design, constructional features, material requirement, manufacture, performance requirement, testing etc. of Elevators to be used in different buildings under Flue Gas Desulphurisation Plant Package of existing 2 x 500 MW Tuticorin Thermal Power Station at Tuticorin, Tamil Nadu of NLC Tamil Nadu Power Limited (NTPL).

2.00.00 CODES AND STANDARDS

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

2.01.01 IS-14665 : Electric Traction Lifts.

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

2.01.03 State Elevator and Escalator Act.

2.01.04 State Elevator and Escalator Rules.

2.01.05 Indian Electricity Act.

2.01.06 Indian Electricity Rules.

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

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

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

2.04.00 Minimum acceptable degrees of protections for various equipment are presented in attached Annexure-III.



2.05.00 In case of any contradiction between the above standards and attachments the stipulation in the attachments shall prevail and shall be binding on the Bidder.

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

3.00.00 **SCOPE OF SUPPLY AND SERVICES**

The Scope of Work under this section shall be as below. Items though not specifically mentioned but needed to make the installation of the elevators complete in all respects are also to be furnished by the Bidder.

3.01.00 **Scope of Supply**

3.01.01 **Group-A: Traction Elevators**

- a) ~~Two (2) nos. of goods cum passenger elevators (1000 kg min.) complete with all accessories to be located adjacent to each absorber.~~
- b) ~~One (1) no. of goods cum passenger elevator (1000 kg min.) complete with all accessories to be located in the Silo and Limestone preparation building.~~
- c) The above elevators shall be provided with the following accessories as applicable:
 - i) Elevator car complete with door, door hangers and tracks, push button station and operating panel, car position indicators, fan and illumination fittings and other required accessories.
 - ii) All required structural steel members and components to accommodate the elevator and accessories in the elevator shaft, steel guides for car and counter weight, necessary steel items associated with elevator such as machine supporting beams, bearing plates, supporting channels, sill supporting angles etc.
 - iii) Counter weight, counter weight guard, sheaves and beams, ropes, hoist rope compensation, terminal buffers and guide rail lubricator device.
 - iv) Complete drive machinery and accessories, electrical and control equipment including power and lighting distribution boards and switch fuse units for power and lighting. Necessary brakes and also automatic leveling device, terminal and final limit switches and all required protective devices including starters, switch fuse unit etc. Complete drive machinery shall include motors, starters, switchgears, fuses, switches, relays, junction boxes etc. as minimum requirement.
 - v) Battery back-up for emergency lighting inside the Elevator car and



alarm, in case of power failure.

- vi) Hoist way doors and push button station with tell-tale digital lights at all the elevator landings.
- vii) Any other fittings and accessories required for the safe and efficient operation of the elevators.
- viii) All required foundation plates and/or base plates, inserts, anchor bolts, lifting lugs, eye bolts etc. wherever necessary.
- ix) Fireman's switch as per rules of fire lifts.
- x) Earth leakage circuit breaker.

3.01.02

Group-B: Rack and Pinion Elevators

- a) One (1) no. of goods cum passenger elevator (1000 kg min.) complete with all accessories to be located in the Limestone Crusher House.
- b) The above elevator shall be provided with the following accessories as applicable:
 - i) Elevator car complete with door, door hangers and tracks, push button station and operating panel, car position indicators, fan and illumination fittings and other required accessories.
 - ii) All required structural steel members and components to accommodate the elevator and accessories in the elevator shaft, rack and Pinion arrangement, steel guides for car, necessary steel items associated with elevator such as machine supporting beams, bearing plates, supporting channels, sill supporting angles etc.
 - iii) Complete drive machinery and accessories, electrical and control equipment including power and lighting distribution boards and switch fuse units for power and lighting. Necessary brakes and also automatic leveling device, terminal and final limit switches and all required protective devices including starters, switch fuse unit etc. Complete drive machinery shall include motors, starters, switchgears, fuses, switches, relays, junction boxes etc. as minimum requirement.
 - iv) Battery back-up for emergency lighting inside the Elevator car and alarm, in case of power failure.
 - v) Hoist way doors and push button station with tell-tale digital lights at all the elevator landings.
 - vi) Any other fittings and accessories required for the safe and efficient operation of the elevators.



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

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

~~ix) Earth leakage circuit breaker.~~

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

4.00.00 **OPERATION AND CONTROL PHILOSOPHY**

4.01.00 The elevators, while starting from any level, shall start at rated speed but during stopping, elevator shall slow down to lower speed when the car reaches around one meter of the selected landing floor and stop when reached the landing floor. The control system shall be microprocessor based with AC variable voltage and variable frequency drive.

4.02.00 The Group-A elevators specified herein shall be operated in selective collective automatic mode of operation as defined in IS-14665. Operation and Control features of these elevators shall be as follows:

4.02.01 One push button for each of the all landings shall be provided inside the car. Two push buttons, one "Up" button and one "down" button, shall be provided at each of the intermediate landings. The uppermost and lower most landings shall be provided with one push button.

4.02.02 Calls initiated by the car or landing push buttons shall be registered and stored until answered, irrespective of the car being in motion or any landing door being open.

4.02.03 The car shall answer calls in one direction of travel, that is all "UP" landing calls shall be answered when the car travels in the upward direction and "DOWN" landing calls shall be answered when the car travels in the downward direction, except in the case of uppermost or lowermost calls which shall be answered as soon as they are reached irrespective of the direction of travel of the car.

4.03.00 Besides the automatic mode of operations described in Clauses 4.02.00 above, the Group-A elevators shall have provision for attendant operation also, transfer of operation between automatic control and attendant operation being achieved by a key operated switch in the car.

4.04.00 The operation of the elevators shall be through push button station located inside the lift car. Suitable interlock shall be provided so that the elevators shall not move unless the door is properly closed. The landing doors of any floor shall not open when the elevator is not on that floor. Push buttons shall be fixed in one car for holding the doors open for any length of time required.

4.05.00 The elevators under this section shall be treated as "Fire Lifts". "Fire Switch" in a glass front box shall be provided adjacent to the lifts at the entrance level, the function of which is to enable the fire authority to take over the complete



control of the lifts, when required. When the switch is on, landing call points shall become inoperative and the lift shall be on the car control only. When the switch is off, the lift will return to normal working.

- 4.06.00 Specific requirements of the Group-B elevator are as follows:
- 4.06.01 The elevator will be operated by a push button system consisting of buttons for 'UP' and 'DOWN' and a button for "next level".
- 4.06.02 The elevator will be operated in a semi-automatic mode. Door will be manually closed and opened but will open only when the Cage reaches the landing.
- 4.06.03 The elevator after a predetermined speed will actuate the over-speed brake Governor. The governor pawl due to the centrifugal action will actuate the incorporated mechanism and stop the downward motion.
- 4.06.04 Calls initiated by the landing push buttons shall be registered and stored until answered, irrespective of the cab being in motion on any landing door being open.
- 4.06.05 The cab shall answer calls in one direction of travel, that is all "UP" landing calls shall be answered when the cab travels in the downward direction, except in the case of uppermost or lowermost calls which shall be answered as soon as they are reached irrespective of the direction of travel of the car.

5.00.00 **SPECIFIC PERFORMANCE REQUIREMENT**

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

6.00.00 **DESIGN AND CONSTRUCTION**

Design and constructional requirement of all the elevators and components thereof shall be in line with Indian Standards specified in clause 2.00.00 above as applicable unless specified otherwise.

6.01.00 **Group-A: Traction Elevators**

6.01.01 **Load and Speed**

The elevator shall lift a pay load as indicated against rated load of the applicable Annexure attached to this section or its nearest higher as per manufacturer's present standard in addition to the weight of the car and its accessories and shall travel at a rated speed as indicated in the applicable Annexure.

6.01.02 **Travel and Landing**

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





6.01.03 **Car**

a) **Size**

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

b) **Car Frame**

- i) Lift car shall be carried in a complete frame of steel which shall be sufficiently rigid to withstand the operation of the safety gear without permanent deformation to the car frame.
- ii) At least four renewable guide shoes or guide shoes with renewable linings or set of roller guides shall be provided, two at the top and two at the bottom of the car frame.

c) **Car Enclosure**

- i) Car shall be enclosed on all sides by means of car body and door. The sides of the car shall be lined with heavy gauge sheet steel panels properly braced and reinforced. The enclosure shall be flush on the inside and securely fastened to the platform. Car inside enclosure shall be of stainless steel plate of grade SS: 304 of bright finish.
- ii) Car of the elevators specified herein shall be equipped with decorated Stainless Steel handrails on three sides. Car shall be equipped with fan with grills and suitable lighting complete with decorative fittings. The light shall be left burning during the whole time the lift is available for use.
- iii) Necessary provisions shall be made for adequate ventilation of the car. Ventilation openings shall be provided in the enclosure walls as per requirement of IS-14665. To permit switching off of the power supply to the lift without switching off the fan and light a separate switch shall be provided for fan and light.
- iv) The enclosure of lift car shall withstand the maximum possible thrust applied normally at any point, excepting any vision panel, without permanent deformation. Glass shall not be used in the lift car except for the following purposes:
 - 1. As covers for certificate.
 - 2. For lighting fixtures.
 - 3. For appliances used in connection with the operation of the car.
 - 4. For vision panels and mirrors.



- v) Suitable arrangement to secure isolating cushion between car and the steel car-frame shall be provided.
- vi) Telephone or paging facility shall be installed in the lift car. The Bidder shall provide suitable cabinets in the car to house handsets. The Bidder shall also provide necessary wiring for telephone or paging connection from the car to a terminal box adjacent to the lift well.
- vii) The car panels shall be given final painting. The type and colour of the final painting shall be subject to the approval of the Purchaser/Consultant.

d) **Car Platform**

- i) It shall be constructed of structural steel shapes securely fastened together with one layer of wood flooring. Floor of the elevators shall be as specified in Annexure. The platform construction should be designed on the basis of rated loads evenly distributed.
- ii) Since, the car levelling devices will be used, substantial aprons of sufficient depth shall be fitted to the car floor to ensure that no space is permitted between the threshold and the landing while the car is being levelled to a floor.

e) **Car Roof**

- i) Car roof shall be covered with sheet metal. The construction of roof should be strong enough to be capable of supporting at least two persons.
- ii) A three pin plug socket with switch of industrial type having adequate capacity for a hand lamp shall be fitted on top of the lift car for use by persons working thereon during maintenance.

6.01.04 **Car and Hoistway Doors**

a) **Type of door**

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

b) **Door Hangers and Tracks**

- i) Hangers and tracks for car door and each hoistway door shall be furnished. Suitable material shall be used to minimize noise. Ball bearing, rollers or equal arrangement shall be provided to take upward thrust of the doors.



- ii) Suitable devices shall be furnished for transmitting motion from one door panel to the other.
- iii) All required materials for landing entrance e.g. extruded aluminium or equivalent sills, strut angles, headers etc. shall be provided.

c) Door Operators

- i) The door operation shall have power opening and power closing. Necessary electric type door operators shall be furnished. The car door and the hoistway door shall be mechanically connected and shall move simultaneously during opening and closing. The necessary door cushioning devices shall be furnished.
- ii) The car door and the hoistway door shall open automatically when the car stops at a landing. Should the electric power fail, the door operator shall be so designed that doors can be manually opened from within the car. Necessary door locking devices shall be furnished. Necessary switches shall be furnished in the elevator machine room to control the operation of the door.

6.01.05 Car Self-leveling Device

The elevator shall be equipped with automatic self-leveling devices, to bring the car to the floor landings. These self-leveling devices shall correct for over travel and rope stretch. Leveling accuracy is applicable as per IS 14665 Part 3 / Section 1.

6.01.06 Car Operating Panel

- a) In the car, these shall be furnished, an operating panel containing push buttons, numbered to elevations of the landings served; two position key-operated switch, marked to indicate "With Attendant" and "without attendant"; an emergency stop switch; a buzzer; an emergency call button connected to a bell to be provided by the Bidder at the bottom most landing of each elevator to serve as an emergency signal and also in the control room with an indication; a non-stop button; push button, or switches for lighting and fan; up push button, down push button, one door open push button and other push buttons, switches, emergency light, telephone hand set etc. as required.
- b) The emergency call button mentioned above shall have two sets of potential free contact and shall be suitably wired up to the control panel in the machine room for indication or annunciation at unit Control Room shall be provided.
- c) When the key switch in the car-operating panel is set at the attendant position, the attendant will have full control of the operation of the elevator. Any hoistway calls which are then registered will cause a



buzzer to sound in the car operating panel and the appropriate indicator light to illuminate.

6.01.07 Car Position Indicator in Car

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

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

a) The elevators as described in clause 4.00.00 above shall be equipped with a push button station consisting of a single up or down push button at terminal landings, and up and down push buttons at each intermediate landing including call registered lights (up or down call registered lights at each terminal landings and both up and down call-registered lights at all intermediate landings). These shall illuminate when the corresponding button is pressed to indicate that the call is registered and shall remain illuminated until the call is answered. An illuminated car position indicator similar to that specified for car in clause 6.07.00 shall be provided above the entrance of all the landings.

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

6.01.09 Safety Shoe Device on Car Door

Safety shoe device shall be furnished on car doors. Safety shoe shall extend the full height on the closing edges of the car doors. The arrangement shall be such that should the safety shoe touch a person or an object while the door is closing, the car and the hoistway door shall return to the open position. The doors shall remain open until the expiration of a pre-determined interval and then close automatically.

~~**6.01.10 Emergency Exit**~~

~~Elevator car shall be provided with an emergency exit of adequate dimensions. The location of the emergency exit shall be at the top of the car.~~

6.01.11 Terminal Buffers

Sufficient number of buffers of spring-loaded type shall be furnished for stopping the car and the counter-weight at the extreme ends of travel. All structural steel members required to install the buffer shall be supplied. The buffers shall be capable of stopping the cab without permanent damage or deformation to themselves or any other part of the equipment. The number of buffers shall be fixed as to ensure proper sharing of impact loads by all of them.



6.01.12 **Load Plate**

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

6.01.13 **Counter-weights and Counter-weight Frames**

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

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

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

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

Car and counter-weight guides shall be of rigid steel and shall be continuous throughout the entire length and shall be provided with adequate steel bracings and stiffeners. The necessary lubrication device for guide rail shall be provided.

6.01.15 **Limit Switches**

Normal terminal limit switches to slowdown and stop the car automatically, shall be provided at terminal landings and final limit switches shall be furnished to automatically cut-off the power and apply the brake, should the car travel beyond the terminal landings.

6.01.16 **Controller & Traction Machine**

- a) The design ambient temperature for these equipment shall be taken as 50°C. The insulation of motor shall be class "F" and temperature rise shall be limited to Class "B".
- b) Complete details of controller and traction machine shall be furnished by the Bidder.
- c) The elevators being offered with Microprocessor based AC variable voltage and variable frequency type control, motor and generator shall be mounted on independent shafts coupled with proper coupling.
- d) Number of starts per hour for which motor shall be capable, shall be selected by the Bidder for the given applications and in accordance with applicable code/standard.
- e) Necessary brakes shall be provided in the traction machine.
- f) Protective relays shall be furnished on the controller to protect against phase reversal, low voltage and phase failure. Overload and other



protective relays shall also be furnished for traction motor. Single phasing preventor shall also be provided to protect motor while running at no-load.

6.01.17 Lighting

- a) Lighting shall be provided in machine room, lift well and lift cabin.
- b) Two (2) nos. 40 W Fluorescent tubes with fittings shall be provided at each of the machine room and the lift cabin whereas incandescent G.L.S. lamp shall be provided in the lift well. Emergency lighting shall be provided in all the places including Cabin. All necessary wires, conduits, junction boxes shall be supplied. In the lift cabin indirect illumination type fitting shall be provided.

6.01.18 Grounding

Grounding of all enclosure of live parts shall be done as per applicable Electricity Rules with latest amendment. All structures of the lift shall also be grounded. Necessary material for grounding shall be supplied by the Bidder.

6.01.19 Other Electrical Items

- a) Special care and precaution shall be taken regarding the handing of lift trailing cable loops between the points of suspension. A 6 mm dia sling rope should be used for tying up. Conductor and insulation of these trailing cables shall be flexible with suitable reinforcement provided.
- b) All control cables shall have crimped type lugs and wire numbering ferrules at either ends.
- c) For general technical requirements, Volume: II-F of this specification shall be referred.

6.01.20 Safety Gears

- a) The elevator shall be provided with one or more safety devices capable of stopping and sustaining the lift car with full rated load in the car at governor tripping speed.
- b) When the safety gear is applied, decrease in the tension of the governor rope or motion of the car in the descending direction shall not release the safety gear.

6.01.21 Overspeed Governor

The elevator shall be equipped with overspeed governor device, which operates to apply the safety gear in the event of the speed of the car in the descending direction exceeding a predetermined limit.



6.01.22 **Brakes**

The machine shall be provided with direct current spring set, solenoid released, double shoe brakes of sufficient capacity to stop the car at any position with the design load. These brakes shall be designed in such a way to apply automatically in the event of power supply failure. The details of equipment offered shall be indicated in the offer.

6.01.23 **Rope**

Suitable traction steel hoist ropes of the sizes and number to ensure proper wearing qualities shall be supplied. As a minimum, the number of ropes shall comply with the factor of safety requirements of Indian Standard for lift/elevator. The full details of ropes, the maker's name, trade name, breaking strength, designed factor of safety of all ropes shall be submitted with the bid.

6.01.24 **Ring of Stranded Lift**

- a) During prolonged power failure, arrangement shall be provided, so that, after cutting out supply point manually through hand wheel the lift stranded between two floors may be brought to the nearer floor.
- b) Alternative offer for bringing the stranded lift to the nearer floor by automatic winding arrangements may be given and price quoted separately.

6.01.25 **Lifting Attachments**

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

6.01.26 Except as otherwise specified herein, the elevators shall be designed in line with the recommendations contained in the latest edition of IS: 14665 (Part-I to Part-V) Electrical items shall be designed in accordance with the latest edition of IEA (Indian Electricity Act). All indoor equipment shall have degree of protection of IP-52 and outdoor equipment as per IP-55.

~~6.02.00 **Rack & Pinion type Elevator**~~

~~6.02.01 All the stipulations mentioned in clause 6.01.00 above for Traction Elevators will also be applicable for rack & pinion type elevator as far as they are applicable.~~

~~6.02.02 Elevator mechanical and electrical operating devices and trailing cable shall be designed for operation indoors with dusty and high humid conditions and shall operate satisfactorily within the range of ambient temperatures specified.~~

6.02.03 **Enclosures**

- a) A three-sided enclosure with one access door shall be provided for ground landing. At each platform landing above ground level, a one sided



6.02.06 **Drive Unit & Safety Device**

- a) Drive unit located on top of the cab shall be complete with AC squirrel cage induction motor, reduction gear, drive pinion and an over speed governor.
- b) Drive unit shall incorporate electromagnetic disc type brake and an external manual brake release. The brake on the electric motor will be of the electromagnetic single disc self-adjusting type with mechanical compression spring being held off by the electromagnet. In the event of power failure, the brake will be automatically applied and will stop the cab. A hand lever which can be operated from the cage is to be provided to enable the occupants to ease the brake and lower the cage to the bottom level. Motor shall be connected to a reduction worm gear which drives the pinion.
- c) An overspeed governor in constant mesh with the rack by means of a pinion shall be incorporated to protect the cab against overspeed during the cab downward motion. At a predetermined speed higher than normal, the centrifugal action of the governor pawl will actuate the incorporated brake mechanism and stop the downward motion of the cab smoothly. The brake shall remain locked on following this action and has to be manually reset before normal elevator operation can be resumed.
- d) A remote control shall be provided for testing the safety device of the elevator with remote control facility.
- e) The drive system shall be designed so that it will be capable to operate smoothly without any tendency to rock or judder with all vertical, horizontal forces as well as the moments through the rack.
- f) The elevator shall be provided with a centrifugal brake to prevent accidental tripping of the safety device if, in case of power failure, the cage has to be taken to the ground by gravity.
- ~~g) Drive unit must be dual motor drive.~~

7.00.00 **INSPECTION AND TESTING**

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

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

7.01.02 All welding shall be carried out as per welding procedures qualified as per ASME Section-IX. Welding procedures shall be forwarded for approval. Only welders qualified as per ASME Section-IX shall be employed for welding.

7.01.03 All NDT operators should be qualified as per SNT-TC-IA.





- 7.01.04 All forgings shall be subjected to ultrasonic test to ensure free from internal defects.
- 7.01.05 All welds shall be subjected to dye-penetration test and visual examination.
- 7.01.06 All forged components shall be subjected to DPI/MPI after machining.
- 7.01.07 The reduction gear/driven pinion/reduction worm gear shall be checked for the following:
- Back lash.
 - Gear ratio.
 - Run outs.
 - Noise and vibration levels.
 - Tooth contact and running test.
 - Dimensional conformity.
- 7.01.08 Buffer springs shall be subjected to load test as per relevant specifications. Material certificates for springs shall also be furnished.
- 7.01.09 Steel wire ropes shall be subjected to all the tests including material test as per relevant standard. Braking load test shall be carried out as per relevant national/international standards.
- 7.01.10 All components prior to assembly shall be checked for dimensions.
- 7.01.11 All rotating components shall be shop tested for dynamic balancing as per ISO-1940.
- 7.01.12 Car sling and car body in assembled condition shall be checked for position of all major components i.e. car sling inside depth, width, height and respective positions of all accessories within the same.
- 7.01.13 Induction Motor shall be subject to both type tests and routine tests in accordance with IS-325 and IS-4029. DC Motor and DC Generator shall be tested as per IS-4722. In addition, following tests shall also be carried out:
- a) 20% overspeed test for 2 minutes.
 - b) Vibration measurement.
 - c) Measurement of noise level as type test.
 - d) Degree of protection test on both motor enclosure and terminal box as per IS-4691 as type test.
- 7.01.14 Following items shall be tested as per relevant standard:



- a) Trailing cable and copper conductors. PVC cables shall also be subjected to type, routine and acceptance tests.
 - b) Brake coil.
 - c) Relays contactors, instruments and controlling equipment.
- 7.01.15 The control panels, door operating panels, junction box & other metallic enclosures test shall conform to specific degree of protection.
- 7.01.16 Mechanical balance test and vibration levels of elevator and accessories shall be carried out.
- 7.01.17 Insulation, resistance test, high voltage withstand test of all wiring shall be carried out.
- 7.02.00 After installation of complete elevator, necessary trial run and performance tests shall be carried out by the Bidder in presence of Purchaser to determine that equipment supplied is satisfactorily installed and commissioned.
- The performance tests to be conducted shall interalia include the following:
- a) Car operates smoothly for full length of travel.
 - b) Car stops at each platform elevation under both loaded and unloaded conditions.
 - c) Car travels at specified speed when loaded at specified capacity.
 - d) Enclosure doors operate properly.
 - e) Mechanical and electrical equipment function as specified.
 - f) Input power at motor terminal at specified design capacity and speed.
- All performance tests shall be conducted by the Bidder and the procedure for conducting such tests shall be approved by Owner.
- 8.00.00 **DRAWING, DATA AND INFORMATION REQUIRED**
- 8.01.00 In addition to the Proposal Data Sheets duly filled up, Bidder shall submit the following drawings/data/information for the elevator along with his offer.
- 8.01.01 Layout drawing showing principal dimensions of the elevator car in plan and the elevator car and shaft in elevation.
- 8.01.02 Layout drawing showing the location of various equipment in the elevator machine room.
- 8.01.03 Complete general arrangement drawing of the elevators and its support structure showing all landing levels and enclosures.



- 8.01.04 Electrical Control Schematics.
- 8.01.05 Write-up, description and illustrative pamphlets on various components of the elevator and its control, interlock and safety devices.
- 8.01.06 Detailed drawing of mast including fixing details of mast sections on the chimney wall for stack elevator.
- 8.01.07 Foundation details and loading.
- 8.01.08 Load on elevator columns.
- 8.01.09 Layout of conduits, conductors, cables etc.
- 8.01.10 Other drawings, data sheets and literature as necessary.
- 8.02.00 Drawing, Data, Information to be furnished by the successful Bidder after award of contract.
- 8.02.01 All drawings, data and information as asked for in Clause No. 8.01.00 in finalized form for review and approval of Purchaser/Consultant.
- 8.02.02 Detailed layout drawings including foundation and structural design data for elevator shaft and elevator machine room. The data shall include braking load on guides, reaction of buffers on lift pits, reaction on support point on machine room, hoistway, etc.
- 8.02.03 Details of block outs, embedments, inserts on RCC Works.
- 8.02.04 Complete Electrical Control, schematic wiring diagram of power and control room.
- 8.02.05 Write-up explaining the sequence of operation of control circuits and elevator components when an operation button is pressed.
- 8.02.06 Performance and characteristics curves for motors.
- 8.02.07 Drawings of control panels, operating panels, position indicators, in car and hoistways, push button station and call registered tell-tale lights at hoistway. These include Electrical Control Diagram and detailed circuit diagrams and physical arrangement/location diagrams of various electrical components in the Controller in the machine room, in the hoistway, in the car, at the landing etc.
- 8.02.08 Detail of pit floor, landing and landing entrance, machine room floor etc.
- 8.02.09 Other drawings and data as necessary.
- 8.02.10 Reports on shop tests and test certificates.
- 8.02.11 Material and performance test certificates.



ANNEXURE-I

DATA SPECIFICATION SHEET FOR TRACTION ELEVATORS

Sl. No.	Description	Specification
1.	Type of service	Goods -cum- passenger type, suitable for dusty environment
2.	Location and Quantity	Absorber – 2 nos Silo and Limestone slurry preparation building – 1 no.
3.	Rated capacity	1000 Kg (minimum)
4.	Rated speed	1.0 M/sec.
5.	Total travel	From Ground Floor to uppermost Floor.
6.	Number of floors to be served	To be decided by Bidder and shall be subject to Purchaser's approval.
7.	Method of control	ACVVVF control with automatic level adjustment.
8.	Position of machine room	Directly above the lift shaft.
9.	Car enclosure construction, design and finish of car	S.S. sheet fabricated smooth finish spray painted to approved shade.
10.	Size of platform and car entrance	As per IS-14665
11.	Car and landing door	Horizontal Sliding door.
12.	Cab Flooring	6mm thick Aluminium Chequered Plate
13.	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.
14.	Signal	Car position indicator in car and at all floors, telltale lights at all floors, battery operated alarm bell and emergency light with suitable battery, battery charger and controls. Remote alarm and Public address system to be provided.
15.	Method of operation of car and landing doors	Power operated with automatic door opening and closing device.



**Tender Specification
for
FGD Package**

**NLC Tamil Nadu Power Ltd.
2x500 MW Project
Tuticorin, Tamil Nadu**

16.	Lighting & fan	One cabin fan, two recessed fluorescent lamp fittings.
17.	Power Supply	
	a) Power	415 Volts, 3 phase, 50 c/s, 3 wire system
	b) Lighting & fan inside the car	240 volts, 1 phase, 50 c/s, 4 wire system
18.	Other requirements	1. Plant Telephone Communication system shall be extended up to the elevator car through EPABX in M/C room.
		2. Suitable arrangement shall be provided to intimate unit control room during emergency in the form of audio-visual alarm.
		3. Automatic rescue device.
		4. If floor-to-floor distance between 2 floors is more than 10m, dummy landing should be provided in between these 2 floors. Dummy landing should have the connectivity with the staircase.
		5. Hall Lantern & gong with scrolling indicator.
		6. Scrolling indicator in car.
		7. CFL lighting inside car
		8. Overload sensing device & warning indicator.
		9. Announcement of floor level.



ANNEXURE-III

**DEGREE OF PROTECTION
FOR
VARIOUS EQUIPMENT**

Sl. No.	Equipment	Degree of Protection
1	A.C. Motor	IP 54
2	Controller	IP 54
3	Hall Buttons Fixture	IP 54
4	Hall Position Indicator	IP 54
5	Car Operating Panel	IP 54
6	Car Position Indicator	IP 54
7	Safety Operating Switch (car)	IP 54
8	Junction/Inspection Box	IP 54
9	Lighting Fixture (for shaft & M/C room)	
	a) Tube Light	IP 21
	b) Bulk Head	IP 21
10	Brake	IP 21
11	Indoor Equipment (car light & fan junction box)	IP 54
12	Outdoor Equipment	IP 53

	TITLE: TECHNICAL SPECIFICATION FOR ELEVATOR	SPEC. NO. PE-TS- 483- 502-A001	
		VOLUME IIB	
		SECTION IA	SUB-SECTION
		REV. 00	DATE: JUNE-2021
		SHEET 1 OF 1	

SECTION C1-B GENERAL REQUIREMENT

(General technical requirement, Special conditions for erection and commission, General conditions, engineering services)



**Tender Specification
for
FGD Package**

**NLC Tamil Nadu Power Ltd.
2x500 MW Project
Tuticorin, Tamil Nadu**

VOLUME : II-A

SECTION - IV

GENERAL TECHNICAL REQUIREMENTS



Development Consultants Pvt. Ltd.

**Vol. II-A/Section-IV
General Technical Requirements**



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VOLUME : II-A

SECTION - IV

GENERAL TECHNICAL REQUIREMENTS

1.00.00 CODES AND STANDARDS

- 1.01.00 Except where otherwise specified, the design of FGD Plant package shall comply with the appropriate Indian Standard or an agreed internationally accepted Standard Specification as listed in the Annexure-I to this Section and mentioned in detailed specifications, each incorporating the latest revisions at the time of tendering. Where no internationally accepted standard is applicable, the Bidder shall give all particulars and details as necessary; to enable the Owner to identify all of the FGD Plant package in the same detail as would be possible had there been a Standard Specification.
- 1.02.00 The Bidder shall submit along with his bid the list of main codes and standards proposed to be used for the design, construction and testing of the plant. Where the Bidder proposes alternative codes or standards in place of those mentioned in this technical specification, he shall include in his tender one copy (in English) of each Standard Specification to which materials offered shall comply. In such case, the adopted alternative standard shall be equivalent or superior to the standards mentioned in the specification.
- 1.03.00 Wherever specified or required to the FGD Plant package shall conform to all applicable statutory regulations such as Indian Boiler Regulations, Indian Electricity Rules, Indian Explosives Act, Factories Act etc. Wherever required, approval for the FGD Plant package supplied under the specification from statutory authorities shall be the responsibility of the Bidder.
- 1.04.00 In the event of any conflict between the codes and standards referred above, and the requirements of this specification, the requirements, which are more stringent, shall govern. And if they are equally stringent, the Bidder shall follow the hierarchy as follows:
- i) Local regulations
 - ii) Local codes and standards
 - iii) This Technical Specifications
 - iv) Industry codes and standards
- 1.05.00 In case of any change of code, standards and regulations between the date of purchase order and the date the Bidder proceeds with manufacturing the Owner shall have the option to incorporate the changed requirements. It shall be the responsibility of the Bidder to bring such changes to the notice of the Owner and advise Owner of the resulting effect.



1.06.00 Combining or mixing of codes and standards of different institutions with respect to individual engineered components/equipments shall not be permitted without the written approval of the Owner.

2.00.00 DESIGN CRITERIA

2.01.00 Capability

The Flue Gas Desulphurisation (FGD) System shall be designed to comply with the design and guarantee point conditions mentioned below and should achieve Sulphur Dioxide (SO₂) level of not exceeding 150 mg/Nm³ and 150 mg/Nm³ respectively at 6% excess oxygen level at the stack outlet under all plant operating conditions. The SO₂ removal efficiency shall not be less than 95 % under all operating condition. These shall be modified to more conservative values if Contractor experience warrants the same. However, no credit shall be given to the Contractor for this during evaluation of the bids. Utilization of these values in no way relieves the Contractor of his responsibility to meet all the guarantee requirements.

- a) Design Point : BMCR load with worst Coal, 45 deg.C and 60% RH ambient condition
- b) Guarantee Point : TMCR load with worst Coal, 27deg.C and 60% RH ambient condition

2.02.00 Equipment Sizing Margins

The following equipment sizing design margins shall be used, as a minimum, based on normal operation of the plant (2x500MW at TMCR) with Coal having highest Sulphur content unless other margins are specified in this Design Specifications.

Equipment/ System	Mass Flow Margin	Pressure Margin
Absorber (gas and slurry)	10%	NA
Limestone Grinding system	10%	NA
Gypsum Dewatering System	10%	NA
Hydro-cyclone	10%	NA
Pumps	10% min.	15% (friction losses)
Blowers/Compressors/ Vacuum pumps	10% min.	10%
Conveyors	10% min.	NA
Crushers	20% min.	NA
Flue Gas Booster Fans	20%	44%



- 2.03.00 Off-normal operation
- 2.03.01 The FGD system shall also be capable of operating with partial bypass of flue gas.
- 2.03.02 The flue gas temperature at inlet to FGD shall be about 175⁰C. However, in case of APH failure the flue gas temperature may rise to about 375⁰C for a short duration and the FGD system shall be designed to suitably withstand such operation without any damage to the system.
- 2.03.03 The FGD plant shall be capable of following the load imposed by the boiler, including rate of load changes, minimum load and the anticipated daily and annual load schedules. Furthermore, the FGD plant shall be capable to be put in operation, while the boiler is in operation at any load, without any disturbance in the operation of the Units.
- 3.00.00 REDUNDANCY**
- 3.01.00 Redundancy of design shall be such that the performance of primary and auxiliary equipment shall be sufficient to meet the availability requirements of the plant.
- 3.02.00 Each equipment whose failure could result in damages to another equipment, or reduce the availability of the plant shall be backed up by a stand-by equipment.
- 3.03.00 Each equipment whose unavailability due to a failure could result in damages to another equipment or create a health & safety risk for the personnel shall be backed up by a stand-by equipment, one of them being fed by an emergency source in case of external black out.
- 3.04.00 Design of availability of the FGD Plant equipment & auxiliaries will be such that a failure with consequential shutdown of one Absorber & auxiliaries will in no circumstances be at the origin of a shutdown of the other Absorber & auxiliaries.
- 3.05.00 Redundancy criteria applicable for specific systems have been addressed in respective sections of the specification (Volume IIB to II-I) and tender drawings (Volume IIJ).
- 4.00.00 NAME PLATES/ RATING PLATES/ LABELS**
- 4.01.00 Instruction plates, nameplates (rating plates) or labels shall be permanently attached to each main and auxiliary item of FGD Plant equipment & auxiliaries, including instruments, in a conspicuous position. These plates shall be of stainless steel and shall be engraved with the identifying name, type, identification number and manufacturer's serial number, together with the loading conditions under which the item of plant has been designed to operate.



- 4.02.00 Items such as valves, etc. which are subject to hand operation, shall be provided with nameplates so constructed as to remain clearly legible throughout the life of the plant giving due consideration to the difficult climatic conditions to be encountered. Nameplates shall be securely mounted where they will not be obscured in service by insulation, cladding, actuators or other equipment. Bidder shall pay specific attention to the nameplates/labels during painting, so that these are not painted over. Direction of flow is also to be engraved. All actuated valves shall be provided with labels, which shall include the valve and actuator reference number.
- 4.03.00 All nameplates and labels shall be in English language. All measurements shall be in S.I. units.
- 4.04.00 All segregated phases of conductors or bus ducts, indoor or outdoor, shall be provided with coloured phase plates to clearly identify the phase of the system.
- 4.05.00 Nameplates shall be 3 mm thick laminated white, black, white traffolyte for electrical and control panels and stamped stainless steel with lettering of a minimum height 5 mm for other equipment of FGD Plant Equipment & auxiliaries. Warning labels and emergency equipments shall have red lettering in place of black. Danger labels shall have red lettering on a white background. Labels shall be of sufficient size to carry a full description of the FGD Plant item and its complete KKS identifier. The size and location of nameplates shall be subject to Approval of the Owner. Lettering in all cases shall be machine-made and made to be legible after prolonged time in the range of ambient conditions prevailing at the Site.
- 4.06.00 Universal designation system utilizing six level breakdown KKS numbering system shall be followed for equipment identification. Each piece of equipment, motor, pump, valve, instrument, switchgear cabinet, junction box, control panel, panel board and associated apparatus shall be provided with tag plates indicating tag number and description. All major equipment (including the absorber, hydrocyclone, ball mills, belt filters, auxiliary transformers, booster fans, large pumps and blowers and motors) shall be provided with the data plates, indicating the name of the vendor, type, serial number, year of fabrication, main characteristics, and all further information necessary for a complete identification of the equipment.
- 4.07.00 All piping shall be painted and/or marked in accordance with the fluid contained according to a power plant color code to be proposed by Bidder and approved by Owner.
- 4.08.00 Tags shall be fitted by stainless steel self-tapping screws, stainless steel banding such that they are not readily lost or broken during routine operations and maintenance.
- 4.09.00 Surfaces of labels for cubicles and control equipment shall have a matte or satin finish to avoid dazzle. Colors shall be permanent and free from fading. Danger labels shall have red lettering on a white background. Labels shall be



provided on front and rear access doors of all cubicles. Labels shall also be provided inside cubicles to assist the identification of apparatus and terminals.

- 4.10.00 All lifting beams, cranes, rails, jibs, hoists, slings, straps and other lifting equipment shall be properly tested and permanently marked with their lifting capacity.

5.00.00 SAFETY AND SECURITY

- 5.01.00 The design shall incorporate every reasonable precaution and provision for the safety of all personnel and for the safety and security of all persons and property. The design shall comply with all appropriate statutory regulations relating to safety. All structures and equipment shall be designed and constructed to withstand every foreseeable static and dynamic loading condition, including loading under earthquake conditions, with an adequate margin of safety.

- 5.02.00 Ready and safe access with clear head room shall be provided to all parts of the FGD Plant Equipment & auxiliaries for operation, inspection, cleaning and maintenance. All platforms shall be fenced and all stairways shall be provided with handrails.

- 5.03.00 Escape routes and clear ways shall be provided to allow speedy evacuation of the personals in the event of fire or explosion, and the plant layout shall allow for ease of access to all parts of the Works by rescue and fire fighting teams. The FGD Plant Equipment & auxiliaries layout shall be designed to localise and minimise the effects of any fire or explosion. The recommendations of NFPA, OSHA, etc. as necessary shall be followed in all respects.

- 5.04.00 The use of corrosive, explosive, toxic or otherwise hazardous materials shall be kept to a minimum during construction and the design of the plant shall minimise the requirement for such materials during operation and maintenance. Where such materials must be used, all necessary precautions shall be taken in the design, manufacture and layout of equipment to minimise the resulting hazard, and all equipment necessary for the protection and first-aid treatment of personnel in the event of accidents shall be provided. Particular attention is drawn to avoid the use of prohibited materials in any form as mentioned elsewhere in this specification.

6.00.00 GUARDS

- 6.01.00 Effective guards and fences must be provided to prevent injury to operators through accident or malpractice.

- 6.02.00 Mesh guards which allow visual inspection of equipment with the guard in place are generally preferable. The guards shall be constructed of mesh attached to a rigid framework of mild steel rod, tube, or angle and the whole galvanised to prevent loss of strength by rusting or corrosion. The guards shall be designed to facilitate removal and replacement during maintenance.



- 6.03.00 All drive belts, couplings, gears, sharp metallic edges and chains must be safely guarded. Any lubricating nipple requiring attention during normal running must be positioned where they can be reached without moving the guards.
- 6.04.00 Guards for couplings and rotating shafts shall be in accordance with latest revisions of BS PD 5304-2005/ BS EN 953-1998 or similar approved standard. All rotating shafts and parts of shafts must be covered.
- 6.05.00 Suitable fencing shall be provided to enclose all openings or doorways used for the hoisting and lowering of machinery etc. This fencing must be securely fixed but quickly detachable when required. A secure hand hold must be provided on each side of the opening or doorway.

7.00.00 LOCATION AND LAYOUT REQUIREMENTS

The majority of FGD Plant Equipment & auxiliaries (excluding Absorber and DG sets) shall all be of indoor installation. A broad list of buildings housing such equipment is given elsewhere in this specification. Layout should facilitate access for operation-maintenance and inspection of any one or more equipment/components at a time without disturbing the operation or installation of rest of the FGD Plant Equipment & auxiliaries. Further, Bidder should comply with the criteria given under the various equipment and system specifications as well as those stipulated in Annexure-II attached to this section.

Enclosed General Layout drawings show the location of major facilities. The Bidder shall try to retain these locations as far as practicable. The layout of equipment within the FGD area as shown in the tender drawings is indicative. The Bidder may, subject to Owner's approval alter the same to suit the space requirement of the equipment offered.

Bidder may give alternate layout of their own with different orientation and relocation but all the equipments and facilities as in tender drawing/specification should be covered and the overall BTG area layout as shown in tender drawing is to be maintained.

While preparing the detailed layout and deciding upon the transportation and construction/ erection strategy and functional requirements, the following aspects shall be ensured:

- a) Face of the buildings and facilities shall be located in such a way so as to have an offset of minimum 20 m with respect to center line of double lane road and 15 meter with respect to center line of single lane road.
- b) The spacing between various buildings and facilities shall be suitably decided so as to avoid interference between the foundations.



- c) The area for construction/erection facilities like lay-down, pre-assembly, offices and stores will be accommodated within the areas available in General Layout Plan.
- d) All statutory requirements including safe distances between various facilities as per applicable rules/acts/laws including local by-laws will be complied with.
- e) Minimum clearances/ dimensions
 - i) Around the equipment : 1200mm
 - ii) Width of all staircases : 1200mm (Minimum)
 - iii) Clear Head room within : 2.5m (Minimum)
Plant Buildings for pipes, ducts,
Structures & cable trays etc.
 - iv) Clear head room in outdoor Power : 8m (BOS)
Block area for cable trays & piping
 - v) Clear head room in other outdoor : 3m (BOS)
Areas for cable trays & piping
 - vi) Clear head room for conveyors : 8m (BOS)
- f) All piping shall be routed at a clear height of 2500mm (min.) from the nearest access level to clear man movement.
- g) A walkway of 600mm (minimum width) with pipe hand rails & toe guards shall be provided all along length of the trestle for maintenance of cables & pipes. Ladders for approach to these platforms shall be provided near roads, passage ways and turning points.
- h) Head room for man movement shall be minimum 2.5m at ground floor in boiler area and 2.1m over all platforms.
- i) Height of trestles at approach roads to various buildings/facilities shall be 8M. In case building are located in off-site area and are adjacent to each other, then as a good engineering practice, the height of trestle shall be maintained all over as 8.0M.
- j) Each equipment room shall be provided with alternate exits in case of fire/accidents as per requirements of factory act and TAC.
- k) All cranes shall be provided with approach rung ladders at least at two places. Where ever cranes can't be maintained in situ on the carriage, facility to draw them to maintenance platforms as well as provision of suitable platforms with access facility shall be provided.
- l) Each building shall have an identified vacant space for equipment unloading and maintenance and preferably a separate bay altogether in buildings housing heavy equipment. Provision for handling equipment by monorail hoist and/or overhead crane shall be made as

specified.

- m) The plinth level with respect to the existing grade level shall be as indicated elsewhere in this specification.
- n) The minimum clear height available between two consecutive floor slabs shall not be less than five (5) meters. Adequate provision for natural ventilation and illumination shall be made as per good engineering practices.
- o) There shall be at least two (2) nos. main access doors, one on either side of each building, of which one shall be minimum 3 meters wide with rolling shutters for equipment entry. For multistoried buildings, at least two (2) nos. regular staircases diagonally opposite to each other shall be provided connecting all the floors and roof. These minimum requirements shall be augmented as required depending on the floor area, statutory requirements and TAC recommendations.
- p) All buildings shall have provision for toilet and associated effluent discharge system together with facility for drinking water. The criteria for ventilation, fire protection and illumination of building spaces specified elsewhere in this specification shall be complied with.
- q) Top cover over underground pipes/cables shall be minimum one (1) meter.
- r) Cubicle for operating personnel shall be located at safe place near the equipment.
- s) Cable racks / pipe racks shall have hand railings in walkways on both sides at appropriate heights.
- t) All the buildings and facilities will be approachable by the fire tenders.
- u) Utility pipes except fire water pipes will be routed over ground on trestles. No trenches for pipes will be envisaged as far as possible. In the Power block area, Fire water pipes will be routed in RCC trenches.
- v) Wherever steam pipes or pipes conveying hazardous fluids are running over the trestle, fire water pipes shall not be routed on the same trestle.

8.00.00 OPERATION & MAINTENANCE CONSIDERATIONS

- 8.01.00 Space for ease of operation and maintenance including equipment removal, tube bundle/cartridge/rotor pulling etc. shall be provided. All valves, gates, dampers and other devices shall be located and oriented in such a way that



they are accessible from operating floor levels. Where this cannot be adhered to, platforms and walkways with hand railing and access ladders/structural steel staircase shall be provided as per layout availability to facilitate operation and maintenance.

- 8.02.00 Lifting devices i.e. hoists, chain pulleys, etc. shall be provided for handling of any equipment and/or part having weight in excess of 250 Kg during erection and maintenance activities. Suitable monorail beams, hooks etc. for this purpose shall be provided in the buildings. The monorail shall be extended to outside the buildings by minimum 2m. The monorail beam shall extend through suitable opening in the building fitted with an approved double flap steel door [with chain or better opening and closing mechanism], removable handrails, platforms etc to enable removal of equipment to ground level or vice-versa.

Lifting tackles, slings, etc. to be connected to hook of the hoist/crane shall also be provided by the Bidder for lifting the various equipment and accessories covered under this specification.

- 8.03.00 All similar parts of the equipment shall be made to gauge and shall be interchangeable with and shall be made of same material and workmanship as the corresponding parts of the equipment. Wherever feasible common components shall be employed in different pieces of equipment in order to optimize the spares inventory and utilization.

- 8.04.00 Suitable machinery-hatch, removable steel gratings / covers / hand-railing etc. shall be provided in Buildings, etc. as found necessary during detailed engineering.

9.00.00 MATERIALS

- 9.01.00 In selecting materials of construction of equipment, the Bidder shall pay particular attention to the atmospheric conditions existing at the Site and the nature of material/fluid handled. Wherever deviations are taken in respect of materials specified, the reasons shall be spelt out clearly in the proposal.

All materials shall be new and shall be of the quality most suited to the proposed application.

- 9.02.00 As far as possible, materials shall be in accordance with Indian or international standard specifications and shall be used in accordance with Indian or international codes of practice. Where such standards or codes of practice are not available sufficient information shall be provided to allow the Owner/ Consultant to assess the suitability of the material for the particular application.

Materials used for various components shall be those which have already proven operating experience in similar type of applications.

- 9.03.00 All parts which could deteriorate or corrode under the influence of the





atmospheric, meteorological or soil conditions at the Site, or under the influence of the working conditions shall be suitably and effectively protected so that such deterioration or corrosion is a minimum over the life of the plant.

9.04.00 Prohibited Materials

The use of the following materials is prohibited:

- a) High alumina cement in structural elements
- b) Wood wool slabs in permanent framework to concrete
- c) Calcium chloride in mixtures for use in concrete works
- d) Naturally occurring aggregate for use in reinforced concrete that does not comply with the applicable codes and standards
- e) Cast iron for any oil service
- f) Carcinogenic material and suspected carcinogenic materials by World Health Organization.
- g) Asbestos or any other fibrous form of hydrated magnesium silicate
- h) Any other material generally known to be deleterious if used or incorporated in such project like the facility.

10.00.00 LUBRICATION

10.01.00 Suitable efficient lubrication system shall be provided where necessary to ensure smooth operation free from undue wear.

10.02.00 Gear boxes and oil baths shall be provided with filling and drain plugs, both of adequate size. An approved means of oil indication including level switches and temperature indication shall be provided.

10.03.00 All high speed gears shall be oil bath lubricated. Low speed gears shall be lubricated by means of soft grease. Removable and accessible drip pans shall be provided to collect lubricant which may drop from operating parts.

10.04.00 All lubrication points shall be conveniently situated for maintenance purposes. It must be possible to carry out lubrication from a gangway or landing and without the removal of guarding or having to insert the hand into it. Where accessibility to a bearing for oiling purposes would be difficult a method of remote lubrication shall be fitted.

10.05.00 The Bidder shall supply grease gun equipment suitable to service each type of nipple fitted

11.00.00 LUBRICANTS, SERVO FLUIDS AND CHEMICALS





11.01.00 The Bidder shall provide a detailed and comprehensive specification for all lubricating oils, greases, control fluids and essential chemicals required for the entire plant. A sufficient supply of these shall be provided by the Bidder for initial commissioning, first fill and one year's topping.

11.02.00 The Bidder shall supply a detailed schedule giving the lubricant testing, cleaning and replacement procedures. All equipment and facilities necessary for the testing, cleaning and changing of lubricants, control fluids and chemicals shall be provided. The Bidder shall endeavour to reduce the varieties and grades of required lubricants and control fluids to a minimum, match them to those already in use in the generating station in order to simplify procurement and minimise storage requirements. All lubricants and control fluids shall be of internationally recognised standards and shall be easily obtainable from a large number of Indian suppliers. Bidder shall also indicate the equivalent Indian Standard for the above for easy procurement in future.

11.03.00 No lubricant or control fluid shall have toxic or other harmful effects on personnel or on the environment. Safety data sheets for all lubricants, oils, chemicals etc .specifying composition, application, chemical properties and preventive or accidental care that must be taken before and after use shall be papered by the Bidder and submitted to Owner for approval

12.00.00 PLANT LIFE AND MODE OF OPERATION

The complete FGD Plant Equipment & auxiliaries including all the equipment and systems individually and collectively shall be designed for continuous operation for an economic service life of thirty (30) years under the prevailing site conditions and for the type of duty intended.

The critical components of the FGD Plant, the life of which is limited by time and temperature dependent mechanisms such as corrosion, thermal stress, creep and low cycle fatigue, etc. are to be designed considering expected duty conditions and cyclic load variations.

The allowable stresses shall be reduced so that life expectancy to minimum 2,00,000 hours of operation can be achieved.

The plant would be designed for base load operation as well as cyclic load variation. The load variation is expected to be as per schedule depending on power demand. The FGD Plant Equipment & auxiliaries shall be suitable for shutdown on every weekend, if required. Moreover, the FGD Plant Equipment & auxiliaries should be capable to operate frequently down to 40% load.

13.00.00 PACKAGING & MARKING

All the equipment shall be suitably protected, coated, covered or boxed and crated to prevent damage or deterioration during transit, handling and storage at site till the time of erection. While packing all the materials, the limitations



from the point of view of availability of railway wagon sizes in India should be taken account of. The details of various wagons normally available with Indian Railways for transportation of heavy equipment shall be considered by the Bidder. The Bidder shall be responsible for all loss or damage during transportation, handling and storage due to improper packing.

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

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

The above indicates the dimensions which can be normally transported on the wagons without infringement of the "moving gauge". However, Bidder shall conduct his own route survey and transportation logistics for transportation of the equipments to project site by road/rail/sea and indicate the same in his proposal. In case of sea transportation, Bidder to consider unloading of equipment at Tuticorin port. Transportation to project site from the nearest railway station or sea port shall be considered by road only.

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

14.00.00 PROTECTION

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

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

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



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

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

15.00.00 PAINTING

15.01.00 Please also refer to Section V of Volume-IIA, for details of painting.

15.02.00 For detail painting on building & structural steel elements refer Section-IIG/1 & IIG/2 of this specification.

16.00.00 COLOUR CO-ORDINATION & FINISH

16.01.00 Exterior surfaces throughout the FGD Plant area shall be finished in colours and textures which will blend harmoniously together and with the surrounding landscape.

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

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

16.04.00 Final colours and finishes shall be to the Approval of the Owner.

17.00.00 ENVIRONMENT PROTECTION AND NOISE LEVEL REQUIREMENT

17.01.00 Environment Protection

17.01.01 The FGD Plant Equipment & auxiliaries area shall be designed for installation and operation in harmony with the surrounding environment and all measures of pollution control shall be ensured by the Bidder to ensure zero discharge from liquid effluents and other effluents within the limits specified in Environment (Protection) Rules 1986 as amended till date.

In case 'The Ministry of Environment, Forest and Climate Change (MOEFCC)' stipulate any other conditions not specified hereunder while clearing the project, the same shall be complied by the Bidder.

17.01.02 Any specific requirement of State Pollution Authorities over and above the above stipulation shall also be complied with by the bidder.

17.02.00 Noise Level Requirement





The plant will be designed, constructed and provided with suitable acoustic measures to ensure the noise level criteria as per the following stipulations.

- a) Maximum noise level shall not exceed 85 dB (A) when measured at 1 meter away from the noise emission source, at a height of 1.5 meters above finished floor level.
- b) Maximum noise level from its source within the premises shall not exceed 70 dB (A) as per Environment (Protection) Rules 1986, Schedule-III, 'Ambient Air Quality Standards' in respect of noise.
- c) Maximum noise level shall not exceed 105 dB(A) for safety valves and associated vent pipes and 90 dB(A) for regulating drain valves. For operating control valves, the noise level shall be within the limit of 85 dBA. For all valves & orifices, the measurement shall be made one (1) metre down stream of the devices and one (1) metre from the surface of the pipe for any combination of pressure drop and flow.
- d) Any statutory changes in stipulations regarding noise limitation that may occur in future according to State Pollution Control Board or Central pollution Control Board or The Ministry of Environment, Forest and Climate Change regulation during tenure of the contract, the Bidder shall comply with the requirement.

17.03.00 Environmental design specifications

17.03.01 Construction materials and system contents prohibited

- a) No equipment or construction materials brought onto or incorporated into the Facility shall contain asbestos at any content level. Only suitable substitutes for asbestos are permitted to be used.
- b) Chemicals that are not accompanied by a material safety data sheet shall not be permitted to be used in any Work Area or incorporated into the Work.
- c) No ozone depleting substances (as defined by the 1987 Montreal Protocol) at any level are allowed to be used in systems provided by Bidder. Only suitable substitutes are permitted.

17.03.02 Ambient noise mitigation

The Facility noise levels shall not exceed the more stringent of Applicable Law or the Noise Compliance Guarantee.

The Bidder shall abate ambient noise to public receptors in accordance with the more stringent of Applicable Law or the Noise Compliance Guarantee. Mitigation measures that shall be considered during project design include, but are not limited to, the following:



- a) Selecting equipment with lower sound power levels;
- b) Installing silencers for fans, blowers, compressors;
- c) Installing suitable mufflers on engine exhausts and compressor components;
- d) Installing acoustic enclosures for equipment causing radiating noise;
- e) Applying sound insulation to improve the acoustic performance of buildings;

18.00.00 INSPECTION AND TESTING

18.01.00 Inspection and Tests during Manufacture

18.01.01 The method and techniques to be used by the Bidder for the control of quality during manufacture of all FGD Plant Equipment & auxiliaries shall be as stipulated elsewhere in the specification.

18.01.02 The Owner's general requirements with respect to quality control and the required shop tests are set out elsewhere in this specification.

18.01.03 Before any item of FGD Plant Equipment & auxiliaries leaves its place of manufacture, the Owner shall be given the option of witnessing inspections and tests for compliance with the specification and related standards.

18.01.04 Advance notice shall be given to the Owner as agreed in the Contract, prior to the stage of manufacture being reached, and the piece of plant must be held at this stage until the Owner has inspected the piece, or has advised in writing that inspection is waived. If having consulted the Owner and given reasonable notice in writing of the date on which the piece of plant will be available for inspection, the Owner does not attend the Bidder may proceed with manufacture having forwarded to the Owner duly certified copies of his own inspection and test results.

18.01.05 Under no circumstances any repair or welding of castings be carried out without the consent of the Owner. Proof of the effectiveness of each repair by radiographic and/or other non-destructive testing technique, shall be provided to the Owner.

18.01.06 All the individual and assembled rotating parts shall be statically and dynamically balanced in the works.

Where accurate alignment is necessary for component parts of machinery normally assembled on site, the Bidder shall allow for trial assembly prior to despatch from place of manufacture.

18.01.07 All materials used for the manufacture of equipment covered under this





specification shall be of tested quality. Relevant test certificates shall be made available to the Owner. The certificates shall include tests for mechanical properties and chemical analysis of representative material.

- 18.01.08 All pressure parts shall be subjected to hydraulic testing as per the requirements of IBR. Other parts shall be tested for one and half times the maximum operating pressure, for a period not less than thirty (30) minutes.
- 18.01.09 All necessary non-destructive examinations shall be performed to meet the code requirements of ASME or IBR as applicable.
- 18.01.10 All welding procedures adopted for performing welding work shall be qualified in accordance with the requirements of Section-IX of ASME code or IBR as applicable. All welded joints for pressure parts shall be tested by liquid penetrant examination according to the method outlined in ASME Boiler and Pressure Vessel code. Radiography, magnetic particle examination and ultrasonic testing shall be employed wherever necessary/ recommended by the applicable code. At least 10% of all major butt welding joints shall be radiographed. Statutory payments in respect of IBR approvals including inspection shall be made by Bidder. Bidder's scope and responsibility shall also include preparation and submission of all necessary documents in the specific formats and manner stipulated by the statutory bodies, coordination and follow up for above approvals.
- 18.02.00 Inspection and Testing at Site
- 18.02.01 The full requirements for testing the system shall be agreed between the Owner and the Bidder prior to Award of Contract. The completely erected System shall be tested under the supervision of the Technical Advisor of the Bidder on site under normal operating conditions. The Bidder shall also ensure the correct performance of the System under abnormal conditions, i.e. the correct working of the various emergency and safety devices, interlocks, etc.
- 18.02.02 The Bidder shall provide complete details of his standard procedure for testing the quality of erection and the performance of erected FGD Plant Equipment & auxiliaries. These tests shall include site pressure test on all erected pipe work to demonstrate the quality of the pipe work and the adequacy of joints made at site.
- 18.03.00 For details of specific tests required on individual equipment refer to respective Technical volumes of this specification.

19.00.00 TRAINING OF OWNER'S PERSONNEL

The Bidder shall extend all possible assistance and co-operation to the Owner regarding the transfer of technology and developing expertise in the area of operation and maintenance of the FGD Plant Equipment & auxiliaries.





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

- 19.01.00 Training at Bidder's Premises
- 19.01.01 The Bidder shall conduct training of engineers and plant operators of the Owner on engineering, operation and maintenance of the Plant at the Bidder's or Associates or Sub-Bidder's premises where adequate training facilities are available during the design and manufacturing stage.
- 19.01.02 The training may also be arranged by the Bidder in any Plant where the equipment manufactured by the Bidder or his Associates is under installation, operation or testing to enable the trainees to become familiar with the equipment being furnished by the Bidder. All expenses inherently related to the training shall be borne by the Bidder and shall include but not be limited to travel expenses (international and inland fares), lodging and per diem charges as well as medical insurance, instructors fee, programme and miscellaneous cost to be incurred during the training.
- 19.01.03 The training programme shall be adequate for the trainees to acquire the necessary expertise and competence in the operation and maintenance of the FGD Plant Equipment & auxiliaries. The Bidder shall be responsible for the development of the Training Module and Programme Schedule which shall be submitted to the Owner for approval.
- 19.01.04 The components of the training modules shall include but not be limited to the training procedures/methodology, instructional materials such as audio visual materials, CDs and slides and manuals for each trainee. Three (3) sets of the materials included in the training modules shall be handed over to the Owner upon completion of the training. An evaluation shall be jointly undertaken by the Bidder and the Purchaser's representative on the adequacy, appropriateness and relevance of the training and the programme effectiveness after the training. The training material shall be in English language only.
- 19.01.05 The content of the training programme shall include but not be limited to:
1. Limestone based Flue Gas Desulphurisation Plant for Coal fired thermal plant principles in management and practice for operators, technicians and maintenance personnel.
 2. Plant operation and systems training for operators including simulator training as applicable.
 3. Maintenance training programme covering electrical, mechanical and instrumentation and control.
- 19.01.06 The timing of the training should be such that the participants will be conversant with sufficient know-how to participate in the pre-commissioning and commissioning tests of the FGD Plant Equipment & auxiliaries. Said training programme shall be submitted to the Owner for approval.



The Bidder shall provide qualified English speaking instructors and training coordinator(s) during the tenure of the training programme.

19.02.00 Operation and Maintenance Training at Site

19.02.01 The Bidder shall provide a comprehensive training programme related to design application, plant management, operation and maintenance, including trouble shooting, of the Bidder's supplied system and equipment at the Site starting from Start of Commissioning and thereafter up to the Final Acceptance of the first FGD Unit.

19.02.02 The following instructors shall be at the Site continuously during the training:

- a) One (1) for Flue Gas Desulphurisation Plant
- b) One (1) for Limestone Handling system (part time)
- b) One (1) for Electrical Works
- c) One (1) for Instrumentation and Control

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

Discipline	No. of Man-months
Operation	12
Mechanical Maintenance	4
Electrical Maintenance	4
Control & Instrumentation	6
Maintenance Planning	4

	30

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

19.03.01 On-the-Job Training

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

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

ANNEXURE-I

LIST OF STANDARDS FOR REFERENCE

- a) International Organisation for Standardisation (ISO).
- b) International Electro-technical Commission (IEC).
- c) American Society of Mechanical Engineers (ASME).
- d) American National Standards Institute (ANSI).
- e) American Society for Testing and Materials (ASTM).
- f) American Institute of Steel Construction (AISC).
- g) American Welding Society (AWS).
- h) Architecture Institute of Japan (AIJ).
- i) National Fire Protection Association (NFPA).
- j) National Electrical Manufacturer's Association (NEMA).
- k) Japanese Electro-technical Committee (JEC).
- l) Institute of Electrical and Electronics Engineers (IEEE).
- m) Federal Occupational Safety and Health Regulations (OSHA).
- n) Instrument Society of America (ISA).
- o) National Electric Code (NEC).
- p) Heat Exchanger Institute (HEI).
- q) Tubular Exchanger Manufacturer's Association (TEMA).
- r) Hydraulic Institute (HIS).
- s) International Electro-Technical Commission Publications.
- t) Performance Test Codes (PTC).
- u) Applicable German Standards (DIN).
- v) Applicable British Standards (BS).
- w) Applicable Japanese Standards (JIS).



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- x) Electric Power Research Institute (EPRI).
- y) Standards of Manufacturer's Standardization Society (MSS).
- z) Bureau of Indian Standards Institution (BIS).
- aa) Indian Electricity Rules.
- bb) Indian Boiler Regulations (IBR).
- cc) Indian Explosives Act.
- dd) Indian Factories Act.
- ee) Tariff Advisory Committee (TAC) rules.
- ff) Pollution Control regulations of Ministry of Environment, Forest and Climate Change, Govt. of India .
- gg) Central Board of Irrigation and Power (CBIP) Publications.
- hh) National Building Code (NBC).
- ii) Indian Road Congress (IRC).



ANNEXURE-II

CRITERIA FOR LAYOUT

PLOT PLAN LAYOUT REQUIREMENTS

The guidelines will be applied in general, unless otherwise stated in other technical Volumes. In addition to these guidelines, Bidder shall refer the attached Area Plans, drawing no. 17A14-DWG-M-0002A, 0002B and 0002C for tentative arrangement of the various facilities under this package.

ITEM	SPECIFICATION REQUIREMENT
A. Site conditions to be considered	
1. Prevalent wind direction(s) during dry seasons (for deciding the location of limestone stock pile and unloading areas, minimising the pollution effect due to dust)	West to East. Also see wind-rose in plot plan.
2. Location of:	
a) Plant drainage outfall point(s).	Towards North East
b) Railway entries & exits.	Not Applicable
B. Layout Requirements	
1. Maximum permissible slope in	
a) Rail track	Not applicable
b) Road	1 in 30
c) Sides of unpaved embankment	1 in 2
2. Required road width	
a) Main Plant access road	10.0 Metres with 1.5 m wide shoulders on either side.
b) Primary roads without access for 500 T crane	7.5 Metres with 1.5 m wide shoulders on either side
c) Access ways	4.0 Metres with 1.2m shoulders on either side.





**Tender Specification
for
FGD Package**

**NLC Tamil Nadu Power Ltd.
2x500 MW Project
Tuticorin, Tamil Nadu**

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- | | | |
|----|---|--|
| d) | Road to the absorber area : | Yes. |
| 3. | Required minimum horizontal distance between the nearest points of | |
| a) | Plant boundary and the boundary of residential area | (Local municipality/factory rule) |
| b) | Electrical transformer and any other | As per the Tariff Advisory building/facility Committee Rules. |
| c) | Fire water supply installation and any building/facility subject to fire risk. | As per the Tariff Advisory Committee Rules. |
| d) | Inflammable liquid (fuel oil, etc.) storage & handling installation and their fencing and other buildings/facilities. | Rules of the Indian Explosive (Indian Explosives Act) and Indian Petroleum Code. |
| 4. | Required minimum vertical clearance | |
| a) | Under pipes/cable racks at road crossings | 8.0 Metres. |
| b) | Soil coverage over underground pipes for CW/ACW piping | 1.0 Metre (minimum)
1.5M |
| c) | Outdoor Pipe/Cable trench (if required) | 150 mm above FGL |
| d) | Minimum height of equipment (switchgear, cabinet etc.) above floor for HT cable entry | 500 mm |
| e) | Minimum height of equipment (switchgear, cabinet etc.) above floor for LT cable entry | 300 mm |
| 5. | Railway Wagon clearance | Not applicable |
| 6. | Minimum Clearance between any road edge and building/structure/ any fixed installation. | 3 Metres. |

ITEM

SPECIFICATION REQUIREMENT





**Tender Specification
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7. Required level, above the local developed grade level, of
- a) top of all roads 150 mm.
 - b) all outdoor paved areas 150 mm.
 - c) Temporary storage areas, workshops, offices, residence etc. required at the time of erection work. Yes.





ANNEXURE-II

BUILDING/ EQUIPMENT LAYOUT REQUIREMENTS

1.0

BROAD GUIDELINES FOR LAYOUT PLAN

General layout plan indicating the available spaces for the exiting project is as shown in the tender drawing placed in Volume-J of the tender specification. It shall form the basis for further elaboration by the Bidder for the plant facilities, which are in his scope.

While preparing the detailed layout, planning the facilities in the Bidder's scope and deciding upon the transportation and construction/ erection strategy and functional requirements, the Bidder shall ensure the following aspects in addition to those mentioned earlier in this section:

- i) The entire construction activity shall take into account the commissioning of the units.
- ii) The finished floor level at ground level of the TG building shall be designated at EL. 0.0M and shall be 500mm above the finished ground level (FGL) of that area.

The finished floor level for various areas / facilities shall be as follows:-

FFL of Main Plant Building	-El.(±) 0.00M
----------------------------	---------------

Top of paving for Transformer Yard	El. (-) 0.10M
------------------------------------	---------------

Top of paving for Boiler/ ESP/ FGD/ Chimney area	El. (-) 0.20M
--	---------------

FFL of buildings	500 mm above FGL of respective area
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- iii) Hazardous chemical storage complex shall be designed in accordance with statutory agencies guideline
- iv) DG Set Exhaust Pipes (Height & Orientation) shall be designed as per Environmental Regulations.

1.1

Common Control Room

Common Control room shall be provided by the Bidder common for both units.

Common Control Rooms / Control Equipment Rooms for each unit/ RIO rooms for each unit shall be provided with air-conditioning by the Bidder.





ANNEXURE-II

2.0 PLANT LAYOUT REQUIREMENT

2.1 The location of main plant block is indicated in the Plot plan drawing enclosed in Volume-J of the tender specification, however Bidder has to develop layout keeping the location/orientation of the existing main power block same as indicated in bid document. Bidder shall develop his own layout for the equipment offered and the same to be clearly brought out in the bid under the scope of Bidder. However, while developing the layout the Bidder must give due considerations for the following requirements:

- i. The FGD control, control equipment's room and the Electrical room shall be common for both units and be located near the Absorber tower.
- ii. The Electrical and control room shall be single-level and shall essentially house but not be limited to the followings:
 1. Electrical Panels
 2. Control panels, operator's consoles etc. for all modules. The control room shall not have any internal column inside the room. Large span roof beams for control room to be adopted and designed.
 3. Computer room with engineering work stations & associated workstations.
 4. A small conference room.
 5. FGD Plant In charge room.
 6. UPS & batteries.
 7. Cabling and all other facilities associated with the above system.

2.2 The Control Room and control equipment rooms, computer room with programmer station, UPS room, shall be provided with Air conditioning. Washroom/Toilet facilities for ladies & gents separately shall be provided. Further, no vertical bracings, pipes, cable shafts etc. shall be routed through control room or control equipment room area. Design of control room interior including lighting, roof, flooring and decoration will also be provided by the Bidder

2.3 The following clearances to be maintained for C&I DCS/ DDCMIS/ PLC cabinets:

i)	Clearance from back	1200mm
ii)	Clearance from front wall	1200mm
iii)	Clearance from side	1000mm

The above clearances are minimum requirement and may increase with increase in door swing of the cabinets.

2.4 Layout of facilities and equipment shall allow removal of transformers without disturbing equipment, piping, cabling, ducts routed in the area.



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Adequate space and provision for handling/removal of booster fans, pumps, motors, heaters, heat-exchanger, compressors, Switchgear Panels, Transformers during maintenance shall be provided.

- 2.5 The Limestone slurry preparation building, Gypsum dewatering building, Gypsum storage building shall be of multi-storied type designed to utilize gravity flow wherever possible.
- 2.6 Equipment requiring monitoring during regular operation shall be approachable from the ground floor through staircase. Staircase with minimum width of 1200 mm shall be provided for approach to elevated structures at 5m height from the nearest platform. Below this height a vertical ladder with minimum clear width of 600 mm may also be acceptable.
- 2.7 Platform with a minimum clear width of 1000 mm shall be provided all around the lowest absorber spray levels and mist eliminators. Similar platforms shall be provided at subsequent elevations if they are more than 3000 mm apart from each other. An adequately sized manhole with platform (min. 2 sq. m) shall be provided above each spray level. Ladders/staircase shall be provided for the access to the platform.
- 2.8 The absorber slurry recirculation pumps, gypsum bleed pumps and limestone feed pumps shall be mounted on the ground level. Suitable approach and platforms shall be provided for all the valves required during regular operation.
- 2.9 A 1500 mm space shall be provided around all pumps, except absorber recirculation pumps, where a 2000 mm space shall be provided.
- 2.10 Platform with a minimum width of 1500 mm shall be provided all around the pulverizers and feeders. Approach along with suitable platforms shall be provided for ball loading hoppers.
- 2.11 A 1000 mm wide platform with suitable approach shall be provided around each hydro-cyclone.
- 2.12 A 2000 mm wide floor/platform shall be provided all around each belt filter.
- 2.13 Independent floor drains with separate down comers shall be provided where fire protection system are provided.
- 2.14 All heavy equipment located in the buildings shall be accessible by the EOT cranes or hoists for their handling during erection and maintenance. Wherever special handling procedures are to be followed, the same shall be described in and attached with the bid.



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- 2.15 Monorail for Magnetic Separators (ILMS & SEM) shall extend outside the building by minimum 2.0m. Tramp iron chute (up to ground level) shall be provided at floor on which above magnetic separators are installed.
- 2.16 The safety guard for the Take-up Carriage / Counterweight box of the Gravity Take-up unit shall be provided with a removable panel for entry of operating personnel for greasing / maintenance of pulleys etc.
- 2.17 Each Floor cleaning chute of Limestone Handling Plant buildings shall terminate at about 1.2 m above ground level. Floor cleaning chute (debris chute) shall be connected to tramp metal chute wherever feasible.
- 2.18 A suitable rail track and associated facilities like, mooring posts etc., shall be provided to facilitate the movement of transformers to the access road/ maintenance area.
- 2.19 Adequate distance shall be maintained between the transformers. As basic guidelines following norms will be adhered to:

- i) Auxiliary transformers shall be separated from the adjacent building/structures and from each other by a minimum distance as defined below or by a fire wall of two hours of fire resisting of height at least 600 mm above bushing / pressure relief vent whichever is higher.

Oil capacity of individual transformer separating distance (in liters)	Clear (in Meters)
5,000 to 10,000	8.0
Above 10,000 to 20,000	10.0
Above 20,000 to 30,000	12.5
Over 30,000 or more	15.0

- ii) In case of auxiliary transformers having an aggregate oil capacity in excess of 2300 liters or more but individual oil capacity of less than 5000 liters, the separating distance between transformers and surrounding building shall be at least 6M unless they are separated by fire separating walls or are protected by high velocity spray system.
- iii) Waste water & oily waste from 220KV / 11 KV Transformer and auxiliary transformer yard areas shall be collected in common oil pits. These common oil pits shall be connected to ETP. Two nos. (1W+1S) vertical screw pumps shall be installed in each common oil pit. These pumps shall transfer oily waste to common oily pit located in ETP area for further treatment through suitable piping system.
- iv) HVWS protection shall be provided as per CEA guidelines if the oil capacity more than 2000 liters or capacity of transformer 10MVA or more.

ANNEXURE-II**3.0 Layout requirements for Electrical MCC/switchgear rooms**

For finalizing room size, following points shall be considered: -

- i) Minimum clearance between HV/MV switchgear and LV switchgear shall be maintained as 2500mm.
- ii) Minimum clearance between any obstruction like column, wall and vertical raceway, etc. and rear of LV switchboard shall be maintained as 1000mm respectively.
- iii) Minimum clearance between two LV switchgear facing each other shall be maintained as 2000mm.
- iv) Minimum rear to rear clearance of LV switchgear shall be maintained as 1000mm respectively.
- v) Minimum rear to front clearance for PCC to PCC shall be maintained as 2000mm.
- vi) Clearance between the bottom of ventilation duct and top of electrical panel shall be as per statutory requirement
- vii) Minimum clearance between two non-drawout panels facing each other shall be maintained as 1500mm.
- viii) Minimum clearance between wall and end of switchgear shall be maintained as 1000mm.
- ix) Minimum clearance between the sides of two switchgears shall be 1000mm.
- x) Minimum clearance between LV switchgear to dry type transformer shall be kept as 2000mm.
- xi) Access to rooms, doors, etc. to be provided in various floors shall consider movement of the panels during erection and later during maintenance.
- xii) Switchgear room/MCC room and cable vault shall be pressurized above the atmospheric pressure to prevent ingress of dust.
- xiii) Control room, switchgear room shall be provided with separate entry and exit door. Rating of fire proof door to be provided in cable vault shall be 2 hours.
- xiv) Walkways shall be provided for accessing the cable laid on cable trays in all pipe racks & cable racks.
- xv) Cable vault floors shall have all openings properly ridged to prevent water drainage into the room below. In addition proper facilities shall be provided at cable vault floor to drain the water in case of operation of sprinkler system.
- xvi) Air-conditioned rooms shall be provided with double door.
- xvii) During design stage adequate space shall be provided for expansion of board on either side to accommodate addition of panel to take care of unforeseen factors.
- xviii) All busducts shall enter the 415V PMCC from top.
- xix) Minimum clearance between two HV / MV switchgear facing each other shall be maintained as 3500mm.

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- xx) Bottom to roof beam in HT/ LT switchgear room from finished floor level shall be 4.5m when the room has busducts and shall be 4.0m without busduct.
- xxi) Cable spreader floors shall have all openings properly ridged to prevent water drainage into the room below. In addition proper facilities shall be provided at cable spreader floor to drain the water in case of operation of sprinkler system.
- xxii) Wherever cables are taken out through wall openings, such openings shall be properly sealed with fire sealing compound.
- xxiii) Fire isolation wall shall be provided wherever necessary as per fire safety norms. Opening in the fire separation wall shall be properly sealed with fire sealing compound after laying of cables.
- xxiv) Major routes in BOP area (BOP Package area) shall be on overhead cable trays either supported from available structures, building structure. Only in specific areas as shall be approved by purchaser/consultant where number of cables are too small compared to the route length and in transformer yard, cable shall be routed in cable trenches.
- xxv) The minimum clear height (excluding roof beam) shall be 3.0m.
- xxvi) Bottom of roof beam shall be min. 3m
- xxvii) In cable vaults clear height in walkway or cross over below the cable trays shall be 2.1m

4.0 EQUIPMENT LAYOUT REQUIREMENT

- 4.1 Local Pits/trenches in buildings are to be avoided. However pits/sumps which are unavoidable shall be provided with required dewatering arrangements by means of permanently fixed drainage pumps, further treatment of effluent for reuse purposes and piping up to the ETP for FGD Pump. Bidder shall provide required sump pumps/drainage pumps/submersible pumps, effluent treatment equipment/ system & Piping etc.
- 4.2 Pump shall be permanently fixed in the pits/sumps. If the pit depth is shallow, vertical top mounted sump pumps shall be provided and in deep pits self-priming drainage pumps (horizontal type) at floor level or alternatively submersible type pumps may be provided.
- 4.3 Each pit/sump shall be provided with two numbers (2x100% Capacity) of respective type pumps so that the entire pit is evacuated within 15-20 minutes and the operation of the pumps shall be interlocked through level measurement devices to be installed in the pit/sump so that the pumps shall start automatically and empty the pit.
- 4.4 The general design and construction features of Vertical sump pumps and Submersible pumps are furnished elsewhere.
- 4.5 In addition to the above, suitable drainage arrangement of different floors of plant buildings shall be provided. These drains shall be led to sumps in ground floor as per approved layout. Bidder shall also provide sump pumps of 2x100%



ANNEXURE-II

capacity in each sump pit and the sump drainage water shall be led to the ETP for FGD plant. Bidder shall also provide piping's, fittings etc. for taking this drain/oily waste water to ETP.

- 4.6 Bidder to furnish the detailed erection strategy along with the bid for major equipment's located in FGD area.
- 4.7 Bidder's shall prepare the detailed layout of FGD plant in the available space in the existing main power block area indicating the location of all major equipment. The layout shall be furnished along with the bids submitted by the Bidder.
- 4.8 Valves in the Bidder's scope shall be located in accessible positions
- 4.9 Provision of monorails with chain pulley blocks/HOT cranes along with hoist, as required shall be kept.
- 4.10 Approach for removal of equipment for maintenance shall be provided.
- 4.11 A/C and ventilation ducts, Bus ducts, and Critical Piping routes to be identified at conceptual stage.
- 4.12 No cable trenches, under-ground cable vaults and pipe trenches are acceptable unless otherwise approved by the Purchaser.
- 4.13 All the pipes and cables within the Plant boundary shall be routed above ground.
- 4.14 All other safety requirements as per the factories act, shall be observed while developing the layout.
- 4.15 Battery rooms should be properly ventilated to release the gases produced. An easily accessible wash basin should be provided in the battery room.
- 4.16 Pipelines shall be routed in such a way to avoid interference with other pipes and their hangers and supports, structure, equipment, electrical conduits, cable trays, ventilation ducts etc. The pipe routing shall also take into account the availability of structural members for providing suitable supports and hangers. Hot and cold premises of the system shall be suitably isolated/ segregated from each other. Also the electrical premises shall be fully segregated from system piping.
- 4.17 Piping layout shall have adequate flexibility to absorb all thermal expansion without causing undue stress in the pipelines.
- 4.18 All piping shall be grouped where practicable and shall be routed to present a neat appearance.
- 4.19 The piping shall be arranged to provide clearance for removal of equipment





**Tender Specification
for
FGD Package**

**NLC Tamil Nadu Power Ltd.
2x500 MW Project
Tuticorin, Tamil Nadu**

ANNEXURE-II

requiring maintenance and for easy access to valves and other piping accessories required for operation and maintenance. Availability of access to valves and specialties shall be properly indicated on the layout drawing.





VOLUME : II-A

SECTION - V

PROTECTIVE COATING AND PAINTING





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VOLUME : II-A

SECTION-V

PROTECTIVE COATING AND PAINTING

1.00.00 INTENT OF SPECIFICATION

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

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

2.00.00 CODES & STANDARDS

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

- | | | | |
|----|--------------------------------|---|--|
| a) | SSPC SP 10 / NACE 2 /
SA 2½ | : | Near white blast cleaning |
| B) | SSPC PA 2 | : | Measurement of dry film coating thickness with magnetic gauges. |
| c) | ASTM D 45 | : | Method for pull off strength using portable adhesion tester. |
| d) | NACE RP 0274 – 2004 | : | High-voltage electrical inspection of pipeline coatings. |
| e) | NACE SP 0188 – 2006 | : | Discontinuity (holiday) testing of new protective coatings on conductive substrates. |
| f) | NACE RP 0169 – 2002 | : | Control of external corrosion of underground or submerged metallic piping systems. |





- g) AWWA C 210 – 2007 : Liquid-epoxy coating systems for the interior and exterior of steel water pipelines.
- h) IS 3589:2001 Annexure-b : Steel pipes for water and sewage specification.
- i) AWWA C 222-2000 : Polyurethane coating for the interior and exterior of steel water pipe and fittings.
- j) IS 13213 : 2000 : Polyurethane full gloss enamel (two pack)
- k) ISC HD 20 (11902) : Polyurethane coating for interior and exterior of steel pipe and fittings.
- l) ISC HD 20 (11055) : Solvent less liquid epoxy system by application of interior and exterior surface of steel pipeline.
- m) IS 10221 : Coating and wrapping for buried piping

3.00.00 GENERAL REQUIREMENTS

- 3.01.00 The bidder shall submit a detailed written description in the form of a manual covering coating equipment, procedures, materials inspection test, and repair etc. to owner/consultant for approval.
- 3.02.00 The bidder shall also provide certificates from paint/primer manufacturer mentioning the batch numbers, date of manufacture and shelf life etc. of the materials to be used. In addition to that manufacturing quality plan (MQP) and field quality plan (FQP) shall also be submitted prior to commencement of supply of material and field application.
- 3.03.00 Paint/coating application work at site shall be done either by paint manufacturer or by their authorized applicator. The authorized applicator shall have proper training & certification from manufacturer. Applicator shall possess all the necessary specialized equipment and manpower experienced in similar job.
- 3.04.00 If necessary, the material may be heated and applied by airless spray / plural component spray system.





- 3.05.00 Manufacturer's specific recommendation, if any, shall be followed during application of lining / paints.
- 3.06.00 In areas where there is danger of spotting automobiles or other finally finished equipment or building by wind borne particles from paint spraying, a purchaser approved method shall be adopted.
- 3.07.00 The colour scheme of the entire FGD Plant equipment and auxiliaries area, covered under this specification shall be approved by the purchaser in advance before application.
- 3.08.00 All indoor and outdoor piping, insulated as well as uninsulated will have approved colour bands painted on the pipes at conspicuous places throughout the system, as approved by purchaser.
- 3.09.00 Inside surfaces of vessels / tanks shall be protected by anticorrosive paints or rubber lining as required / specified elsewhere in the specification. External surfaces of all vessels / tanks shall be protected by anti-corrosive painting.
- 3.10.00 For vessels / tanks requiring lining and anti-corrosive painting all inside surface shall be blast cleaned using non-siliceous abrasive after usual wire brushing.
- 3.11.00 Natural rubber lining shall be provided on the inside of vessels / tanks as required / specified elsewhere in the specification, in three layers resulting in a total thickness not less than 4.5 mm.
- 3.12.00 Surface hardness of rubber lining shall be 65 +/- 5 deg. A (shore).
- 3.13.00 After the lining is completed, the vessels / tanks shall not be subjected to any prolonged exposure to direct sunlight in course of its transportation, erection etc. They shall not be stored in direct sunlight. No further lining or burning shall be carried out on the vessel, after application of the lining.
- 3.14.00 All lining projecting outside of the vessel shall be protected adequately from mechanical damages during shipment, handling storage etc.
- 3.15.00 Suitable warnings, indicating the special care that must be taken with respect to these lined vessels shall be stenciled on their outside surface with the letters at least 12 mm high.
- 3.16.00 All insulated piping shall have aluminium sheet jacketing.

4.00.00 SURFACE PREPARATION

- 4.01.00 Most metallic articles that are usually given protective coatings are heavily contaminated and require, at least, some cleaning treatment before the coating is applied. The importance of surface preparation cannot be over emphasized as many investigations have shown convincingly that the performance and durability of any protective coatings are, to a large extent governed by the thoroughness of surface preparation. Often they concluded





that careful cleaning and preparation of the surface were more important than the quality of the protective coating.

4.02.00 Surface contamination in the form of rust, scale, oil grease and dirt is often obvious. Invisible contamination may also be present and represents, on the whole, a greater hazard. Examples of the latter are soldering fluxes, perspiration in the form of hand marks, chlorides from marine atmosphere and sulfite from industrial atmosphere.

4.03.00 The following table gives a surface preparation specification in the descending order of Effectiveness:

Sl. No.	Methods of cleaning	Specifications NACE/SSPC
1.	White metal blast	NACE # 1, SSPC SP 5-63
2.	Near –white metal blast	NACE # 2, SSPC SP 10-63
4.	Acid Pickling	SSPC SP 8-63
5.	Brush Blast	NACE # 4, SSPC SP 7-63
6.	Flame Clean and Power Sanding	SSPC SP 4-63
7.	Power Tool Cleaning	SSPC SP 3-63
8.	Chip and Hand Wire Brush	SSPC SP 2-63
9.	Solvent Wipe	SSPC SP 1-63

4.04.00 The following table gives the Specifications for sand / shot / grit blasting

Sl. No.	Methods of Cleaning	Specification
1.	NACE # 1	White sand blast
2.	NACE # 2	Near-white sand blast
3.	NACE # 3	Commercial blast
4.	Pickle, phosphate treated	
5.	NACE # 1	Grit
6.	NACE # 1	Shot
7.	NACE # 4	Brush blast
8.	No surface preparation	

4.05.00 Inspection of blasted steel surface

For the purpose of inspecting the blasted steel surface with sand abrasive, the respective “Visual standards” shall be utilized.

The standards used in industry to describe surface preparation are:

- i. National association of Corrosion Engineers (NACE)
- ii. Steel Structural Painting Council (SSPC)
- iii. Swedish Pictorial Standards

White metal blast (SSPC 5-63, NACE No.1, and SA-3)

This is defined as removing all rust, scale, paint etc. to a clean white metal which has a uniform Grey white appearance. Streaks and stains of rust or



other contaminants are not allowed.

Near white metal (SSPC 10-63, NACE No.2, SA – 2.5)

This provides a surface of about 95% as clean as white metal. Light shades and streaks are not allowed.

Commercial blast (SSPC 6-63, NACE No.3, SA –2)

This type of blast is more difficult to describe. It essentially amounts to about 2/3 of a white metal blast, which allows for very slight residues of rust and paint in the form of staining.

Brush of blast (SSPC 7-63, NACE No.4 SA-1)

This preparation calls for removal of loose rust, paint, scales, etc. Tightly adherent paint, rust and scale is permitted to remain.

4.06.00 Pictorial Standards of different surface preparation to be adopted

During surface preparation operations, the surface condition obtained shall be compared with pictorial standards available for getting the specified condition. These pictorial standards are available in steel structural painting Manual (Vol. 1), "Good painting practice ", visual standards of surface cleaning sp 7,6,10 and 5 are described in page No.185 and 186 viz. Fig 9,11,12 and 13.Surface profile gauge and surface compactor could be used to check surface conditions according to NACE standard TM 01 70 of NACE.

4.07.00 PRESSURIZED WATER CLEANING METHODS

These standards provides requirements for the use of high and ultra-high pressure water jetting to achieve various degrees of surface cleanliness. This standard is limited in scope to the use of water only without the addition of solid particles in the stream. These standards define four levels of working pressure:

SSPC-SP WJ-1/NACE WJ-1:	Water-jet cleaning of metals. Clean to bare substrate.
SSPC-SP WJ-2/NACE WJ-2:	Water-jet cleaning of metals. Very thorough cleaning.
SSPC-SPWJ-3/NACEWJ-3:	Water-jet cleaning of metals. Thorough cleaning.
SSPC-SP WJ-4/NACE WJ-4:	Water-jet cleaning of metals. Light cleaning.





This cleaning standard defines 4 levels of cleanliness for visible contamination by water jetting and 3 levels for non-visible contamination, such as chlorides and other soluble salts. See the full standard for complete definitions on the level of cleanliness.

4.08.00 SPECIFICATIONS FOR COPPER SLAG BLASTING:

1. The surface shall be cleaned of all dust and heavier layers of rust by copper slag blasting the entire internal surface to photographic standard SIS: 055900- 1967.
2. The consumption rate of copper slag is 1.6 Kg/Sqm of the blasted area. This has to be ensured strictly.
3. All tools, equipment, base material, hand and power tools for cleaning, including scaffolding material, copper slag blasting equipment, air compressor, etc. shall be arranged by the contractor at site in sufficient quantity.
4. The compressor used shall be of size enough to produce displacement of 5.6 to 7.0 Cum/Min of air at a pressure of 7 Kg/sq.cm. Standard blasting equipment, hoppers, hoses nozzles and attachments shall be used to obtain best test results and to maintain safety standards. The rate of cleaning shall be about 15 sq.mt. per hour at a pressure of 7 kg/sq.cm.
5. The abrasive used shall be of the physical properties as mentioned below and shall be free from oil, loan and mud etc.
6. The blast cleaned surface shall be blasted with dry compressed air before applying primer. This should be done even if the surface appears very clean and white in colour. The white colour may be due to deposition of silicon and reflection of light on the surface.
7. Proper earthing and bonding arrangements shall be made to prevent any damage by sparks produced by static electricity. Bonding shall be done between tank and blast nozzles and hopper and air compressor also. The bonding conductor should not be less than 16 SWG single strand copper cable.
8. The time gap between blast cleaning and application of primer shall not be more than THREE hours. Blast cleaning work shall, commence from top to bottom.
9. The blast cleaning operation shall be carried out keeping the nozzle at an angle of 30 degree to the vertical in order to prevent rebounding abrasive from showing down the abrasives emerging from nozzle and from under cutting the material to be removed.
10. A blast cleaning, the percentage of bare metal obtained shall be between 95% to standards of SA 2 ½ of the Swedish standard referred above. (Pictora) surface preparation standards for painting steel surfaces).





11. Arrangements for inspection of various stages of the job shall be made available by the Contractor so that the entire sand blasted area is available for inspection. Any defective work noticed shall be immediately rectified and even reblasting shall be done if necessary.

5.00.00 PAINT APPLICATION

The coating is a unique product. It is only after application on the substrate a coating becomes valuable and useful. The manufacturer shall produce high performance liquid coatings, yet the product usefulness lies in the hands of the applicator. That is the reason why stress is given for proper and careful application as a key to the success of any coating. Protection by coating mainly depends upon three factors

- a) The material
- b) The surface preparation
- c) The application

If any one of the three is weak, protection value is affected to that extent.

High performance coatings are especially sensitive to misapplication and may fail drastically. Therefore, it is imperative that the instruction for application be followed explicitly, particularly when applying sensitive and expensive high performance coating systems.

The purpose of coating application is to develop a continuous highly adherent film with an even thickness over the substrate. To achieve this, various factors have to be considered such as type of coatings and weather conditions, application methods etc. It is advisable to avoid painting below 10°C and above 40°C, if the relative humidity is above 80%, during the rainy weather and wind velocity is above 24km/hr or else freezing will occur before the paint dries.

5.01.00 Application methods

There are a number of methods by which coatings can be applied. The two principal methods are by brush and spray. The other methods are paint pad applications, electrostatic spray, electro-coating, dipping and fluidized bed technique. The latter methods are primarily for in-plant application.

The choice of application methods depends on a number of factors. The first is the type of coating. Most of the oil-based coatings can be easily applied by brush but it is the slowest process. Spray application is the fastest for large flat surfaces. The type of surface is also a factor. For small and intricate areas, brushing is probably the best method. If the surface is used and pitted, application of the first coat by brushing is probably the best method.

Brushing can be done in almost all areas, since the liquid coating is transferred from the brush to the surface. Spraying however, causes problem with toxic solvents as well as a possible fire hazard due to fume build up.





Spraying in small, enclosed areas are usually not suggested. Clean up is also a factor. Cleaning a brush is the least difficult procedure and cleanup of spray equipment is the most time consuming and most complicated procedure.

5.02.00 Storing and handling of paints

Coating materials (paint) as they are packed at the manufacturing plant are thoroughly dispersed, with the pigments fully suspended and of a uniform consistency in terms of both texture and colour. Unfortunately, very few coatings are applied within a short time after manufacture. They may be placed in inventory at the manufacturing plant or sent to a distribution point where they will be held for a period of time. Also, the coating material may be purchased several months before its actual use and again under different conditions. Thus, coatings generally must be remixed and properly re-dispersed prior to actual application.

A pigment, which is usually heavier than the vehicle, tends to settle and may even cake at the bottom of the container. Coatings vary to a wide degree in this particular characteristic. Some may stay suspended for many years; others settle out hard at the bottom of the container. This is a defect. Paints, which gelled in the container or in which the pigment liveried (i.e. become thick and rubbery) are not satisfactory for use and cannot be practically redispersed. The formulation has to contain proper antissettling additive to avoid this defect.

The purpose of remixing and re-dispersion is to make the coating completely homogeneous, so that upon application the pigment and vehicle can produce the film that was intended by the manufacturer. In certain cases, particularly in oil-type vehicles, there may be skin on the surface of the liquid. These should be removed before re-dispersion, since they will not get redispersed into the vehicle.

5.03.00 Mixing

The mixing process is not practically easy, even if the system has not settled hard. This is often neglected by applicators, particularly in coatings, which have settled rather solidly. There have been examples of coatings that were applied with at least half of the pigment remaining at the bottom of the container un-dispersed and later thrown away with the container. This procedure does not allow for the maximum performance of coating properties and normally leads to rapid coating failure.

Mechanical mixing

It is always better to use a mechanical mixer of some type, since mechanical mixing always produces a more uniform coating and does so much more rapidly than manual mixing. Manual mixing should only be done under unavoidable circumstances and only in containers with the maximum of a 20-liter capacity.



Even when the coating has settled rather hard, the propeller-type agitator can break it up and re-disperse it to a point, which is closely equivalent to its original form. Nevertheless, care should be taken in the mixing operation, particularly to ensure that the material at the bottom and lower sides of the container has been well separated from the container and re-dispersed. Some materials form soft sediment, which clings to both the sides of the container and the bottom, making it necessary to scrape these off before they can be properly dispersed. This is usually done by manual operation. The mixing should be done in such a manner that splashing is avoided.

The speed of a mechanical mixer should be as low as possible in order to obtain the re-dispersion of the pigment in the vehicle. The coating should have a slight vortex at the surface. A large vortex tends to mix air into the coating, which can cause pinholes and air bubbles during application.

Manual mixing

If the manual mixing is necessary, the liquid portion of the coating should be separated into a clean container. The lower, thicker part of the coating can then be more readily mixed into a heavy paste, including the material, which is clinging to the sides of the container. Once the heavier material is mixed into a smooth paste, the remainder of the liquid from the second container can be remixed into the original container with the heavy material, making sure that the two are thoroughly mixed into a uniform coating. One way to do this is to pour the material back and forth between the two containers. This is called boxing. The materials should be poured back and forth several times to assure complete uniform mixing.

5.04.00 Two component coatings

In the case of two component coatings, there are two materials that must be checked to determine whether or not they are properly dispersed prior to being mixed together. Two component coatings are extremely common at the present time. They include numerous kinds of epoxy coatings, coal tar epoxy coatings, polyurethane coatings, and inorganic zinc coatings. With two component coatings, it is essential that the two components be separately and thoroughly mixed. Two component materials are designed to react chemically, so that if they are not thoroughly mixed, the chemical reaction may not take place properly. Mechanical blending of the two components is recommended to obtain a thoroughly mixed product. The two component materials often are in different colours so that a satisfactory mixing can be readily identified. The fully mixed coating should have a uniform colour and consistency.

5.05.00 Mixing dry powder and liquid

The primary example of mixing dry powder and liquid components is in the use of inorganic zinc coatings. In-organic zinc coatings are made from liquid component and dry powdered zinc. The first step is to determine whether or not the liquid component is thoroughly mixed and dispersed to a completely

homogeneous liquid. This usually is not difficult since most liquid components are lightly pigmented.

Second, stir the total contents of the powder slowly into the total content of the liquid until it becomes a well dispersed, free flowing material. In the case of inorganic zinc coatings, the manufacturers supply the liquid and the powder in two different containers in the exact amount that should be mixed. It is essential that the total powder and total liquid be used in order to obtain the desired final coating. Mixing small portions of zinc and liquid is not recommended, since correct proportions are seldom measured under field conditions.

5.06.00 Straining

Most coatings are thoroughly strained prior to being placed in their container. When the container is opened, if the contents have not settled to a hard deposit in the bottom, straining in the field may not be necessary. On the other hand, if the pigment has settled hard, if the coating has a skin on the surface, or if the product is a material such as inorganic zinc, straining is recommended. Straining prior to spraying often eliminates considerable downtime due to gun clogging by small particles those blocks the orifice in the gun.

Straining can be done with a fine fly screen with a mesh size 150µm or through nylon stocking. Nylon stocking does not contain any lint and is a very fine mesh that most coating materials can readily pass through. Mosquito netting or similar materials also are used, although they often contain some lint, which can cause problems.

5.07.00 Compatibility of different paints

While applying multicoated system of paint it is always desirable to have a first-hand knowledge of compatibility of different coating systems with one another. A general view of such information is given in the following table. This is only a general view.

Primer	Oleo resinous	Alkyd	Silicone alkyd	Vinyl	Chlorinated rubber	Epoxy (2 pack)	Urethane
Oleoresins	C	C	C	NR	NR	NR	NR
Alkyd	C	C	C	NR	NR	NR	NR
Silicone alkyd	C	C	C	NR	NR	NR	NR
Phenol resin	C	C	C	NR	NR	NR	NR
Vinyl	C	C	NR	C	C	C	NR
Chlorinated rubber	C	C	C	C	C	NR	NR
Epoxy	NR	NR	NR	C	C	C	C
Coal tar epoxy	NR	NR	NR	NR	NR	C	NR



Zinc-rich epoxy	NR	NR	NR	NR	C	C	NR
Inorganic zinc	NR	NR	NR	C	C	C	NR
Urethane	NR	NR	NR	NR	NR	NR	C

TE: C-Normally

NOTE: C-Normally compatible; NR- Not recommended due to known or suspected problems. Certain combinations marked "NR" may be used provided a suitable tie coat is applied.

6.00.00 INSPECTION

Inspection techniques shall be applied at various stages i.e. from purchase of coating materials to paint application and evaluation of performance during service. Inspection procedures at various stages before and after the application of coating systems over the oil installations have been described below:

6.01.00 Paint composition

The type of paint system shall be selected depending upon the environmental conditions. Generally primer, undercoat and finish coats are used in protective coating system. The purchased paint materials are used in protective coating system. The purchased paint materials shall be tested for the following properties to ascertain whether the supplied paint conforms to the specifications.

- i. Type of film formers present
- ii. Type of pigments present
- iii. Thickness per coat
- iv. Volume solids
- v. Pigment volume concentration
- vi. Area coverage per liter of the paint
- vii. Specific gravity
- viii. Drying time and
- ix. Main pigment content in total pigmentation

It is the duty of the inspection engineer to get the paint system tested for the above factors. The painting operation shall be started only after the values obtained coincide with the required specification of the paint system.

It is essential to see that the surface is not wet during the application of the paint. Moreover paints should not be applied when the humidity of the environment is above 80%. The atmospheric temperature should not be below 10°C during the painting operation.

6.02.00 Procedure for testing paint samples

The following laboratory test procedures shall be adopted for the characterization of the film-formers, pigments and studying the properties of the paint.

a) Type of film-formers present

The film former shall be separated out of the paint by means of centrifuging. It is then to be analyzed using infrared spectroscopy for identifying the functional group. i.e. the type of film formers.

b) Type of pigments present

After separating the pigment from the paint and proper drying, it shall be subjected x-ray diffraction for identifying the pigment.

c) Thickness per coat

Magnetic thickness gauges are used to measure the thickness of the paint film applied over the iron-substrate. The thickness is measured in micrometer (μm). Some of the thickness gauges operating under magnetic principle are elecometer, posi test and micro test. Thickness gauges operating on eddy current principle are used to measure coating thickness over metals other than steel/magnetic substrates.

d) Volume solids

Paint is a mixture of three major components such as pigment, binder and thinner.

The pigment and film-former will remain in the paint film after the evaporation of the solvent. The pigment and film former together are called as solids. The volume of these together in the liquid paint is called as volume solids. This is determined as follows:

A known volume of the paint is taken. Let it be V1. Distilling the solvent and collecting it in a measuring cylinder determine the volume of the solvent present of the paint. Let it be V2. By subtracting V2 from V1, we can determine the volume solids.

e) Pigment volume concentration (PVC)

Pigment volume concentration is defined as

$$\text{PVC} = \frac{\text{Volume of pigment}}{\text{Volume of pigment} + \text{Volume of binder}} \times 100$$

By separating out the pigment and binder from the paint and knowing their specific gravity, we can calculate PVC.

f) Area coverage per liter of the paint

This is determined by taking a known volume of the paint and applying it over a surface. The area covered by the known volume of the paint is determined. From this value, area covered by one liter of the paint is calculated.

g) Specific gravity

For determining specific gravity, a cup of known volume is taken. The difference in weight of the cup filled with paint and the empty cup gives the weight of paint of known volume. From this, we can calculate specific gravity.

h) Drying time

i) Touch Dry

In this case, if the coated surface is touched with finger, no finger mark should be found on the coating.

ii) Hard Dry

It is the condition of coating drying very hard. Unless the coating itself is damaged with force, no pressure could mar the coating in this condition. This condition is attained usually after seven days.

i) Flow properties (viscosity) of the paint (Ford cup method)

Ford cup is the mostly used instrument for studying the flow properties of the paint. Ford cups having different orifice sizes are available in the market. The varying orifice sizes are meant for measuring the flow time of different viscosities. Generally, the most viscous liquids require bigger orifice. The results are reported simply as seconds per cup. Number

6.03.00 Spot testing procedures

The following spot tests will be useful to identify the binders (film-formers) qualitatively before application at the site.

a) EPOXY RESIN

i) Filter paper test

This test can be carried out even with paint itself. 0.5 gms of paint part (binder part) / binder is taken in a 100 ml beaker and treated with 1ml concentrated sulfuric acid. The beaker is slightly heated at 60°C for a few minutes. It is again mixed with 5ml of conc.H₂SO₄ until the colour intensity is similar to that of very dilute potassium-di-chromate solution. A drop of the solution is taken in a glass rod and is spread over a filter paper. If Bis-phenol-A-type of epoxy resin is present, a purple colour develops in 1 minute, the colour eventually turns blue.

ii) Formaldehyde Test

Few drops of the sample is dissolved in 1 to 2 ml of concentrated sulphuric acid if necessary by heating to 40°C to 50°C. One to two drops of formaldehyde solution is added in to it. An orange colour, which on dilution with water turns violet to blue indicates the presence of epoxy resins.

b) Chlorinated rubber resin

Few milligrams of the sample is allowed to stand in pyridine at room temperature for few minutes. Few drops of methanolic potassium hydroxide solution is added in to it. If chlorinated rubber resin is present in the solution, a yellow precipitate is formed which gradually darkness to a yellow-brown colour.

c) Isocyanate hardener

The aliphatic nature of isocyanate is confirmed by the following spot test. A small sample of isocyanate hardener is heated in a test tube until white fumes are evolved and these fumes are absorbed on a filter paper. One drop of a solution of 4-nitrobenzene-di-azofluoroborate in methanol (1%) on the filter paper should give any coloration, confirms the presence of aliphatic isocyanate. If any coloration is seen on the filter paper, this will confirm the presence of aromatic isocyanate

The infrared spectra of the aliphatic isocyanate will show peaks at 1370 cm⁻¹ and 2250-2350 cm⁻¹.

Physical, Chemical and Instrumental methods of paint analysis with their relevant standards are given in the following tables.

i) Physical Tests

Paint property	IS Standard	ASTM
Preparation of panels	IS 101 PART1 – SEC3	D 609
Preparation of Tin panels	IS 101 PART1 – SEC3	D 609
Viscosity (KU)	IS 101 PART1 – SEC5	D 562
Weight per Gallon	IS 101 PART1 – SEC 7	D 1475
Fineness of Grind	IS 101 PART3 – SEC 5	D 1210
Water content	IS 101 PART2 –SEC 1	D 95
Coarse particles and skins		D 185
Drying times Set to touch Dry for recoating Dry hard	IS 101 PART3 – SEC 1 & 2	D 1640
Pigment content	IS 101 PART8 – SEC 2	D 2371
Vehicle content		D 2371
Non – volatile content	IS 101 PART2 – SEC2 & PART8 – SEC –2	D 2369
Adhesion	IS 101 PART5 – SEC2	D 3359
Brushing properties	IS 101 PART1 – SEC4	

Exposure tests of paints on metals		D 1014
Salt spray resistance	IS 101 PART6 – SEC1	B 117
Accelerated weathering	IS 101 PART6 – SEC5	D 822
Leafing		D 480
Flexibility	IS 101 PART5 –SEC	D 522

ii) Chemical Tests

PAINT PROPERTY	TEST METHOD (ASTM)
Chemical resistance	D 1308
Liquid dryers	D 564
Aluminum	D 480
Aluminum silicate	D 718
Calcium carbonate	D 34
Extenders in colors	D 126
Iron oxide	D 768, D 50
Leaded zinc oxide	D 34
Red lead	D 49
Water soluble salts	D 2448, D 2455
Zinc oxide	D 34
Zinc powder	D 521
Zinc sulfide	D 34

iii

) Instrumental Tests

Paint property	Test method (ASTM)	Instrument
Dry Opacity	A 2805	Reflectometer
Gloss	D 523	Gloss meter
Color	D 2244	Colorimeter
Vehicle Identification	D 3168 D 3271	Infrared spectrophotometer Gas chromatograph
Solvent solids Identification	D 3271	Gas chromatograph
Vehicle solids Identification	D 2621	Infrared spectrophotometer

7.00.00 SPECIFICATION OF COATING SYSTEM

7.01.00 Protective coating for steel structures

Most commonly used coating system for atmospheric zone of blast cleaned steel structures are given below:

7.01.01 System-1



**Tender Specification
for
FGD Package**

**NLC Tamil Nadu Power Ltd.
2x500 MW Project
Tuticorin, Tamil Nadu**

Coating system used for atmospheric open exposure zone is one coat of inorganic zinc-rich primer, one coat of epoxy-Glass flake filled intermediate coating and one coat of aliphatic polyurethane provides better performance in more aggressive services. The coating system for closed atmosphere is also the same system with the replacement of aliphatic urethane with aromatic polyurethane top coat. The surface preparation of this Zinc rich primer requires sand blasted surface or grid blasted surface to the Swedish Specification of Sa 2.5. The coating systems are to be applied by spray method. The specification of the system is as given below:

i. Specification of Inorganic zinc rich primer

Colour	Green Grey
Gloss Level	Matt
Volume Solids	63%
Typical Thickness (DFT)	70-80 microns
Theoretical Coverage	8.40 m ² /litre
Method of Application	Airless Spray, Air Spray
Drying Time	One Hour
Volatile Organic Compound	216 g/ Litre
Mix Ratio	Liquid Binder Base part(A) 3: Powder Zinc component part (B)1
Working Pot Life	2-2.5 hours
Shelf Life	1 year

ii. Specification for glass flake filled epoxy coating

Colour	As desired
Finish	Semi-Glossy
Type	Two packs
Application	By brush or spray
Dry film thickness/coat	100– 110 µm
Volume solids	Approx. 90 ± 2 %
Area coverage (theoretical)	8 to 9 sq.m/ litre
Surface dry	4 hrs.
Hard dry	24 hrs.
Over coating	24 hrs.
Recoatibility	24 hours.
Full cure	1 week.
Shelf life	12 months

iii. Specification for Aliphatic Polyurethane top coat for open zone

Colour	Required colour
Gloss Level	Glossy
Volume Solids	63±2%
Typical Thickness (DFT)	50-60 microns
Theoretical Coverage	8 - 9 m ² /litre
Method of Application	Airless Spray, Air Spray
Guiding data for airless spray:	
Nozzle tip (inch/1000)	15-21





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Pressure at nozzle (minimum)	150 bar/2100 psi
Drying Time	One Hour
Volatile Organic Compound	340 g/ Litre
Mix Ratio	Acrylic Polyol Base part 5: Aliphatic Isocyanate Hardener part 1
Working Pot Life	3 hours
Shelf Life	2 years

iv. Specification for Aromatic Polyurethane top coat for closed zone

Colour	Required colour
Gloss Level	Glossy
Volume Solids	63±2%
Typical Thickness (DFT)	50-60 microns
Theoretical Coverage	8-9 m ² /litre
Method of Application	Airless Spray, Air Spray

Guiding data for airless spray:

Nozzle tip (inch/1000):	15-21
Pressure at nozzle (minimum):	150 bar/2100 psi
Drying Time	One Hour
Volatile Organic Compound	340 g/ Litre
Mix Ratio	Acrylic Polyol Base part 5: Aliphatic Isocyanate Hardener part 1
Working Pot Life	3 hours
Shelf Life	2 years

7.01.01 System-2

The surface preparation is not possible through blast cleaning, then the surface is cleaned with wire brushing or power tool cleaning and coated with two coats of non aluminium epoxy mastic followed by an aliphatic polyurethane coating is recommended.

i. Specification for non aluminium Epoxy mastic paint (High build)

Colour	As desired
Finish	Semi-Glossy
Type	Two pack
Application	By brush or Airless spray
Dry film thickness/coat	100-110 microns
Volume solids	Approx. 80 ±2 %
Area coverage (theoretical)	6 to10 sq.m/litre
Surface dry	4 hrs.
Hard dry	12 hrs.
Recoatibility	24 hours.
Full cure	7 days.
Shelf life	months (or as recommended by manufacturer)

ii. Specification for Aliphatic Polyurethane top coat for open zone





Colour	Required colour
Gloss Level	Glossy
Volume Solids	63±2%
Typical Thickness (DFT)	50-60 microns
Theoretical Coverage	8-9 m ² /litre
Method of Application	Airless Spray, Air Spray

Guiding data for airless spray

Nozzle tip (inch/1000):	15-21
Pressure at nozzle (minimum):	150 bar/2100 psi
Drying Time	One Hour
Volatile Organic Compound	340 g/ Litre
Mix Ratio	Acrylic Polyol Base part 5: Aliphatic Isocyanate Hardener part 1
Working Pot Life	3 hours
Shelf Life	2 years

7.02.00 Protective coating system for Pipelines without Cathodic Protection

There are a number of factors to be considered for the selection of an external pipeline coating including physical and chemical stability of the coating in the pipeline environment, adhesion, and resistance to impact. The pipeline should be cleaned and prepare the surface for painting as follows:

The pipeline surface shall be cleaned. The main objective of surface preparation is to ensure that all contamination (rust, mill scale, etc.) is removed to reduce the possibility of initiating corrosion so that a surface profile is created that allows satisfactory adhesion of the paint to be applied. The surface of the pipe is cleaned with a wire brush or power tool cleaning to get the surface of Sa 2/St 3. Thus prepared surface to be cleaned with lint free cloth, which also includes cleaning & dewatering (in case of valve chamber) and drying the surface. After preparing the surface of the pipe for painting, the primer coat, undercoat and finish coat shall be applied. The coating system recommended for the pipeline is high build epoxy mastic coating as primer followed by an epoxy glass flake filled coating with the top coat of aliphatic polyurethane. The specifications of the systems are given below:

i. Specification for Epoxy mastic paint (High build)

Colour	As desired
Finish	Semi-Glossy
Type	Two pack
Application	By brush or Airless spray
Dry film thickness/coat	100-110 microns
Volume solids	Approx. 80 ±2 %
Area coverage (theoretical)	6 to10 sq.m/litre
Surface dry	4 hrs.
Hard dry	12 hrs.
Recoatibility	24 hours.



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Full cure	7 days.
Shelf life	12 months (or as recommended by manufacturer)

- ii. Specification for glass flake filled epoxy coating
- | | |
|-----------------------------|----------------------|
| Colour | As desired |
| Finish | Semi-Glossy |
| Type | Two packs |
| Application | By brush or spray |
| Dry film thickness/coat | 100– 110 μ m |
| Volume solids | Approx. 90 $\pm$ 2 % |
| Area coverage (theoretical) | 8 to 9 sq.m/ litre |
| Surface dry | 4 hrs. |
| Hard dry | 24 hrs. |
| Over coating | 24 hrs. |
| Recoatibility | 24 hours. |
| Full cure | 1 week. |
| Shelf life | 12 months |
- iii. Specification for Aliphatic Polyurethane top coat for open zone

Colour	Required colour
Gloss Level	Glossy
Volume Solids	63 $\pm$ 2%
Typical Thickness (DFT)	50-60 microns
Theoretical Coverage	8-9 m ² /litre
Method of Application	Airless Spray, Air Spray

Guiding data for airless spray:

Nozzle tip (inch/1000):	15-21
Pressure at nozzle (minimum):	150 bar/2100 psi
Drying Time	One Hour
Volatile Organic Compound	340 g/ Litre
Mix Ratio	Acrylic Polyol Base part 5: Aliphatic Isocyanate Hardener part-1
Working Pot Life	3 hours
Shelf Life	2 years

7.03.00 Protective coating for all other surfaces

The surface shall be cleaned with wire brushing or by power tools (St3). These structures will be protected by three layer system of Epoxy zinc rich primer followed by Glass Flake filled epoxy and aliphatic polyurethane finish coat. The specifications of the coating system are given below:

- i. Specification for Epoxy Zinc rich primer

Colour	Grey
Finish	Matt
Type	Two pack
Application	By brush or spray





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Pigment (Main)	Zinc dust (30-40% by wt. of the total pigments.)
Type of epoxy	Condensation product of bisphenol-A and Epoxide equivalent Epichlorohydrin with terminal Epoxide groups 450-500
Curing agent	Polyamide (amine value 210-230)
Dry film thickness/coat	50-60 μ m
Volume solids	55 $\pm$ 2% (volume)
Area coverage (theoretical)	11 to 14 sq.m/litre
Surface dry	2-3 hrs.
Hard dry	24 hrs.
Re-coatability	24 hours.
Full cure	5 days.
Shelf life	6 months under sealed conditions

ii. Specification for Epoxy glass flake paint

Colour	As desired
Finish	Semi-Glossy
Type	Two packs
Application	By brush or spray
Dry film thickness/coat	100–110 μ m
Volume solids	Approx. 90 $\pm$ 2 %
Area coverage (theoretical)	8 to 9 sq.m/ litre
Surface dry	4 hrs.
Hard dry	24 hrs.
Over coating	24 hrs.
Re-coatability	24 hours.
Full cure	1 week.
Shelf life	12 months

iii. Specification for aliphatic Polyurethane top coat

Colour	Required colour
Gloss Level	Glossy
Volume Solids	63 $\pm$ 2%
Typical Thickness (DFT)	50-60 microns
Theoretical Coverage	8-9 m ² /litre
Method of Application	Airless Spray, Air Spray

Guiding data for airless spray:

Nozzle tip (inch/1000):	15-21
Pressure at nozzle (minimum):	150 bar/2100 psi
Drying Time	One Hour
Volatile Organic Compound	340 g/ Litre
Mix Ratio	Acrylic Polyol Base part 5: Aliphatic Isocyanate Hardener part-1
Working Pot Life	3 hours
Shelf Life	2 years



7.04.00 Summary of Specification of Coating System

The summary of the coating system shall be as mentioned below:

Area	Surface preparation	Recommended coating scheme
Directly exposed to Sunlight- Steel structures	Copper shot blasting to Sa2.5	Scheme I
	Power tool cleaning to St3	Scheme II
Indoor –Steel Structures	Copper shot blasting to Sa2.5	Scheme III
	Power tool cleaning to St3	Scheme IV
Pipelines (over ground)	Power tool cleaning to St3	Scheme V
All other surfaces	Wire brushing / Power tool cleaning to St3	Scheme VI

7.04.01 Scheme-I: For blast cleaned structures and exposed to sunlight

For new steel structures/Existing steel structures	Exposed to sun light Outdoor)	
Surface preparation	Copper slag blasting to Sa2.5	
Primer	Zinc ethyl silicate	50 – 60µm
Undercoat	Epoxy Glass flake (high build)	100 – 110 µm
Top Coat	Aliphatic polyurethane (TiO ₂) rutile	50 – 60µm
Total dry film thickness (DFT)		200 –230µm

7.04.02 Scheme-II: For under prepared structures and exposed to sunlight

For new steel structures/Existing steel structures	Exposed to sun light (Outdoor)	
Surface preparation	Power tool cleaning St-3/Paint strippers	
Primer	Epoxy mastic(non aluminium)	100 – 110µm
Undercoat	Epoxy mastic(non aluminium)	100 – 110 µm
Top Coat	Aliphatic polyurethane (TiO ₂) rutile	50 – 60µm
Total dry film thickness (DFT)		250 –280µm

7.04.03 Scheme- III: For blast cleaned structures and not exposed to sunlight



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For new steel structures/Existing steel structures	Not exposed to sunlight (Indoor)	
Surface preparation	Blast Cleaning to Sa2.5	
Primer	Zinc Ethyl Silicate	50 – 60µm
Undercoat	Epoxy Glass flake (high build)	100 – 110 µm
Top Coat	Aromatic polyurethane TiO ₂ (rutile)	50 – 60µm
Total dry film thickness (DFT)		200 –230µm

7.04.04 Scheme-IV: For under prepared structures and not exposed to sunlight

Surface preparation	Mechanical chipping / Power tool cleaning St-3/Wire brushing St-2	
Primer	Self-priming epoxy mastic	100 – 150µm
Under coat	Self-priming epoxy mastic	100-110 µm
Top Coat	Aromatic polyurethane TiO ₂ (rutile)	50 – 60µm
Total dry film thickness (DFT)		250 –320µm

7.04.05 Scheme- V: For pipelines (above ground)

Surface preparation	Mechanical chipping / Power tool cleaning St-3/Wire brushing St-2	
Primer	Self-priming epoxy	100 – 150µm
Under coat	Epoxy Glass flake (high build)	100-110 µm
Top Coat	Aliphatic polyurethane TiO ₂ (rutile)	50 – 60µm
Total dry film thickness (DFT)		250 –320µm

7.04.06 Scheme-VI: Coating specifications for all other surfaces

Surface preparation	Power tool cleaning St-3/ Paint strippers	
Primer	Epoxy Zinc rich	50 – 60µm
Under coat	Epoxy glass flake	100-110µm
Top Coat	Aliphatic polyurethane TiO ₂ (rutile)	50 – 60µm
Total dry film thickness (DFT)		200–230µm

8.00.00 TESTING REQUIREMENTS





8.01.00 Measurement of dry film thickness

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

8.01.01 Apparatus / instrument

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

8.01.02 Procedures

a) Number of measurements

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

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

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

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

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

Area measurement must be within specified range.

8.02.00 Electrical inspection (holiday) test

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

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





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

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

Testing voltage $v = 7900\sqrt{t} \pm 10\%$ where t = the average coating thickness, mm.

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

8.03.00 Adhesion pull off test

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

8.03.01 Apparatus / instrument: adhesion tester consists of three basic components:

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

8.03.02 Prepare the test surface

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

8.03.03 Prepare dolly (test pull stub)

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

8.03.04 Select an adhesive

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

8.03.05 Attach the dolly to the surface

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

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

c) Attach the dolly to the coated surface and gently push downward to



displace any excessive adhesive.

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

8.03.06 Adhesion test procedure

- a) Attach the adhesion tester to the dolly by rotating the hand wheel counter clockwise to lower the jaw of the device.
- b) Slide the jaw completely under the head of the dolly. Position the three legs of the instruments so that they are sitting flat on the coated surface.
- c) Slide the dragging indicator pin on the black column to zero by pushing it downward.
- d) Firmly hold the base of the instrument in one hand and rotate the hand wheel clockwise to raise the jaw of the device that is attached to the head of the dolly. The dragging indicator pin will move upward on the black column as the force is increased and will hold the reading. Apply the tension using a moderate speed. Continue to increase the tension on the head of the dolly until (a) the minimum psi/mpa/kg/cm² required by project specification is exceeded and the test is discontinued, (b) the maximum psi/mpa/kg/cm² of adhesion tester has been achieved and dolly is still attached, (c) the force applied by the adhesion tester causes the dolly to dislodge.
- e) Read the scale and record the adhesion value.

8.04.00 Coating repair

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

8.04.01 Surface preparation

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

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

8.04.03 Coating application

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

8.04.04 Repair inspection:



Repaired portion shall be electrically inspected using a holiday detector.

8.05.00 Welded field joints

8.05.01 Preparation

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

8.05.02 Electrical inspection

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

9.00.00 INFORMATION / DATA REQUIRED

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



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**ANNEXURE-I
MARKET AVAILABLE COATING SYSTEMS AS PER SPECIFICATION**

Sl.No.	Specification	ASIAN PAINTS	BOMBAY PAINTS GRAUER & WEIL Paints	BERGER PAINTS	GRAND POLYCOTS	International Protective Coatings	KRISHNA CONCHEM
1.	Zinc Ethyl Silicate Primer	Apcosil 605 ZS	Zinc-o-sil 75	Zinc Anode 304	GP Prime 402	InterZinc 22	-
2.	Epoxy Zinc rich Primer	Apcodur CP 686			GP Prime 205	Inter Zinc 42	
3.	Self Priming Epoxy Mastic Paints	Rust-O-Cap	Penthdur Mastic 5527	Berger protecto Mastic	GP Prime guard 235	Interplus 256	-
4.	Epoxy Glass Flake Paint	Apcodur EP glass Flake	Pentadur Glass Flake 3580	Epilux Super Build ST Glass Flake Coating	GP SUPERGUA RD GLASS- FLAKE	Interzone 505	Karaikote 100 S
5.	Aliphatic Polyurethane Paint	Apcothane CP 674	Pentathane 4512 (M)	Polyuretha ne Coating	GP Bond 141	Interthane990	-
6..	Aromatic Polyurethane Paint	---	--	--	GP COAT 131	---	





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7.	Moisture Compatible anti Corrosion system			Epilux Durebild WSE Coating			Karaikote- 6545
8.	Epoxy red oxide primer	AP CODUR Epoxy polyamide primer					
9.	Epoxy MIO Under coat	AP CODUR Epoxy MIO Under coat					
10.	Epoxy TiO2 Under coat	AP CODUR Epoxy 420HS					



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**Vol. II-A/Section-V
Protective Coating & Painting**

	TITLE: TECHNICAL SPECIFICATION FOR ELEVATOR	SPEC. NO. PE-TS-483-502-A001	
		VOLUME IIB	
		SECTION IA	SUB-SECTION
		REV. 00	DATE: JUNE-2021
		SHEET 1 OF 2	
FUNCTIONAL/PERFORMANCE / DEMONSTRATION GUARANTEE (AS APPLICABLE)			

	TITLE: TECHNICAL SPECIFICATION FOR ELEVATOR	SPEC. NO. PE-TS-483-502-A001	
		VOLUME IIB	
		SECTION IA	SUB-SECTION
		REV. 00	DATE: JUNE-2021
		SHEET 2 OF 2	

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

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

- A. Rated capacity of the elevator.
- B. Travel and hoist Speed of the elevator.
- C. Accurate positioning of the elevator.
- D. Over Load test as per IS:14665 (Latest edition)

		MANUFACTURING QUALITY PLAN FOR=M/S vendor		PROJECT: PACKAGE: ITEM: ELEVATOR BHEL REF. NO.:				Q.P/FQP. NO & REV: DATE:1 PAGE: 1of 4 JOB NO:						
1	2	3	4	5	6	7	8	9	10				11	
Sr. No.	COMPONENT& OPERATION	CHARATERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMATE OF RECORD	AGENCY				REMARKS	
									D	VE	M	B		
A. Boughtout Items :														
1	Raw materials, Round Hexagon & Structural. Type : EN-8/EN-8D to EN-9,B and En-24	A: Chemical Composition B: Mechanical Properties C: Dimensional Checks	Major Major Major	Analysis Hardness Measurement	Sample Sample 100%	IS/BS : 970 IS/BS : 970 DRG.	IS/BS : 970 IS/BS : 970 DRG.	O.S.L/ T.C QA REG. D.I.R/Q.C.R		V V V	V V w	V V V		
2	Raw material Rounds, En-8, EN-9, EN-24	Crack Detection	Major	Ultrasonic testing	100%	ASTM-388	ASTM -388	QA/FMT/03		V	W	V		
3	Casting : a. C.I. Graded Castings	A: Chemical Composition B: Mechanical Properties C: Dimensional Checks D: Blow Holes	Major Major Major Major	Analysis Hardness on traction sheave Measurement Visual	Sample Sample Sample 100%	IS-vendor DRG vendor-DRG IS : 210 vendor-DRG —	AS PER DRG. vendor-DRG IS : 210 vendor-DRG -	S.T.C S.T.C QA/FMT/02 QA/REG	√ √ - -	V V - -	V V W W	V V - -		
4	Suppliers Item : a. Manufactured Items b. Moldings Rubber Items (ABSORBER) c. Springs (Buffer) d. Guide Rail. e. Wire rope	Dimensional Check A: Dimensional Checks B: Hardness A: Dimensional Check B: Spring Constant compression. A.Chemical Test. B. Dimension check. A: Dimensional Check B: Mechanical Properties.	Major Major Major Major Major Major Major Major	Measurement Measurement Compression Test Measurement Compression Analysis Measurement Measurement of O.D/ Const. Measurement	100% 100% Sample 100% Sample Sample Sample Correlate S.T.C	vendor/DRG. vendor-DRG. vendor-DRG. vendor-DRG. vendor-DRG. vendor- DRG vendor-DRG. IS/2365 & IS : 2266	vendor/DRG. vendor/DRG. vendor-DRG. vendor-DRG. vendor-DRG. vendor -DRG vendor-DRG. IS/2365 & IS : 2266	D.I.R QA/FMT/02 QA/FMT/02 QA/FMT/02 S.T.C S. T.C QA/FMT/02 QA/FMT/02 S.T.C	 √ √ √	- - - - V V - V	W W W W V W W V	- - - - V V - V		
*V= Verification as appropriat. *M= Manufacturer/Sub contractor. *W=Witness , *VE= Manufacturer/ sub contractor Vendor. *S.T.C= Supplier Test Certificate, *B =BHEL/Nominated inspection agency. *O.S.L = Out Side Lab, *D.I.R=Daily inspection register. *R.Q.C = Rvendoript Quality Control (vendor) . *P =Perform. *Q.C.R = Qua;ity Control Register (vendor) . *T.C. = Test Certificate, *D.I.R = Daily inspection register. * D = Documents. *U.E.R. =Ultra Sonic Examination Record .			MANUFACTURER SEAL AND SIGN		CONTRACTOR SIGN AND SEAL .		NAME & SIGN OF APPROVING AUTHORITY & SEAL							
					Page 108 of 247									

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

1	2	3	4	5	6	7	8	9	10				11
Sr. No.	COMPONENT& OPERATION	CHARATERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMATE OF RECORD		AGENCY			REMARKS
									D	VE	M	B	
2	Motor Assembly :	A-Winding Insulation test.	Major	High Volt. Test	100%	I S :325-96 1.5 KV for 5 SEC	I S :325-96 1.5 KV for 5 SEC.	D.I.R QA/FMT/13		V	W	V	
		B-Insulation Resistance	Major	Measurement	100%	> 10 mega ohms	> 10 mega ohms	Test report		V	W	V	
		C-Motor testing for elect. Pmt.	Major	Elect.	100%	IS : 325	IS : 325	Test report		V	W	V	
		D-Vibration measurement & noise lev	Major	Measurement	100%	vendor - Norms	vendor -Norms	Test report		V	W	.	
3	Speed Governor Assembly :	Tripping speed Easy Run test	Major	Function Check	100%	I S : 9878 LCH -112	I S : 9878 LCH - 112	T.C IN Pant.		V	W	V	
4	Controller Assembly / VVVF Unit.	1. Visual Inspection 2. Electrical Checks (Routine Test). 3. Functional Checks 4. Pretreatment in seven tank for sheet & paint thickness.	Major do do Major	Visual Electrical Function Measurement + Visual	100% 100% 100% Sampling	vendor Norms do do do	vendor Norms do do do	T.C do do vendor - FMT.		V V V V	W W W W	V V V V	
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1	2	3	4	5	6	7	8	9	10				11
Sr. No.	COMPONENT& OPERATION	CHARATERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMATE OF RECORD	AGENCY				REMARKS
									D	VE	M	B	
5	Mechanical assembly :	Cage assembly .	Major	Measurement	100%	Appd. L/o DRG. vendor-INSP. Norms	Appd. L/o DRG. vendor-INSP. Norms	QA/FMT/15		V	W	V	
6	Painting	Parts & Components	Major	Cross Hatch Test	Sampling	vendor-INSP. Norms	vendor-INSP. Norms	QA / REG.		V	W	V	
			Major	Powder Coating Thickness Test	Sampling	vendor-INSP. Norms	vendor-INSP. Norms	QA / REG.		V	W	V	
6	Electrical Assembly	1- Break assembly .	Minor	Function check	Sampling	vendor- NORMS	vendor - NORMS	TC		V	W	V	
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PAINTING SPECIFICATION

All items shall be treated with anti- corrosive epoxy based paint for the ferrous metal items except for the items of SS construction, which shall not be painted.

Note: Refer General Technical specification for details of painting.



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**ANNEXURE-I
LIST OF MAKES**

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



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

NOTE:

1. THE SUB VENDOR LIST ABOVE IS INDICATIVE ONLY AND IS SUBJECT TO BHEL AND CUSTOMER APPROVAL DURING DETAILED ENGINEERING STAGE WITHOUT ANY COMMERCIAL & DELIVERY IMPLICATION TO BHEL.

BIDDER TO PROPOSE SUB VENDOR WITHIN 4 WEEKS OF PLACEMENT OF LOI. THEREAFTER NO REQUEST FOR ADDITIONAL SUB-VENDOR SHALL BE ENTERTAINED.

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



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ANNEXURE-II
MANDATORY SPARES



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ANNEXURE-II
List of Mandatory Spares for elevator.

One (01) set of list of Mandatory Spares for FGD Control building shall be provided.

List of Mandatory spares for FGD Control building Elevator.

Sl. No.	Description	Quantity (Units)
1	Friction block	2 nos. each type
2	Guide roller of each type of type	20% of total population or 3 no's of each type whichever is higher
3	Contactors of each type	2 nos. of each type & rating
4	Control transformer	1 no. of each type & rating
5	Time Device	2 nos. of each type
6	Rectifiers	2 nos. of each type & rating
7	Over current relay	2 nos. of each type
8	Auxiliary Relay	2 nos. of each type
9	Resistor	20% of total population or 3 no's of each type whichever is higher
10	Fuses-of replacement	20% of total population or 3 no's of each type whichever is higher
11	Limit Switches of each type	3 nos. of each type
12	Push Button	2 nos. of each type
13	Contact Device	2 nos. of each type
14	Brake motor	2 nos. of each type
15	Transmitters	2 nos. of each type
16	Switches of each Type	2 nos.
17	Receiver	3 nos. of each type
18	Bearings of each Type & size	2 nos.
19	Roller of each type	2 nos.
20	Bushing (for door front)	2 sets
21	Brake	
	Fans	2 nos.
	Brake pads	2 sets
	Brake discs	2 sets
	Magnetic coil	2 sets
22	Worm gear spares	
	a) O rings	3 Sets.
	b) Sealing rings of each type	3 Sets.
23	Pinion	2 nos. of each type
24	Elevator motor with VVVF System	1 no. of each type & rating
24.1	End Shield Cover Driving & Non-Driving End (as applicable)	1 set for each type and rating of Motor
24.2	Heaters (as applicable)	2 sets for each type and rating of motor
24.3	Bearings (DE and NDE) for each type and rating of motor (as applicable)	2 sets
24.4	Cooling Fan for all type and rating of LT motors (as applicable)	One (1) set
24.5	Dust seals and gaskets for each type of motors (as applicable)	1 Set

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24.6	Motor Terminal Block (as applicable)	1 set for each type and rating of Motor
24.7	Complete Set of Coupling (as applicable)	1 set for each type and rating

Note:

- a) Mandatory spares listed above is bare minimum requirement. In case any additional mandatory spares requirement is covered elsewhere in the tender specification apart from specified above, same shall be deemed to have been covered in bidder's scope of supply.
- b) Unless stated otherwise, a 'set' means item or sub-items required for each type/ size, range of assembly/ sub- assembly required for complete replacement in one equipment system; it is further intended that the assembly/ sub-assembly which have different orientation (like left hand or right hand, top or bottom), different direction of rotation or mirror image positioning or any other reasons which result in marinating two different sets of spares to be used for subject assembly/ sub assembly, these shall be considered as different type of assembly/ sub assembly.
- c) Wherever quantity has been specified as percentage (%), the quantity of mandatory spares to be provided by the vendor shall be the specified percentage (%) of total population required to meet the specification requirements. In case the quantity of mandatory spares so calculated happens to be in fraction, the same shall be rounded off to next higher whole number.
- d) Wherever the quantities have been indicated for each type, size, thickness, material, radius, range etc, these shall cover all the items supplied and installed and the breakup of these shall be furnished by the vendor during detail engineering.
- e) In case spares indicated in the list are not applicable to the particular design offered by the bidder, the bidder should offer spares applicable to the offered design with quantities generally in line with the approach followed in the above list.
- f) Wherever bidder has indicated an item as not applicable, the same will have to be supplied free of cost, in case it is found applicable during detail engineering.
- g) Interchangeability and Packings: All spares supplied under this contract shall be strictly interchangeable with parts for which they are intended for replacements. These spares should include all mounted accessories like components, boards, add or items, fitting, connectors etc. and be complete in all respects so that the replacement of the main items by these spares does not require any additional item. The vendors must conform the pair to pair compatibility of each electrical spares modules with the modules should be supplied in the original package. All electronic modules should be pre set and/or preprogrammed for ready use at site. Alternatively, suitable instruction sheet indicating the details of required PCB jumper position, BCD which is setting, EPROM/PROM listing etc should be packed along with each module. Also a caution mark sign should be put on all such module which needs pre setting /pre-programming before putting them in to service. The spare shall be treated and properly packed for long term storage.
- h) Identification: Each spare shall be clearly marked and labeled on the outside of the packing with its description. When more than one spare part is packed in single case, a general description of the contents shall be shown on the outside of such case and a detailed list enclosed. All cases, containers and other packages must be suitably marked and numbered for the purpose of identification.
- i) Refer additional notes at subsequent sheets (extracted out of customer specification).

REQUIREMENTS OF SPARES, TOOLS & TACKLES

1.0 Scope

This section covers the general requirements regarding the spares and tools & tackle for all the equipment and systems in the Flue Gas Desulphurisation Plant.

2.0 Mandatory Spares

The Bidder shall supply in his scope mandatory spares as listed in Annexure I of this Section.

The supply of mandatory spares shall be started with the consignments of the first unit and completed before the provisional takeover of the first unit and common facilities. However, the spares shall not be dispatched before the dispatch of the main equipment.

3.0 Tools and Tackle

1. The Contractor shall supply with the equipment one complete set of all special tools and tackles and other instruments required for the erection, assembly, disassembly and proper maintenance of the plant and equipment and systems (including software). These special tools will also include special material handling equipment, jigs and fixtures for maintenance and calibration / readjustment, checking and measurement aids etc. A list of such tools and tackles shall be submitted by the Bidder along with the offer. The price of each tool / tackle shall be furnished in Price schedule, Volume I.
2. These tools and tackles shall be separately packed and sent to site. The Contractor shall also ensure that these tools and tackles are new and not used by him during erection, commissioning and initial operation. For this period the Contractor should bring his own tools and tackles. All the tools and tackles shall be of reputed make acceptable to the Purchaser.
3. The supply of special tools and tackles shall be started with the consignment of first unit and completed before the provisional takeover of the first unit. However, the tools and tackles shall not be dispatched before the dispatch of the main equipment.

4.0 Guidelines for Mandatory Spares and Tools and Tackle

1. The bidder shall supply the mandatory spares and tools and tackles as listed in Annexure I below.
2. The bidder shall give itemized unit price for the spare parts, tools and tackles while submitting the bid. The Purchaser reserves the right to modify or delete the items/quantity of the spares/tools & tackles. The quoted price for taxes & duties, transport, insurance etc. shall get reduced proportionately to the extent of the value of ordered spares/tools and



tackles. The list of such spares/tools and tackles to be ordered by the Purchaser shall be finalized by the Purchaser before signing of the Contract.

3. In case the description / nomenclature of any of the items of spares/tools and tackles is differing from the description / nomenclature indicated in the list of mandatory spares/tools and tackles, the bidder shall offer functionally equivalent part in lieu of the listed item.
4. In case if such items of spares/tools & tackles indicated as “not applicable”, are found applicable at a later date during execution of the project, such items of spares/tools & tackles are to be supplied within the ordered cost of the mandatory spares.
5. If any of the items of spares/tools & tackles ordered is found to be not applicable during detailed engineering stage/execution stage, the bidder shall have to supply alternative items of spares/tools & tackles. The alternative items of spares/tools & tackles are to be mutually agreed between the PURCHASER and BIDDER.
6. In respect of quantity mentioned as ‘Set’ means the total quantity of all the components/items used in particular equipment unless otherwise specified.

Example-1

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

Example-2

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

7. Wherever % is indicated for the mandatory spares, the quantity shall be calculated for % of supply for total quantity for 2 units of 2 x 500 MW, unless otherwise specified
8. All relevant drawings to identify of spares/tools & tackles are to be furnished when called for by the PURCHASER

5.0 Recommended Spares

1. In addition to the spare parts mentioned above, the Contractor shall also provide a list of recommended spares for three (3) years of normal operation of the plant and indicate the list and total prices in relevant schedule. The list shall take into consideration the mandatory spares specified and should be independent of the list of the mandatory spares. The purchaser reserves the right to buy any or all of the recommended spares. The recommended spares shall be delivered at project site at least





~~two months before the scheduled date of initial operation of first unit. However, the spares shall not be dispatched before the dispatch of the main equipment.~~

- ~~2. Prices of recommended spares will not be used for evaluation of the bids. The price of these spares will remain valid up to execution of the contract. However, the Contractor shall be liable to provide necessary justification for the quoted prices for these spares if desired by the purchaser.~~

6.0 Start up and Commissioning Spares

Start up and commissioning spares are those spares which may be required during the start-up and commissioning of the equipment/system till the commercial operation of the Plant. The Contractor shall provide all such start up and commissioning spares and keep an adequate stock of the same to be brought by him to the site for the plant erection and commissioning. These must be available at site before the equipment are energized. The unused spares, if any, should be removed from there only after commercial operation of the plant. All start up spares which remain unused at the time shall remain the property of the Contractor.

7.0 General Requirements of Spares

1. The Contractor shall indicate the service expectancy period for the spares parts (both mandatory and recommended) under normal operating conditions before replacement is necessary.
2. All spares supplied under this contract shall be strictly inter-changeable with the parts for which they are intended for replacements. The spares shall be treated and packed for long storage under the climatic conditions prevailing at the site e.g. small items shall be packed in sealed transparent plastic with desiccator packs as necessary.
3. All the spares (both recommended and mandatory) shall be manufactured along with the main equipment components as a continuous operation as per same specification and quality plan.
4. The contractor will provide purchaser with cross-sectional drawings, catalogues, assembly drawings and other relevant documents so as to enable the purchaser to identify and finalise order for recommended spares.
5. Each spare part shall be clearly marked or labelled on the outside of the packing with its description. When more than one spare part is packed in a single case, a general description of the content shall be shown on the outside of such case and a detailed list enclosed. All cases, containers and other packages must be suitably marked and numbered for the purposes of identification.
6. All cases, containers or other packages are to be opened for such examination as may be considered necessary by the purchaser.
7. The Contractor will provide the purchaser with all the addresses and particulars of his sub-suppliers while placing the order on vendors for items/ components/





**Tender Specification
for
FGD Package**

**NLC Tamil Nadu Power Ltd.
2x500 MW Project
Tuticorin, Tamil Nadu**

equipment covered under Contract and will further ensure with his vendors that the purchaser, if so desires, will have the right to place order for spares directly on them on mutually agreed terms based on offers of such vendors.

8. The Contractor shall warrant that all spares supplied will be new and in accordance with the Contract documents and will be free from defects in design, material and workmanship.
9. In addition to the recommended spares listed by the Contractor, if the purchaser further identifies certain particular items of spares, the Contractor shall submit the prices and delivery quotation for such spares within 30 days of receipt of such request for consideration by the purchaser and placement of order for additional spares if the purchaser so desires.
10. The Contractor shall guarantee the long term availability of spares to the purchaser for the full life of the equipment covered in the Contract. The Contractor shall guarantee that before going out of production of spare parts of the equipment covered under the Contract, he shall give the purchaser at least 2 years advance notice so that the latter may order his bulk requirement of spares, if he so desires. The same provision will also be applicable to Sub-contractors. Further, in case of discontinuance of manufacture of any spares by the Contractor and/or his sub-contractors, Contractor will provide the purchaser, two years in advance, with full manufacturing drawings, material specifications and technical information including information on alternative equipment makes required by the purchaser for the purpose of manufacture/procurement of such items.





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ANNEXURE-III

LIST OF TOOLS AND TACKLES



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ANNEXURE-III

List of Tools & tackles for elevator.

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



TITLE:
**TECHNICAL SPECIFICATION
FOR
ELEVATOR**

SPEC. NO. PE-TS-483-502-A001

VOLUME IIB

SECTION IA

SUB-SECTION

REV. 00

DATE: JUNE-2021

SHEET 1 OF 1

ANNEXURE-IV

Drawing document submission schedule

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

Note:

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

	TITLE TECHNICAL SPECIFICATION FOR ELEVATOR	SPEC. NO. PE – TS – 483 - 502 – A001	
		VOLUME	III SECTION- IA
		S. No.	
		REV	0 DATE JUNE-2021
		SHEET	OF

ANNEXURE-V

MDL FOR ELEVATOR

S.NO.	BHEL DOC No	TITLE	PURPOSE
1	PE-V0-483-502-A001	TDS OF FGD CONTROL BUILDING ELEVATOR	A
5	PE-V0-483-502-A007	GA, M/C ROOM LAYOUT, SCOPE & BOM OF PASSENGER ELEVATOR (FGD CONTROL BUILDING)	A
9	PE-V0-483-502-A008	MQP FOR ELEVATOR (FGD CONTROL BUILDING)	A
10	PE-V0-483-502-A010	O&M MANUAL FOR ELEVATOR (FGD CONTROL BUILDING)	I
11	PE-V0-483-502-A011	WIRING DIAGRAM & POWER DISTRIBUTION SCHEMATIC (For FGD CONTROL BUILDING)	I

A= APPROVAL
I= INFORMATION

ANNEXURE-VI

Check List for Operation & Maintenance Manual

Project name :

Project number :

Package Name :

PO reference :

Document number :

Revision number :

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

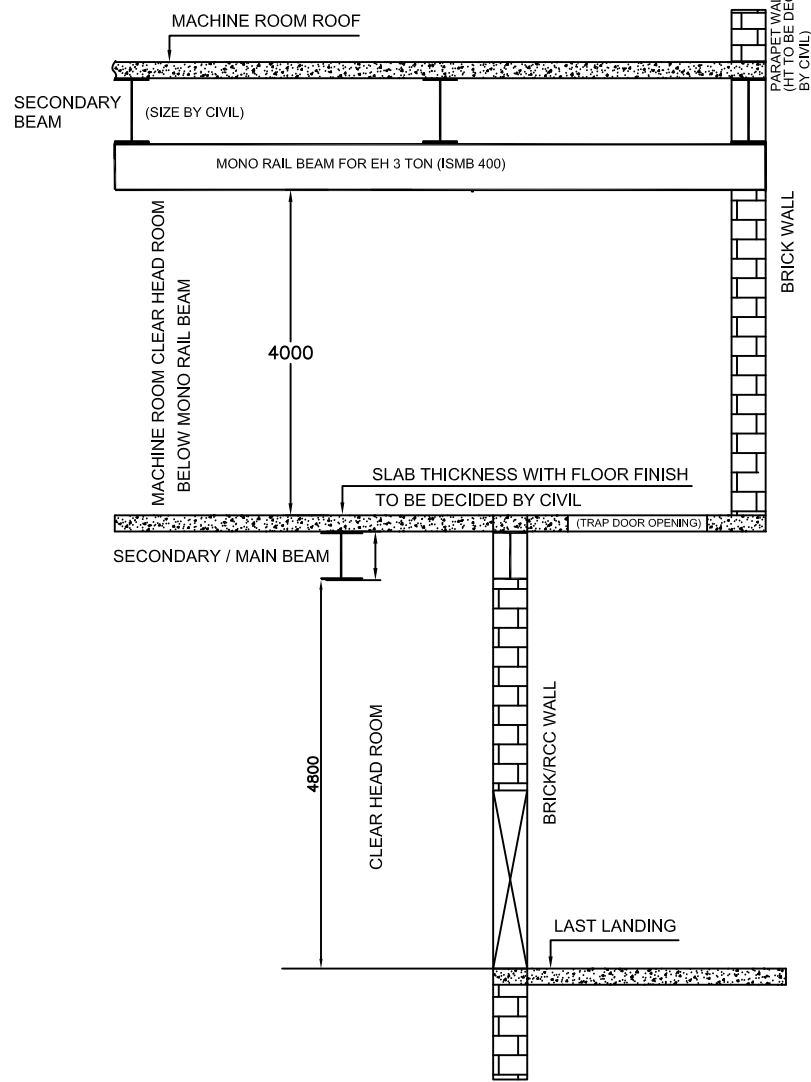
4.0	Commissioning Activities (if not covered in separate document i.e. erection manual, commissioning manual)				
4.1	Pre-Commissioning Checks				
4.2	handling of items at site				
4.3	Storage at site				
4.4	Unpacking & Installation procedure				
5.0	Operation Guidelines for plant personal/user/operator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

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

CIVIL INPUT DETAILS.

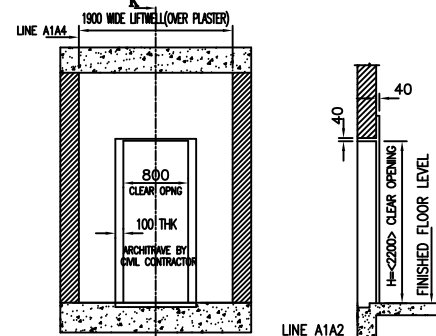
Refer attached civil input assignment drawings.

ELEVATION ON MACHINE ROOM



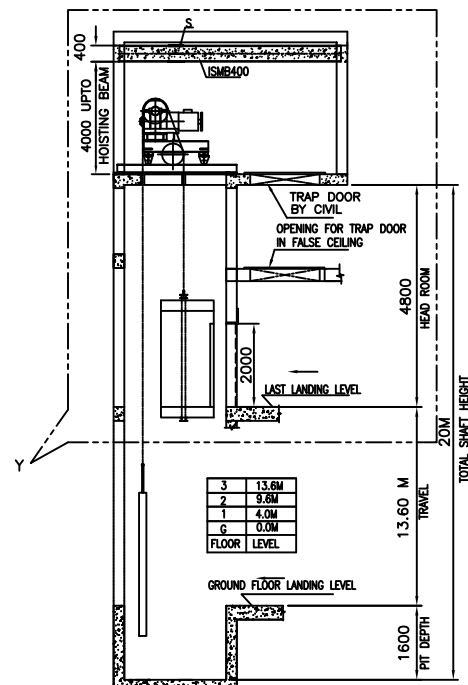
DETAIL-Y

STANDARD DETAILS OF SHAFT



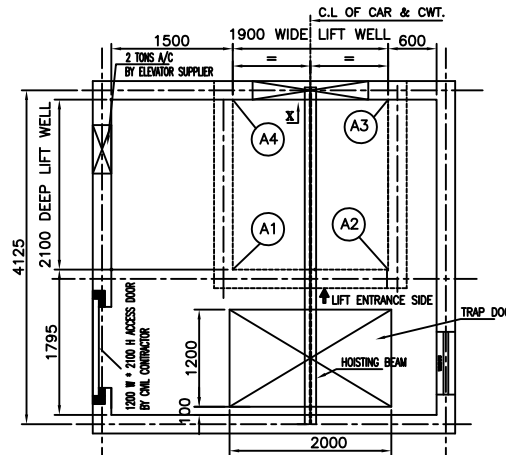
LANDING ENTRANCE DETAIL
(VIEW FROM LIFT WELL OUTSIDE)
(TYPICAL FOR ALL FLOORS)

SECTION-KK

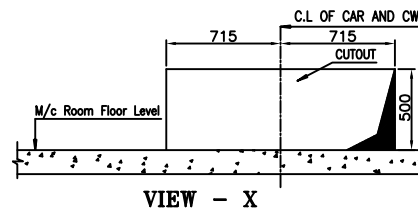


ELEVATIONAL DETAILS
(NOT FOR SCALE)

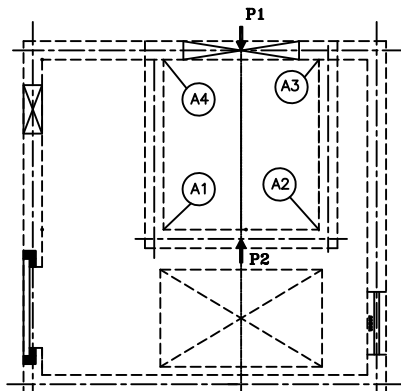
STANDARD DETAILS OF MACHINE ROOM



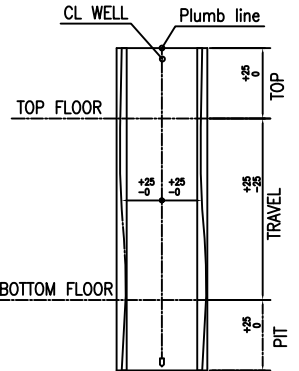
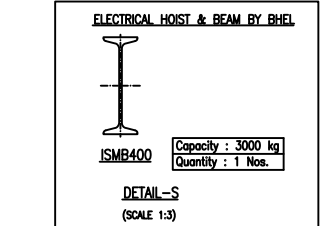
PLAN ON MACHINE ROOM



VIEW - X



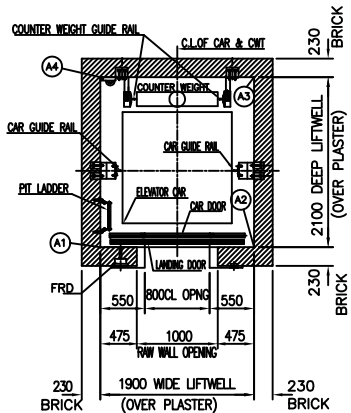
Point	Dynamic Load (Kg)
P1	15000
P2	6000



WELL TOLERANCES
(NOT FOR SCALE)

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

NOTE: ALL DIMENSIONS ARE IN MM

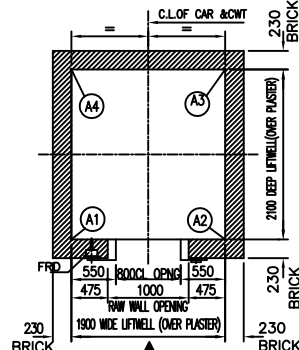


FORCES ON CAR & CWT GUIDE RAIL	
Fx	700 N
Fy	600 N
J	19000 N

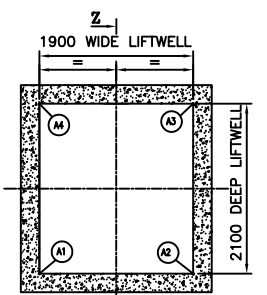
GUIDE RAIL FORCES

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

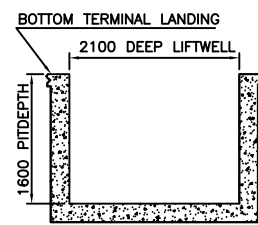
STANDARD DETAILS OF PIT



PLAN ON LIFTWELL



R.C.C DETAILS OF PIT



SECTION ZZ

REVISION NO. 483 STATUS: CONTRACT DISTRIBUTION:		NLC TAMILNADU POWER LIMITED (NTPL) DISTRIBUTION CONSULTANT PVT. LTD. 2x500 MW COAL FIRED UNITS AT TUTICORIN-FGD BHARAT HEAVY ELECTRICALS LTD. (A COMPANY OF NTPC LIMITED) POWER SECTOR PROJECT ENGINEERING MANAGEMENT NOIDA	
REV. DATE 18.06.21 18.06.21 18.06.21	ALD CHD APPD	DEPT. CODE DESK GP RR RR	NAME SIGN DATE 18.06.21 18.06.21 18.06.21
TITLE: ENGG. INPUTS DRAWING FOR 10 PASS.(680KG) ELEVATOR-FGD CONTROL ROOM BUILDING		DEPT. SCALE SIGN	
DRAWING NO. PE-DG-483-502-A001 SHEET 01 OF 01		REV. 00	

SITE STORAGE AND PRESERVATION GUIDELINES

FOR

MECHNANICAL BOPs

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



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

CONTENT

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

1. SCOPE OF THE DOCUMENT

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

2. PURPOSE OF STORAGE & PRESERVATION

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

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

a) GENERAL STORAGE REQUIREMENTS

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

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

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

b) GENERAL PRESERVATION REQUIREMENTS

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

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

c) GENERAL INSPECTION REQUIREMENTS

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

4. TYPE OF STORAGE FOR VARIOUS EQUIPMENT

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

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

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



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

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





iii Open storage (O)

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

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

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



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

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

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

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

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

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

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

5. CONCLUSION

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

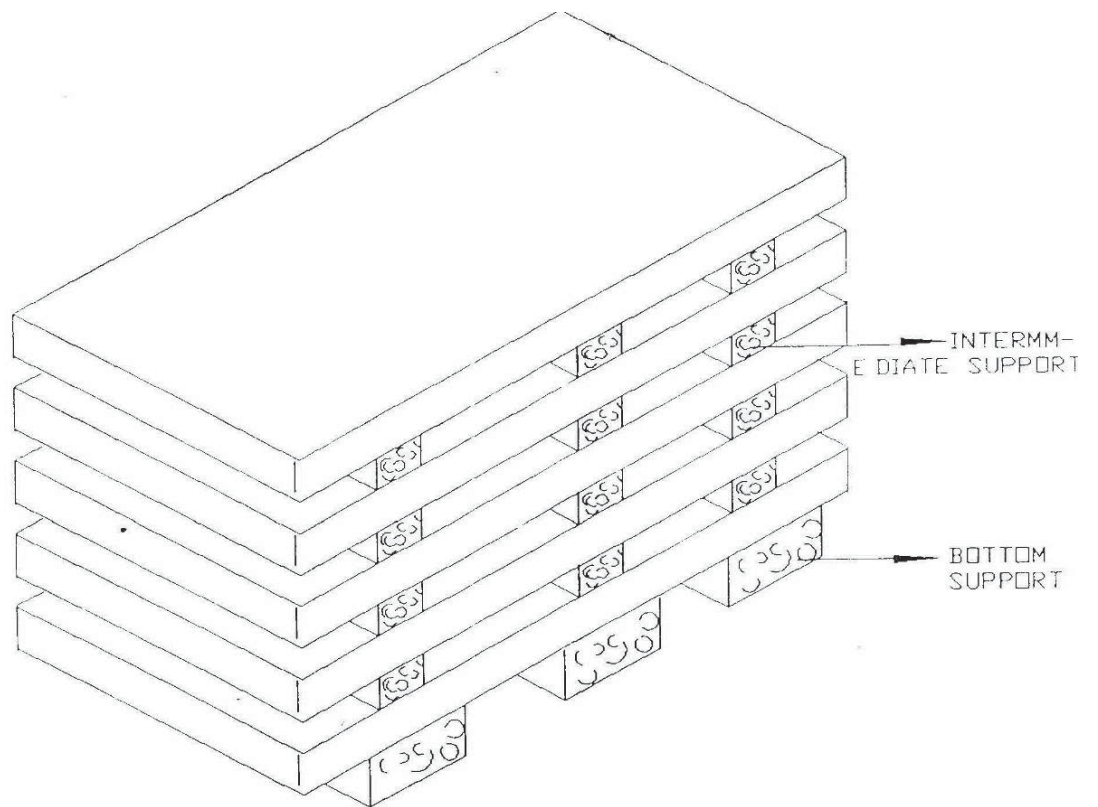


Figure – 1 – PLATE STACKING ARRANGEMENT

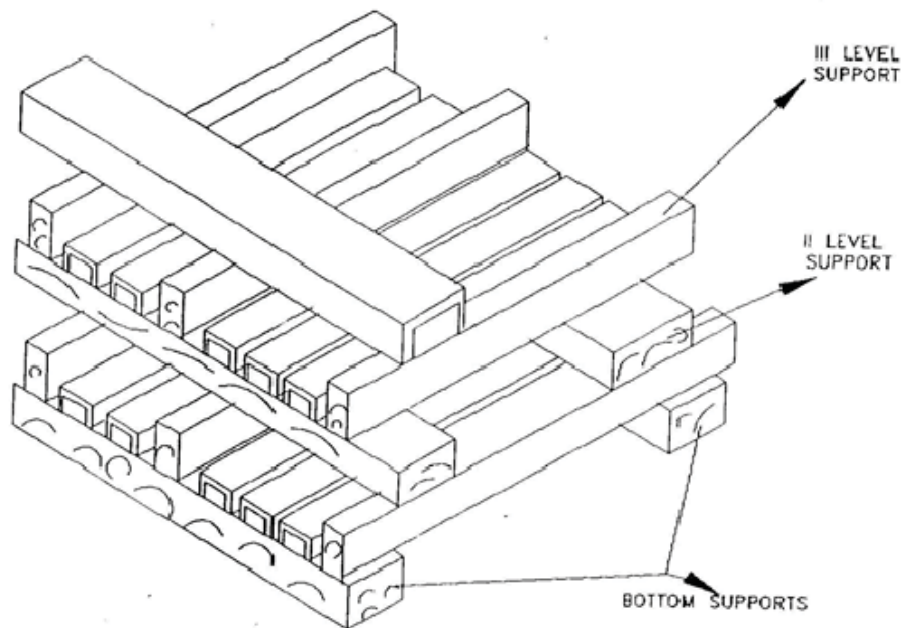


Figure – 2 – STRUCTURAL STEEL STACKING ARRANGEMENT

	TITLE TECHNICAL SPECIFICATION FOR ELEVATOR	SPECIFICATION NO. PE – TS – 483 - 502 – A001	
		VOLUME	II B
		SECTION	IB
		REV 0	DATE JUNE-2021
		SHEET	OF

SECTION –IB

SPECIFIC TECHNICAL REQUIREMENT (ELECTRICAL)

2 X 500 MW NTPL TUTICORIN FGD

TECHNICAL SPECIFICATION

ELEVATOR

(ELECTRICAL PORTION)



BHARAT HEAVY ELECTRICALS LIMITED

POWER SECTOR

PROJECT ENGINEERING MANAGEMENT

NOIDA, UP [INDIA]



TITLE :
ELECTRICAL EQUIPMENT SPECIFICATION
FOR
ELEVATOR

2x500 MW NLC Tamil Nadu Power Ltd.
Tuticorin, Tamil Nadu

SPECIFICATION NO.

VOLUME NO. : **II-B**

SECTION :

REV NO. **00** : DATE : 17.06.2021

SHEET : 1 OF 3

TECHNICAL SPECIFICATION

FOR

ELEVATOR
(ELECTRICAL PORTION)



TITLE :
ELECTRICAL EQUIPMENT SPECIFICATION
FOR
ELEVATOR

2x500 MW NLC Tamil Nadu Power Ltd.
Tuticorin, Tamil Nadu

SPECIFICATION NO.

VOLUME NO. : **II-B**

SECTION :

REV NO. **00** : DATE : 17.06.2021

SHEET : 2 OF 3

1.0 EQUIPMENT & SERVICES TO BE PROVIDED BY BIDDER:

- a) Services and equipment as per “Electrical Scope between BHEL and Vendor”.
- b) Any item/work either supply of equipment or erection material which have not been specifically mentioned but are necessary to complete the work for trouble free and efficient operation of the plant shall be deemed to be included within the scope of this specification. The same shall be provided by the bidder without any extra charge.
- c) Supply of mandatory spares as specified in the specifications of mechanical equipments.
- d) Electrical load requirement for ELEVATOR .
- e) All equipment shall be suitable for the power supply fault levels and other climatic conditions mentioned in the enclosed project information.
- f) Bidder to furnish list of makes for each equipment at contract stage, which shall be subject to customer/BHEL approval without any commercial and delivery implications to BHEL
- g) Various drawings, data sheets as per required format, Quality plans, calculations, test reports, test certificates, operation and maintenance manuals etc shall be furnished as specified at contract stage. All documents shall be subject to customer/BHEL approval without any commercial implication to BHEL.
- h) Motor shall meet minimum requirement of motor specification.
- i) Vendor to clearly indicate equipment locations and local routing lengths in their cable listing furnished to BHEL.

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

Refer “Electrical Scope between BHEL and Vendor”.

3.0 DOCUMENTS TO BE SUBMITTED ALONG WITH BID

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

	TITLE : ELECTRICAL EQUIPMENT SPECIFICATION FOR ELEVATOR 2x500 MW NLC Tamil Nadu Power Ltd. Tuticorin, Tamil Nadu	SPECIFICATION NO.
		VOLUME NO. : II-B
		SECTION :
		REV NO. 00 : DATE : 17.06.2021
		SHEET : 3 OF 3

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

4.0 List of enclosures :

- a) Electrical scope between BHEL & vendor
- b) Customer specification for Motors
- c) Customer cabling spec (to be referred by vendor for their scope of work (as per Electrical scope between BHEL & vendor)).
- d) Quality plan for motors & Customer quality assurance plan format
- e) Datasheet A and C for LT Motors (Annexure-I)
- f) Electrical Load data format (Annexure –II)
- g) BHEL cable listing format (Annexure –III)

STANDARD ELECTRICAL SCOPE BETWEEN BHEL AND VENDOR

PACKAGE: ELEVATORS

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

PROJECT : 2x500 MW NLC Tamil Nadu Power Ltd

<u>S. NO</u>	<u>DETAILS</u>	<u>SCOPE SUPPLY</u>	<u>SCOPE E&C</u>	<u>REMARKS</u>
1	Isolating Switch	Vendor	Vendor	BHEL will provide two number 415 V (3ph, 4W) supply feeder only up to isolating switches for elevators. Any other voltage level (AC/DC) required will be derived by the vendor. Motor starter shall be part of elevator control panel.
2	Power cables, control cables, screened control cables and any special cables (if required) between equipment supplied by vendor.		Vendor	Cable from supply feeder to isolating switch shall be in BHEL scope.
3	Cabling material (cable trays, accessories, cable tray supporting system, conduits etc).	Vendor	Vendor	
4	Equipment Earthing	Vendor	Vendor	All equipment metallic enclosures / frames, metal structure etc. shall be grounded at two points each to the nearest grounding points / risers provided by BHEL.
5	Motors	Vendor	Vendor	
6	Cable glands and lugs for equipment supplied by vendor	Vendor	Vendor	1. Double compression Ni-Cr plated brass cable glands 2. Solder less crimping type heavy duty tinned copper lugs for power & control cables.
7	a) Input cable schedules (C & I) b) Cable interconnection details for above c) Cable block diagram	Vendor Vendor Vendor	- - -	Cable listing for Control and Instrumentation Cable in enclosed excel format shall be submitted by vendor during detailed engineering stage.
8	Equipment layout drawings	Vendor	-	
9	Electrical Equipment GA drawing	Vendor	-	For necessary interface review.

Make of all electrical equipment/ items supplied shall be reputed make & shall be subject to approval of BHEL/customer after award of contract.

2x500 MW NLC Tamil Nadu Power Ltd. Tuticorin, Tamil Nadu

A.C. & D.C. MOTORS

1.00.00SCOPE

- 1.01.0 This specification covers the general requirements of the electric motors for Limestone based flue gas de-sulphurisation system.
- 1.02.00Motors shall be furnished in accordance with both this general specification and the accompanying driven equipment specification.
- 1.03.00 In case of any discrepancy, the driven equipment specification shall govern.
- 1.04.00 Recommended spare parts for three (3) years operation in addition to mandatory spares

2.00.00CODES & STANDARDS

- 2.01.00All motors shall conform to the latest applicable IS, IEC and CBIP Standards/Publications except when otherwise stated herein or in the driven equipment specification.
- 2.02.00 Equipment and materials conforming to any other standard, which ensures equal or better quality may be accepted. In such case, copies of the English version of the standard adopted shall be submitted along with the bid.

3.00.00SERVICE CONDITIONS

- 3.01.00The motors shall be installed in hot, humid and tropical atmosphere, highly polluted area.
- 3.02.00 Unless otherwise noted, electrical equipment/system design shall be based on the service conditions and auxiliary power supply given in the annexure to this specification.
- 3.03.00 For motor installed outdoor and exposed to direct sunrays, the effect of solar heat shall be considered in the determination of the design ambient temperature.

4.00.00 TYPE AND RATING

4.01.00A.C. Motors

- 4.01.01 Motors shall be general purpose, constant speed, squirrel cage, three/single phase, induction type.
- 4.01.02All motors shall be either totally enclosed fan cooled (TEFC) or totally enclosed tube ventilated (TETV) or closed air circuit air cooled (CACA) or closed air water

2x500 MW NLC Tamil Nadu Power Ltd. Tuticorin, Tamil Nadu

cooled (CACW) type. Temperature rise shall be limited to 70 deg C by resistance method for class F insulation.

- 4.01.03 All motors shall be rated for continuous duty (S1). They shall also be suitable for long period of inactivity.
- 4.01.04 All LT motor shall conform to minimum efficiency performance standards (MEPS) of IE3 mentioned in IS: 12615. All HT motors shall have efficiency and power factor higher than 90% and 0.83 power factor respectively.
- 4.01.05 The motor name plate rating at 50°C shall have at least 15% margin for LT system and 10% margin for HT system, over the input power requirement of the driven equipment at rated duty point and also covering the maximum load demand of the driven equipment under entire operating range, including voltage and frequency variations, unless stated otherwise in driven equipment specification or in general electrical specification.
- 4.01.06 The motor characteristics shall match the requirements of the driven equipment so that adequate starting, accelerating, pull up, break down and full load torques are available for the intended service. The direction of rotation of motor and its cooling fan should be properly matched with the driven equipment.

4.02.00 AC motor for VFD application

- 4.02.01 Inverter duty motors are designed according to the requirements of IEC/TS- 60034 part 17 & part 25 or NEMA MG-1, Part-30, Part 31 and have performance characteristics match with the driven equipment and variable speed requirement.
- 4.02.02 Induction motors to be operated in adjustable-speed drive applications should be de-rated as per NEMA/IEC standard due to the reduction in cooling resulting from any reduction in operating speed and the effect of additional losses introduced by harmonics generated by the control.
- 4.02.03 Inverter duty motors shall have VPI/improved insulation systems that do not degrade readily due to transient voltage spikes and have an adequate thermal margin.
- 4.02.04 Inverter duty motors shall be self-ventilated without any auxiliary blower. Force ventilation shall be subject to purchaser approval.
- 4.02.05 Inverter motor shall be suitable for scalar (open loop) control, without any speed feedback signal, where fast response is not required. Vector (closed loop) control will be used with encoder if specified.
- 4.02.06 The breakdown torque at any frequency within the defined frequency range shall be not less than 150% of the rated torque at that frequency when rated voltage for that frequency is applied.
- 4.02.07 The motor should be capable of producing a breakaway torque of at least 140% of rated torque requiring not more than 150% rated current when the voltage

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boost is adjusted to develop rated flux in the motor and when the inverter is able to produce the required minimum fundamental frequencies.

4.02.08 The motor shall be provided with insulated bearing on one side.

4.02.09 Normally the maximum safe speed shall be as per IEC/NEMA, however it should be co-ordinated with VSD requirement.

4.02.10 In case of a conflict, the requirement mentioned under clause no. 4.02.00 for motors for VFD application shall supersede the corresponding requirement for standard motors.

4.03.00 D.C. Motors (If applicable)

4.03.01 D.C. motor provided for emergency service shall be shunt wound type. It can also be of compound-wound type with the series field shorted.

4.03.02 Motor shall be sized for operation with fixed resistance starter for maximum reliability. Starter panel complete with all accessories shall be included in the scope of supply.

5.00.00 PERFORMANCE

5.01.00 Running Requirements

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

5.01.02 The motor shall be capable of operating satisfactorily at full load for 5 minutes without injurious heating with 75% rated voltage at motor terminals. The mill motors shall be suitable for operating at 75% of rated voltage for one (1) minute

5.02.00 Starting Requirements

5.02.01 Motor shall be designed for direct on line starting at full voltage. Starting current shall not exceed 600% of full load current (subject to IS tolerance of 20%) for HT motors rated upto 1000kW. For HT motors above 1000kW upto 3000kW starting current shall not exceed 600% of full load current without any positive tolerance. For HT motors above 3000kW starting current shall not exceed 450% of full load current without any positive tolerance.

For LT motors the starting current shall be as per the limit mentioned in the relevant standard with IE-3 efficiency class. For D.C. Motors the starting current shall be limited to 2 times full load current.

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

5.02.03 All motors (except mill motors) shall start with rated load and accelerate to full speed with 80% rated voltage at motor terminals. Mill motors shall start with rated load and accelerate to full speed with 85% of rated voltage.

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

Cold Motor Starting

Under specified voltage variations two (2) starts in quick succession and third start five (5) minutes thereafter, all with full load (including loaded equipment) of driven equipment. No additional start shall be made till lapse of further thirty (30) minutes.

(b) Hot Motor Starting

Under specified voltage variations, one (1) immediate and two (2) fifteen (15) minutes interval starts all with full load (including loaded equipment) of driven equipment. No additional start shall be made till lapse of further thirty (30) minutes.

(c) Motor shall also be suitable for three (3) equally spread starts per hour when the motor is under normal service condition.

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

5.03.00 Stress During Bus Transfer

5.03.01 Motors subjected to bus transfer shall be suitable for sudden application of 150% rated voltage during bus transfer, due to the phase difference between the incoming voltage and motor residual voltage.

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

5.04.00 Locked Rotor Withstand Time

5.04.01 For motors with starting time up to 20 secs, starting time at minimum permissible voltage should be less than the locked rotor withstand time under hot condition at highest voltage limit by at least 2.5 secs.

For motors with starting time more than 20 secs. and upto 45 secs, starting time at minimum permissible voltage should be less than the locked rotor withstand time under hot condition at highest voltage limit by at least 5 secs.

For motors with starting time more than 45 secs, starting time at minimum permissible voltage should be less than the locked rotor withstand time under hot condition at highest voltage limit by at least 10% of the starting time.

5.04.02 To prevent unwanted tripping of a high inertia load at start-up, there may be need to shunt out the motor's overload trip device. Speed switches mounted

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on the motor shaft may be provided in such case. Heating experienced during start-up must still be considered when sizing the motor.

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

5.05.00 Torque Requirements

5.05.01 Accelerating torque at any speed with the lowest permissible starting voltage shall be at least 10% motor full load torque.

5.05.02 Pull out torque at rated voltage shall not be less than 205% of full load torque.

6.00.00 SPECIFIC REQUIREMENTS

6.01.00 Enclosure

6.01.01 All motor enclosures and terminal boxes shall conform to the degree of protection IP-55 unless otherwise specified. Motor for outdoor or semi-outdoor service shall be of weather-proof construction.

Motors, located inside a building and not directly exposed to coal dust or fly ash, could have screen protected drip proof enclosure conforming to IP-23.

6.01.02 Motor located in hazardous area shall have flameproof enclosure conforming to IS: 2148 /Equiv.

6.03.00 Cooling

6.03.01 The motor shall be self ventilated type, either totally enclosed fan cooled (TEFC) or closed air circuit air- cooled (CACA).

6.03.02 For large capacity motors, totally enclosed tube ventilated (TETV) may be considered for acceptance. In case of motors rated 3000kW and above, closed air circuit water cooled (CACW) motors may be offered for consideration before proceeding with design and manufacturing.

6.04.00 Winding and Insulation

6.04.01 All insulated winding shall be of copper.

6.04.02 HT and LT motors shall have Class F insulation with winding temperature limited to 120°C. Windings shall be impregnated to make them non-hygroscopic and oil resistant. The lightning impulse and coil inter-turn insulation surge withstand level shall be as per IEC-60034 – Part 15.

6.05.00 Tropical Protection

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

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6.05.02 All fittings and hardwares shall be corrosion resistant.

6.06.00 Bearings

6.06.01 Motor rated above 1000kW shall have insulated bearings to prevent flow of shaft currents.

6.06.02 Vertical shaft motors shall be provided with thrust and guide bearings.

6.07.00 Noise & Vibration

6.07.01 The noise level shall not exceed 85 db (A) at 1.0 meters from the motor.

6.07.02 Peak amplitude of vibration shall be limited within the values prescribed in IS: 12075 / IEC 60034-14.

6.08.00 Motor Terminal Box

6.08.01 Motor terminal box shall be detachable type, made of cast iron or pressed steel and located in accordance with Indian Standards clearing the motor base-plate / foundation.

6.08.02 Terminal box shall be capable of being turned 360 Deg. in steps of 90 Deg., unless otherwise approved.

6.08.03 The terminal box shall be split type with removable cover with access to connections and shall have the same degree of protection as motor. Terminal box for all LT motors shall be diagonally split type.

6.08.04 The terminal box shall have sufficient space inside for termination / connection of XLPE (11000V/3300V) or XLPE (415V) insulated armoured aluminium cables. Where the specified main cable size demands, adopter / extension box of suitable size shall be provided as a part integral to the motor, for easy termination of the cable.

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

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

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

6.08.08 For 11000V and 3300V motor, the terminal box shall be phase-segregated type. The neutral leads shall be brought out in a separate terminal box (not necessarily phase segregated type) with shorting links for star connection.

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

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

6.08.11 Motors rated 1000kW and above shall be provided with neutral current transformers of PS class on each phase in a separate neutral terminal box for differential protection.

6.09.00 Grounding

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

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

Motor above 90KW	:	50 x 6 mm GS Flat
Motor above 30KW up to 90KW	:	25 x 6 mm GS Flat
Motor above 5KW up to 30KW	:	25 x 3 mm GS Flat
Motor up to 5KW	:	8 SWG GI Wire

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

6.10.00 Rating Plate

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

- Temperature rise in Deg.C under rated condition and method of measurement.
- Degree of protection (IP No.).
- Bearing identification no. and recommended lubricant.
- Location of insulated bearings.

7.00.00 ACCESSORIES

7.01.00 General

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

7.02.00 Space Heater

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

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

7.03.00 Temperature Detectors

7.03.01 All 11000V and 3300V motors shall be provided with minimum four (4) numbers simplex or two (2) numbers duplex platinum resistance type winding temperature detectors per phase.

7.03.02 11000V and 3300V motor bearing shall be provided with one (1) duplex or two (2) simplex type temperature detectors.

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

Leads of all duplex or simplex type motor winding RTDs and motor bearing RTDs shall be wired up to respective switchgear metering & protection compartment. From which one set of RTDs shall be connected to numerical protection relay and another set shall be kept free for DDCMIS connectivity.

7.04.00 Indicator/Switch

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

- a) 11000V and 3300V motor bearing temperature.
- b) Hot and cold air temperature of the closed air circuit for CACA and CACW motor.

7.04.02 Flow switches shall be provided for monitoring cooling water flow of CACW motor and oil flow of forced lubrication bearing, if used.

7.04.03 Alarm switch contact rating shall be minimum 0.5A at 220V D.C. and 5A at 240V A.C.

7.05.00 Current Transformer for Differential Protection

7.05.01 Motor above and including 1000KW shall be provided with three differential current transformers (PS class) mounted over the neutral leads within the enclosure. Loose three (3) numbers matching PS class CT shall be supplied for mounting on switchgear.

7.05.02 The arrangement shall be such as to permit easy access for C.T. testing and replacement. Current transformer characteristics shall match with the requirements of differential protection relay.

7.06.00 Accessory Terminal Box

7.06.01 All accessory equipment such as space heater, temperature detector, current transformers etc., shall be wired to and terminated in terminal boxes, separate from and independent of motor (power) terminal box.

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

7.07.00 **Drain Plug**

Motor shall have drain plugs so located that they shall drain the water, resulting from the condensation or other causes from all pockets of the motor casing.

7.08.00 **Lifting Provisions**

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

7.09.00 **Dowel Pins**

The motor shall be designed to permit easy access for drilling holes through motor feet or mounting flange for installation of dowel pins after assembling the motor and driven equipment.

7.10.00 **Painting**

Motor including fan shall be painted with corrosion proof paints.

8.00.00 TESTS

8.01.00 Upon completion, each motor shall be subject to standard routine tests as per IS. In addition, any special test called for in the driven equipment specification shall be performed.

8.02.00 Unless and otherwise stated, Six (6) copies of routine test certificates shall be submitted for approval prior to the dispatch of the motors from works.

8.03.00 The following type test reports shall be submitted for each type and rating of 11 kV & 3.3 kV motor:

- a) Degree of protection test for the enclosure followed by IR, HV and no load run test.
- b) Fault level withstand test for each type of terminal box.
- c) Lightning impulse withstand test on the sample coil as per IEC 60034, part-15.
- d) Surge withstand test on inter-turn insulation as per clause no. 5.1.2 of IEC 60034, part-15.

SPARES

Recommended spares for three (3) years operation shall be quoted along with the bid clearly identifying the part numbers with recommended quantities.

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09.00.00 DRAWINGS, DATA & MANUALS

Drawings, data & manuals for the motors shall be submitted as indicated below:

09.01.00 Along with the bid

- a) List of the motors
- b) Individual motor data sheet as per format of the proposal data sheets.
- c) Scheme & write up on forced lubrication system, if any
- d) Type test report

09.02.00 After Award of the Contract

- a) Dimensional General Arrangement drawing
- b) Foundation Plan & Loading
- c) Cable end box details
- d) Space requirement for rotor removal
- e) Thermal withstand curves hot & cold
- f) Starting and speed torque characteristics at 80% & 100% voltage
- g) Complete motor data
- h) Erection & Maintenance Manual
- i) Efficiency curves.
- j) List of motors.
- k) Test reports

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DESIGN DATA

1.0 SERVICE CONDITIONS

Refer Vol-IIA of Specification for FGD package.

2.0 AUXILIARY POWER SUPPLY

Supply	Description	Consumer
H.T. Supply	11000V, 3Ø, 3W, 50 Hz, non-effectively earthed. Fault level 40kA symm. for 3sec	Motors above 750kW
	3.3kV, 3Ø, 3W, 50 Hz, non-effectively earthed. Fault level 40kA symm for 3sec	Motors above 160kW up to & including 750kW
L.T. Supply	415V, 3Ø, 3W, 50 Hz, effectively earthed. Fault level 50kA symm for 1sec	Motors above 200W upto 160 kW
	240V, 1Ø, 2W, 50 Hz, effectively earthed.	Motors less than 200W, Lighting, space heating, A.C. control & protective devices
D.C. Supply	220V, 2W, unearthed. Fault level 25*kA for 1sec	D.C. alarm, control & protective devices

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

3.0 RANGE OF VARIATION

A.C. Supply

Voltage: $\pm 10\%$ Frequency: $\pm 5\%$

Combined Volt & frequency: 10%(absolute sum)

D.C. Supply

Voltage: (+10% to -15%)

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SCHEDULE OF PRE-COMMISSIONING TESTS OF ~~TRANSFORMER & ELECTRICAL EQUIPMENT~~

1.	Power Transformer	
	Pre-commissioning Tests	
a.	The following test shall be carried out a site as minimum requirements before energizing of a transformer. All tests which may not have been specifically mentioned here but necessary for commissioning and any tests, which have been specifically asked for by the purchaser shall be done by Bidder at no extra cost:	
b.	IR test on each winding to ground and between windings	
c.	Turns ratio test on each tap	
d.	Polarity and vector group test	
e.	Measurement of winding resistance of HV & LV windings for all taps by Kelvin bridge	
f.	IR, wiring and operational tests on all control devices in control cabinet, oil level indicator, winding and oil temp. indicators, cooling fan etc.	
g.	Checking of earthing with respect to transformer tank (flexible from top cover to tank) other parts, neutral and tank to electrodes of Las (for Las located near to transformer)	
h.	Testing of buchholz relay for alarm and trip conditions	
i.	For bushing CTs, tests applicable shall be as for current transformers.	
j.	Setting of oil/winding temperature indicators, level gauge and checking of alarm/trip circuits.	

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9.	AC Motors (including slip rings motor)	
a	IR test of stator and rotor windings.	
b	Heating of both windings upto the permissible temp. limit from heating curve (only for HT motors).	
c	Ensure that checking / testing of associated switchboard, cables, relays / meter interlockings as mentioned in relevant chapters are completed.	
d	Check tightness of cable connection.	
e	Winding resistance measurement of stator and rotor.	
f	Checking continuity of winding.	
g	Check tightness of earth connections.	
h	Check space heaters and carryout heating of winding (if required).	
i.	Check direction of rotation in decoupled condition during kick start.	
j	Measure no load current for all phases.	
k	Measurement of temperature of body during No-load and load conditions.	
l	Check for tripping of motor from local / remote switches and from electrical / technological protection including differential protection.	
m	Checking of vibration (if required)	
n	Checking of noise level (if required).	
o	During load running, measurement of stator and bearing temperatures (if applicable) for every half an hour interval till saturation comes.	
p	Checking tightness of foundation bolts.	

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q	Check operation of speed switch (if there).	
r	Check continuity of temp. detectors.	
s	Check alignment, paralleling of shafts, level of lubricating oil etc. as per manufacturer's manual.	
t	Check contact of slip ring brush and measure brush pressure (150-200 gm/sq.cm).	
u	For CACW drive check cooling water and system / piping, availability of pressure cleaning and pressure testing of pipelines etc.	
v	Check for polarisation index of stator windings R10 / R1 by motorised megger. (The value should not be less than 2.0). R60/R10 absorption coefficient shall not be less than 1.5	
w	Dielectric test (only for HT motors).	
X	Measurement of open circuit rotor winding voltage for slip ring motor.	
10	Motors (DC) If required	
a	IR measurement and heating the winding as per heating curve.	
b	Check for earth connection.	
c	Winding resistance for field and armature.	
d.	Check running of drive at minimum and maximum specified voltage.	
e	Check auto start of drive on failure of AC supply (if applicable).	
f	Check operation of overload relay.	

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g	Measure vibration.	
h	Check temperature rise on body of drive after required period of continuous running.	
i	Measure load currents and no load currents (if possible).	
j.	Check direction of rotation.	
k.	Check continuity of winding.	
l	Measurement of RPM.	
11	For actuator drives following shall be checked / tested.	
a	Visual and dimensional	
b	Hydraulic pressure for valves	
c	IR and operation of limit switches	
d	Winding resistance	
12	CRANE/HOIST	
a	Check IR of all drives, panels and other equipment	
b	Check & clean surface of shop leads(if there)	
C	Check earthing system and earthing of all metallic part	
d	Measurement of no load and load currents for all drives	
e	Observations on speed of hoisting/lowering for main and aux.hoists & brake.	
f	Measurement of deflection at full load and as per mechanical requirement at overload for main hoist.	
g	Checking for operations of all limit switches	



TITLE :
GENERAL TECHNICAL REQUIREMENTS

FOR

LV MOTORS

SPECIFICATION NO.
PE-SS-999-506-E101
VOLUME NO. : **II-B**
SECTION : **D**
REV NO. : **00** DATE : 29/08/2005
SHEET : 1 OF 1

GENERAL TECHNICAL REQUIREMENTS

FOR

LV MOTORS

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

	TITLE : GENERAL TECHNICAL REQUIREMENTS FOR LV MOTORS	SPECIFICATION NO. PE-SS-999-506-E101
		VOLUME NO. : II-B
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1.0 INTENT OF SPECIFICATION

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

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

2.0 CODES AND STANDARDS

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

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

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

3.0 DESIGN REQUIREMENTS

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

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

3.3 Starting Requirements

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

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



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

3.3.3 The following frequency of starts shall apply

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

3.4 **Running Requirements**

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

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

3.5 **Stress During bus Transfer**

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

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

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

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

4.0 **CONSTRUCTIONAL FEATURES**

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

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

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

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



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

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

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4.9.1 Motors provided for similar drives shall be interchangeable.

4.9.2 Suitable foundation bolts are to be supplied alongwith the motors.

4.9.3 Motors shall be provided with eye bolts, or other means to facilitate safe lifting if the weight is 20Kgs. and above.

4.9.4 Necessary fitments and accessories shall be provided on motors in accordance with the latest Indian Electricity rules 1956.

4.9.5 All motors rated above 30 kW shall be provided with space heaters to maintain the motor internal air temperature above the dew point. Unless otherwise specified, space heaters shall be suitable for a supply of 240V AC, single phase, 50 Hz.

4.9.6 Name plate with all particulars as per IS: 325 shall be provided

4.9.7 Unless otherwise specified, the colour of finish shall be grey to Shade No. 631 and 632 as per IS:5 for motors installed indoor and outdoor respectively. The paint shall be epoxy based and shall be suitable for withstanding specified site conditions.

5.0 **INSPECTION AND TESTING**

5.1 All materials, components and equipments covered under this specification shall be procured, manufactured, as per the BHEL standard quality plan No. PED-506-00-Q-006/0 and PED-506-00-Q-007/2 enclosed with this specification and which shall be complied.

5.2 LV motors of type-tested design shall be provided. Valid type test reports not more than 5 year shall be furnished. In the absence of these, type tests shall have to be conducted by manufacturer without any commercial implication to purchaser.

5.3 All motors shall be subjected to routine tests as per IS: 325 and as per BHEL standard quality plan.

5.4 Motors shall also be subjected to additional tests, if any, as mentioned in Data Sheet A.

6.0 **DRAWINGS TO BE SUBMITTED AFTER AWARD OF CONTRACT**

a) OGA drawing showing the position of terminal boxes, earthing connections etc.

b) Arrangement drawing of terminal boxes.

c) Characteristic curves:
(To be given for motor above 55 kW unless otherwise specified in Data Sheet).

i) Current vs. time at rated voltage and minimum starting voltage.

ii) Speed vs. time at rated voltage and minimum starting voltage.

iii) Torque vs. speed at rated voltage and minimum voltage.
For the motors with solid coupling the above curves i), ii), iii) to be furnished for the motors coupled with driven equipment. In case motor is coupled with mechanical equipment by fluid coupling, the above curves shall be furnished with and without coupling.

iv) Thermal withstand curve under hot and cold conditions at rated voltage and max. permissible voltage.

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CABLES

CABLES

1.00.00 SCOPE OF SUPPLY

1.01.00 Power and Control Cables shall cover the entire requirement of FGD Package. The cables shall be furnished in accordance with this specification and Annexure.

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

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

- a) H.V. Power cables : Annexure – I
- b) L.V. Power Cables : Annexure – II
- c) Control Cables : Annexure – III
- d) Standard Cable Sizes : Annexure – IV

1.03.00 All relevant drawings, data and instruction manuals

2.00.00 CODES & STANDARDS

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

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

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

3.00.00 DESIGN CRITERIA

- 3.01.00 The Cables shall be used for connection of power and control circuits of the auxiliary electrical systems.
- 3.02.00 Cables will be generally laid on ladder type trays or drawn through rigid PVC/GI /HDPE pipe/conduits or directly buried in ground depending on layout requirement.
- 3.03.00 For continuous operation at specified rating, maximum conductor temperature shall be limited to the permissible value as per relevant standard and / or this specification which one is more stringent.
- 3.04.00 The insulation and sheath materials shall be resistant to oil, acid and alkali and shall be tough enough to withstand mechanical stresses during handling.
- 3.05.00 The outer sheath of power and control cables shall have rodent and termite repulsion treatment.
- 4.00.00 SPECIFIC REQUIREMENTS**
- 4.01.00 General Description**
- All Cables shall be furnished in strict compliance with ratings and requirements and sizes as given in Annexures to this Specification.
- 4.02.00 Drum Length and Tolerance**
- The cables shall be supplied in non-returnable packing steel drum for 3.3/11kV power cables, wooden drums for 415/240V power and control cables, each containing minimum 500meters length of larger sizes of cable unless specifically asked for. For smaller sizes of cables, each drum shall contain 1000 meters length of cable. Allowable tolerance on individual drum length is $\pm 5\%$.
- 4.03.00 Total Quantity Variation**
- Total supplied quantity shall not vary by more than $\pm 2\frac{1}{2}\%$ of total quantity for ordered length for all types of cables.
- 4.04.00 Non-Standard Length**
- Owner may accept non-standard lengths up to 5% of the total ordered quantity. However, the Bidder shall be required to obtain Owner's approval before packing the Cables on drums. Non-standard lengths shall not be less than 100 meters in any case.
- 4.05.00 Cable identification**
- Cable identification shall be provided by embossing on every meter on the outer sheath the following:
- a) Manufacturer's name or trade mark

- b) Voltage grade
- c) Year of manufacture
- d) Type of insulation, e.g. XLPE/PVC/HR85 etc.
- e) No. of core and size of cables.
- f) Type of improved fire performance, e.g. FR/FR-LSH
- g) IS number

4.06.00 **Packing**

4.06.01 Cables shall be supplied in non-returnable drums. The drums shall be of heavy construction. All wooden parts shall be manufactured from seasoned wood. All ferrous parts used shall be treated with suitable rust preventive finish or coating to avoid rusting during transit or storage.

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

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

- a) Manufacturer's name or trademark
- b) Type of cable & voltage grade
- c) Year of manufacture
- d) Type of insulation e.g. XLPE
- e) No. of core and size of cables
- f) Cable code
- g) Length of cable on drum
- h) No. of length on drum, if more than one
- i) Direction of rotation, by arrow
- j) Approx. gross mass.
- k) IS number and ISI mark

4.07.00 **Selection Criteria**

- 4.07.01 In cable sizing the following are to be taken into consideration.
- a) Short circuit current and duration
 - b) Continuous current.
 - c) Installation conditions.
 - d) Voltage drop under normal running and starting condition.
 - e) Grouping factor and laying method.
- 4.07.02 Apart from above, consideration shall also be given to limit the cable to some standard sizes instead of using too many types.
- 4.07.03 The standard cable sizes, capacities, derating factors, etc. as given in IS / IEC shall be generally followed.
- 4.07.04
- a) For breaker protected circuits minimum size shall be determined by short circuit rating and system short circuit current withstand time shall be considered as 0.2 secs. System short circuit current withstand time for Incomers and Tie feeders shall be considered as 1 sec.
 - b) For motor circuits the selection of size shall be made ensuring that the cable shall withstand a short circuit fault directly following a second hot start.
- 4.07.05 For fuse protected circuit, the conductor size shall depend on full load current subject to voltage drop not exceeding 3%. For practical purposes, the minimum size chosen is as below:
- a) Aluminium : 16 Sq. mm.
 - b) Copper : 2.5 Sq. mm.
- All drives of small rating where terminations with 16 Sq. mm. cables are not feasible, shall have copper cable.
- 4.07.06 Multicore control cables shall generally have spare conductor (s) in accordance with the following chart:

Conductors required	Cables
1 or 2	1-3/C
3 or 4	1-5/C
5 or 6	1-7/C
7 to 8	1-9/C
9 or 10	1-12/C
Above 10	Two or more of above cables

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

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

4.08.00 Selected sizes of power and control cables are given in Annexure-VI.

5.00.00 TESTS

5.01.00 Shop Tests

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

5.01.01 Routine tests on each drum of cables.

The following minimum tests shall be carried out as routine tests on each and every drum length of cable, as per IS 7098 (Part 2) / 1985, in addition to other tests.

- a) High Voltage Test

5.01.02 Acceptance Test

The following test shall be carried out as Acceptance Test in the presence of Owner's Inspecting Engineer on samples taken from the delivery lot. One drum out of every 10 number of drums or less shall be selected at random sampling basis in each lot for the Acceptance Tests which shall be carried out at manufacturer's/supplier's cost:-

- a) High Voltage Test
- b) Conductor Resistance Test
- c) Tensile / wrapping test.
- d) Partial discharge test (In screened cables).
- e) Insulation Resistance/Volume resistivity test
- f) Measurement of thickness of insulation and sheath and other dimensions
- g) Tensile strength & elongation at break for insulation & sheath.
- h) Hot set test on XLPE insulation

- i) Flammability test as per Swedish standard SS:424-15-75 Class-F-3 (Swedish Chimney test)/IS:10810
 - j) Acid gas generation test as per IEC-754-1/IS:10810.
 - k) Smoke density test as per ASTM-D-2843/1977/IS:10810
 - l) Oxygen index test as per ASTM-D 2863/1977/IS:10810
 - m) Temp. index test as per ASTM-2863/77/IS:10810
 - n) Test for Rodent and termite repulsion property
- 5.01.03 Type tests on each type of cable, size and batch inclusive of measurement of armour D.C. resistance of power cables as per relevant IS.
- 5.02.00 **Additional Tests**
- Following additional acceptance tests shall also be performed on each type of cables having outer sheath with improved fire performance (Type FRLSH):
- 5.02.01 Oxygen index test
- The Oxygen index shall not be less than 29.
- 5.02.02 Temperature Index Test
- The measured value of temperature index shall be 21 at a temperature of 250°C
- 5.02.03 Flame Retardance test on single cable and on bunched cables
- After the test, there should be no visible damages on the test specimen within 300mm from its upper end.
- After burning has ceased, the cables should be wiped clean and the charred or affected portion should not have reached a height exceeding 2.5 meter above the bottom edge of the burner, measured at the front and rear of the cable assembly.
- 5.02.04 Halogen acid gas evolution test
- The level of HCL evolved shall not exceed 20 per cent by weight
- 5.02.05 Smoke density test
- The cables shall meet the requirements of light transmission of minimum 40% after the test.
- 5.02.06 **Test for rodent & termite repulsion property**
- The test shall be carried out to note the presence of rodent and termite repelling chemical in PVC compound. Normal procedure is that a few chippings of the PVC compound are slowly ignited in a porcelain dish or crucible in a muffle furnace at about 600°C. The resulting ignited ash is boiled with a little ammonium acetate solution (10%). A drop of aqueous sodium