	Bharat Heavy Electricals Ltd ***Boiler Auxiliaries Plant*** **Ranipet-632 406**	**FLUE GAS DESULPHURISATION** **TECHNICAL SPECIFICATION**

SPECIFICATION NO: PANKI:FGD:ELEVATOR-BMB&GDB	**REV NO:00**

TECHNICAL SPECIFICATION

OF

PASSENGER CUM GOODS ELEVATORS

			Jyotish Kumar Patel	S. Shanmuga Sundaram	
00	15-12-2021	Fresh Release	Jyotish Kumar Patel (Sr.Engr/EDC-FGD)	SHANMUGA SUNDARAM S (DM/EDC-FGD)	Kesavan V (DGM/EDC-FGD)
REV	**DATE**	**DESCRIPTION**	**PREPARED**	**CHECKED**	**APPROVED**

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A) DOCUMENTS TO BE SUBMITTED ALONG WITH THE OFFER:

Sl. No.	Description	Require For Part	Purpose
1.	Reference plant details of similar or higher capacity elevator supplied	I	Qualification Requirement
2.	Unpriced Bid of Supply	I	Consideration of Bid
3.	Unpriced Bid of Mandatory Spares	I	Consideration of Bid
4.	Unpriced Bid of Erection & Commissioning	I	Consideration of Bid
5.	Seal & Sign of bidder on all pages of specification	I	Technical Evaluation of Bid(TEB)
6.	Deviation List (if any)	I	TEB

B) DOCUMENTS TO BE SUBMITTED AFTER CONTRACT:

Sl. No.	Description	Handing over of Documents after Contract (in weeks)	Purpose
1.	GA of Elevator & accessories with bill of material with loading data (in PDF & Autocad format)	2	BHEL Approval
2.	Filled Data Sheets of Elevator & All accessories	2	BHEL Approval
3.	Anchor Plan & Civil foundation Loading details	2	BHEL Approval
4.	Machine room layout (in consultation with BHEL)	2	BHEL Approval
5.	Quality Plan with Inspection & Performance Test Procedure at site	3	BHEL Approval
6.	Motor Sizing Calculation	4	BHEL Approval
7.	T-S Curve for motor selected	4	BHEL Approval
8.	Motor Rating in Kw	4	BHEL Approval
9.	Sub vendors List	4	BHEL Approval
10.	Manufacturing Schedule	4	BHEL Approval
11.	List of Special Tools	8	E&C
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15.	Installation & assembly procedure	10	E&C
16.	Erection, Testing & Commissioning Shedule	10	E&C
17.	Recommended Repair Procedure	10	E&C
18.	Operation and Maintenance Manual (10 hardcopies and 5 electronic copies in English)	10	E&C
19.	Electrical Load List with Single Line Diagram	10	BHEL Review
20.	Control Logic of Elevator	10	BHEL Review
21.	Local Panel Control Circuit Diagram	10	BHEL Review
22.	Catalogue	10	BHEL Review
23.	Proforma Packing List	12	Dispatch

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1.0 INTENT OF SPECIFICATION

This specification covers design, manufacture, inspection, testing at bidder's and/ or his sub vendor's work(s), packing, transportation, handling at site, erection, testing and commissioning, final painting and carrying out acceptance tests at site of Elevators along with accessories which is to be furnished in the Flue Gas Desulphurization plant.

a. 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/ Customer, who will interpret the meaning of drawings and specifications and shall be entitled to reject any work or material, which in his judgment is not in full accordance herewith.

b. The bidder shall be deemed to have understood completely all the tender drawings and documents and quoted accordingly.

c. The bidder has to note carefully the parameters, estimated capacities of equipment indicated and the tender drawing in the specification are only for guidance of the bidder. The system shall be designed as per relevant standards/ codes and exact capacities and quantities are to be estimated by the bidder. All such estimations and design calculations shall be submitted for Purchaser's approval.

d. Contract shall be unit rate basis for this package. Variations in quantities during contract stage shall be settled on basis of unit rate quoted by the bidder in the tender. During contract stage, quantities of various items of BOQ may vary to any extent and same unit rates will be applicable.

e. ***Deviation:*** There shall preferably be no deviation on technical specification. In case of any deviation, the bidder shall indicate separately the deviations clause-wise with respect to the specification in the 'Schedule of Deviation' given in **Annexure-I**. Deviations in any other form including clarifications / assumptions / etc will not be considered and it will be construed that the bid conforms strictly to the specification.

f. Compliance to this specification shall not relieve the Bidder of the responsibility of furnishing equipment and accessories/auxiliaries of proper design, materials and workmanship to meet the specified start up and operating conditions.

All accessories, items of work, though not indicated but required to make the system complete for its safe, efficient, reliable and trouble free operation and maintenance shall also be in supplier's scope unless specifically excluded.

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2.0 SCOPE

Two numbers **(02) Passenger cum goods lift shall be provided** for following areas:

Sl. No.	Lift Description	Area to be provided	Quantity
1.	Passenger cum goods lift, Capacity : 1000 Kg (minimum)	Wet Ball Mill Building	1 No.
2.	Passenger cum goods lift, Capacity : 1000 Kg (minimum)	GYPSUM Dewatering Building (GDS)	1 No.

3.0 STATUTORY REQUIREMENTS

All registration and statutory inspection fees if any, in respect of his work pursuant to this contract shall be to account of the elevator vendor. However, any registration, statutory inspection fees lawfully payable under the provision of any statutory laws and its amendments from time to time, during erection in respect of the plant equipment ultimately to be owned by owner shall be to the account of the owner. Should any such inspection or registration need to be re-arranged due to the fault of the vendor or his sub-contractor, the additional fees for such inspection and / or registration shall be borne by the vendor. While the statutory payment shall be made by the owner for any registration, statutory inspection etc. during erection, the vendor shall be responsible for carrying out and co-ordinating various activities with the statutory authority as well as for obtaining the clearance and registration of the equipment.

4.0 REFERENCE STANDARDS

The Elevators shall be designed in line with the recommendation contained in the latest editions of applicable Indian Standards. The Design/construction/installation codes shall confirm to Latest edition of IS:14665 (All parts) AND also meeting any additional requirements of IS:4666, IS:1860 and IS:3534 and Any other equivalent code, subject to Employer's approval (Load carrying capacity)

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5.0	**SCOPE OF WORK**		
	i) Design, engineering, manufacture, inspection, delivery, erection, commissioning and handing over. ii) Maintenance & services during guarantee period**.** iii) Necessary erection / commissioning spares and consumables shall be included in vendor scope. iv) Necessary tools and tackles required for maintenance, testing and inspection shall be covered in vendor scope. v) Necessary electric Hoist / hand operated monorail hoist trolley arrangement. During technical offer Vendor shall provide the weight of the single heaviest item which can be dismantled. If the single heaviest item / component weight exceeds 500kg then electrically operated hoist to be provided. Items weighing more than 50 kg and required to be replaced for maintenance shall be provided with manual hoist with trolley. Manual hoist may be provided for horizontal movement across the monorail, hoist, rope and hook arrangements at the machine room ceiling to carry out the maintenance and erection of equipment shall be supplied by Elevator vendor. The necessary mono-rail beam will be supplied by purchaser (BHEL). All chain pulley blocks shall be designed to IS: 3832 and shall be SPARK Proof Trolley type Chain pulley. The electric hoist shall be designed and constructed in accordance with the latest revision of IS:3938 and shall be suitable for duty class 2.. vi) A steel ladder for access to the pit shall be supplied by the Elevator vendor. vii) Guard to protect the hoist way including temporary barricades at hoist way openings shall be supplied by Elevator vendor. viii) Scaffolding as per erection requirement shall be provided by the Elevator vendor. After completion of handing over activities, the scaffolding materials may be taken back by the vendor. ix) All the electrical equipment including Lift well, Hoist way & machine room lighting with fittings, Power/control/trailing cables, MCCB/MCB & ELCB for 415 V AC 3ph supply (to receive the incoming feeders provided by customer) shall be included in the Elevator vendor scope. x) The vendor shall assume all responsibility for proper design and operation of each and every component of the elevator as well as the elevator as a whole. Complying with Indian electricity rules & Indian electricity acts and applicable statutory requirements (of Government of India and applicable States) as well as procedural formalities also shall be taken care by the Elevator vendor. xi) All the push/ call buttons for Hoist way Front wall Shall have a canopy over it to protect from rain.		
6.0	**EXCLUSIONS**		
	Works not included in elevator contract, but furnished by others in accordance with local codes and regulations and the approved drawing of the Elevator vendor. i) Civil works associated with the Elevator pit. ii) Furnishing and installation of steel beams (Hoisting beams) in the machine room to lift equipment during installation and to facilitate maintenance.		
	iii) Machine room civil works including concrete flooring. iv) Steel structures for Columns and associated bracings and approach platforms up to landing doors at each level. v) Supporting steel material between hoist way & car will be provided by BHEL. vi) Unloading and Storage at site.		
7.0	**ELEVATOR PARTICULARS & DESIGN PARAMETERS**		
	i) Passenger cum Goods Elevator shall be provided with 1 no. fireman's switch (Alarm Switch). ii) The Elevator shall be located as per the plant layout drawing which will be provided during detailed engineering. iii) Entry to the Elevator shall be indicated in the enquiry. Foundation plan and elevation with landing levels shall be as per purchaser (BHEL) drawings.		
8.0	**Design Criteria and Equipment specification for Passenger cum Goods Elevator.**		
	i)	Design/Construction codes	Latest edition of IS : 14665
	ii)	Elevator Type	**Rope & Pulley Type**
	iii)	Type of service	**Passenger cum Goods Elevator**
	iv)	Number required	As per enquiry
	v)	Load carrying capacity	1000 kgs (minimum)

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	vi)	Rated speed	1.0 meter/ sec for Passenger cum Goods Elevator.
	vii)	Position of machine room	Directly above elevator shaft
	viii)	Total travel	Refer ANNEXURE-V
	ix)	No. of floors to be served (Landing levels)	Refer ANNEXURE-V
	x)	Specification code	As per IS: 14655 (5 parts) latest edition.
	xi)	Size of platform	As per IS: 14655 & manufacturer's standard latest.
	xii)	Entrances	One number in each floor
	xiii)	Car entrance and landing doors	As per BS:476 (Part 20 & 22)
	xiv)	Method of control Motor Speed Control: Logic Control:	Variable Voltage variable frequency (VVVF) control. Microprocessor based Control with automatic level adjustment. **The control system shall be of field proven design and having satisfactory track record.**
	xv)	Flooring of Cabin	Vitrified ceramic tiles of mat finish
	xvi)	False ceiling	Powder coated
	xvii)	Position of Machine room	Directly above the Lift shaft
	xviii)	Design, construction and finish of car	SS (ASTM-304 No: 4 Hairline finish)
	xix)	**Car door**	**SS (ASTM-304 No: 4 Hairline finish)**
	xx)	**Landing door**	**SS (ASTM-304 No: 4 Hairline finish)**
	xxi)	Car Enclosure	SS (ASTM-304 No: 4 Hairline finish)
	xxii)	Lighting and fan in the car	Recessed fluorescent light fittings for illumination level of 100 lux on Car floor shall be provided. Cabin charger ventilation fan with control suitable for operation on 240 V, 50 Hz, AC single phase power supply shall be provided. Portable light shall be provided on Car top. Adequate ventilation and illumination of car to be ensured.
	xxiii)	Method of operation of car	Power operated type – automatic, Horizontal Centre opening / closing car and landing doors.
	xxiv)	Operation of Elevator	Selective duplex collective, automatic operation with and without attendant, through illuminated pushbutton station located inside the car with provision for locking control in Auto or attendant position.
	xxv)	Car opening & hoist way opening	Protected by central opening sliding steel door.
	xxvi)	Signals / Indicator	a) Car position informer in car both visual and audio, hall position indicator at all floors, telltale lights at all floors, battery operated alarm bell and emergency light with suitable battery, charger & controls. b) Soft touch keys and digital luminous display in car operating panel and on all floors landings. (All fixtures in stainless steel face plates). Battery operated alarm bell and emergency light with suitable battery and battery charger and controls.

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			Audio annunciation for car position indication shall also be provided inside the car. Overload warning indicator with visual & audio annunciation.
	xx)	Shaft lighting	The Elevator shaft shall be suitably illuminated by providing CFL fittings at every 3m (three metres) from bottom of Lift well.
9.0	**DETAILS OF SPECIAL TREATMENT FOR ELEVATOR**		
	As the Elevators are to be installed in a heavily polluted and dusty area in a thermal power station. All the Elevator components shall be given special corrosion resistant treatment.		
	i)	Cars & Counter weight	Anti-corrosive epoxy paint
	ii)	Fish plates	Anti-corrosive epoxy paint
	iii)	Car & Counter weight buffer	Anti-corrosive epoxy paint
	iv)	Supports(Buffer)	Anti-corrosive epoxy paint
	v)	Rail Brackets	Anti-corrosive epoxy paint
	vi)	Bracket & rail fasteners	Zinc-passivated with epoxy painted
	vii)	Tie down bolts	Zinc-passivated with epoxy painted
	viii)	Machine	Anti-corrosive epoxy paint
	ix)	Brake adjusting screw & coupling fasteners	Zinc-passivated
	x)	Bracket	Anti-corrosive epoxy paint
	xi)	Controller cabinet	Anti-corrosive epoxy paint as per industry standard.
	xii)	Hall buttons	Dust-proof with stainless steel hardware.
	xiii)	Car operating panel	Dust proof contact & button with aluminium face plate and SS hardware. Main face plate SS.
	xiv)	Governor	Cover and casting epoxy painted. Other components zinc plated.
	xv)	Governor Tension frame	Hot dip galvanised and anti-corrosive epoxy paint with M.S. shaft for sheave.
	xvi)	Car frame, level brace rods and counter weight frame	Epoxy paint as per IS-1477 Part 1 & 2.
	xvii)	Safety equipment (Linkages)	Zinc-plated
	xviii)	Safety switch and car gate switch	IP-65. Dust proof heavily zinc plated arm, stainless steel shaft and housing as per vendor standard.
	xix)	Guide shoe	Zinc-plated
	xx)	Cam bar mountings and channels	Zinc-plated and anti-corrosive epoxy paint
	xxi)	Counter weight frame	Anti-corrosive epoxy paint
	xxii)	Guide shoe with Nylon ribs	Zinc-plated
	xxiii)	Filter weights	Anti-corrosive epoxy paint
	xxiv)	Rope fasteners	Zinc-passivated and chromate dipped
	xxv)	Hoist rope	Greased, Self-lubricating
	xxvi)	Governor rope	Greased, Self-lubricating

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	xxvii)	Alarm and door open bells (Electronic hooter)	Painted.
	xxvii)	Junction box	Thermoplastic or thermosetting or FRP type but - shall be dust proof, All the metal parts corrosion protected / JB's mounting brackets powder coated MS.
	xxix)	Hall position indicator and car position indicator	Dust proof with stainless steel enclosure and Face plate.
10.0	**MECHANICAL EQUIPMENT**		
10.1	**ELEVATOR CAR**		
	The car platform frame and sling shall be of steel construction. The platform shall be suitably isolated from its sling. The car shall be enclosed with suitably braced and reinforced sheet metal panel. The sheet metal panel shall have ventilation slots at the base. The cabin shall be provided with the following accessories: i) Car control station with position indicator inside the car and at landing platforms. ii) An emergency stop switch (shall have two sets of potential free contact. Second one shall be taken and terminated in machine room for further connection by owner). This is as per IS 14665 Part 2 Amendment 3 Clause 9.6 -"An emergency stop switch, of manually opened and closed type, shall be provided on top of every lift car and shall be marked conspicuously". iii) 5/15A plug socket with switch on top of lift car.		
	iv) Telephone instrument shall be provided inside the car. Connection from the same shall be brought up to the machine room for further connection to plant network by customer. Telephone instrument provided inside the car shall have provision for hands free operation also, i.e. Speaker phone shall be provided for hands free operation. v) For better safety, elevator vendor to provide car top barricade on car top to ensure that service personnel stay inside the car region. A selector switch and a set of push buttons shall be provided on the top above the ceiling of the car to operate the elevator locally for inspection and maintenance. The selector switch when set to position "inspection" shall exclude control from other places and movement of the car in the desired direction shall be effected by the push buttons. For normal operation of the elevator, the selector switch shall be set to the position working. It shall be possible to operate the elevator only when the appropriate button is kept in pressed condition. The roof shall be strong enough to support at least two persons. vi) Adequate lighting and ventilation shall be provided in the Elevator car. The car shall be fitted with fan of adequate capacity and lighting with decorative fittings. The car platform shall be robust in construction and elegant in appearance. vii) The car shall be provided with an emergency alarm push button inside the Elevator car which shall be clearly marked. The alarm shall be clearly audible outside the Lift way in order to obtain assistance in case of breakdown or failure between the floors. viii) Car shall be equipped with handrails on three sides (material mirror stainless steel).		
10.2	**CAR DOOR**		
	The car door shall be of hollow metal construction minimum 16 gauge thick sheet steel. Sides of the door shall be flush with all seams continuously welded. Guide shoes shall be rubber or roller type designed for operation on unlubricated guides. The car door shall be provided with locking gear of heavy and robust construction, so arranged mechanically and interlocked that the doors cannot be opened unless the Elevator car is within a particular landing zone. Conversely the Elevator shall not move until all the landing doors are closed and interlocked properly. Width of Car Entrance shall be min 1000 mm or as per applicable Indian or International Standard for Passenger cum Goods Elevator. The live load shall be taken into consideration while designing doors, door frame and hanger tracks. The car doors shall be designed such that their closing and opening is not likely to injure a person. A retractable safety shoe shall extend the full height and project beyond the front edge of the car, to open the closing door if and when it touches a person		

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	or an object. Alternatively opening of car by means of optical sensing shall also be provided.
10.3	**LANDING DOORS**
	All landing openings in the Lift well enclosure shall be protected with doors which shall extend the full height and width of the landing opening. The type of door provided shall be similar to the Elevator car door. Every landing door shall be fitted with a locking device. The door shall be suitably interlocked so that they cannot open unless the car is within a particular landing zone. The locking device is closed until the door is closed. The levers operating the locking devices shall not interfere with the landing side or Elevator enclosures. Landing doors of the elevators shall have fire resistance of at least one hour. These doors shall also be smoke tight as far as possible.
10.4	**LOAD PLATE**
	A load plate displaying the rated load of the Elevator in terms of persons and kilograms shall be fitted in the car in a conspicuous position.
10.5	**SUSPENSION ROPES**
	The car and the counter weights shall be suspended by steel wire ropes. Chain shall not be used for suspension. Not less than four independent stranded steel wire suspension ropes shall be used for car or counter weights of the Elevator with traction drive. The minimum diameter of the stranded rope shall not be less than 12.5 mm and minimum factor of safety shall not be less than 12. The suspension ropes shall conform to latest edition of IS 2365 – "Specification for steel wire suspension ropes for Lifts and hoists".
10.6	**SHEAVES AND PULLEYS**
	All driving sheaves and pulleys fixed to and revolving with the shaft shall be fixed by means of sunk keys of sufficient strength and quality. Sheaves and pulleys shall be made of cast iron as per the latest edition of IS 14665 and free from cracks, sand holes and other injurious defects. They shall have suitable flanges and smoothly machined rope grooves. The diameter of the sheave or pulley shall be as specified in the latest edition of IS 14655 or equivalent International Standards.
10.7	**SHAFT**
	Shafts and axles shall be forged steel. They shall have sufficient rigidity and bearing surface. Any shaft when stepped shall be turned to a reasonable radius at the point of reduction.
10.8	**COUNTER WEIGHTS**
	The Elevator shall be provided with suitable counter weights located in the Lift shaft. The counter weight shall be designed for smooth and easy operation of the Elevator and shall be in accordance with Indian Standard (or) equivalent International Standard. Suitable counter weight screen shall be provided in the Elevator shaft. The counter weights shall consist of cast iron weight contained in structural steel frame. The traction should be such that no appreciable slip may occur but that slip shall be free to take place upon the landing of either the car or the counter weights.
10.9	**GUIDE RAILS**
	Guide rails for the car and counter weights shall be machined 'T' sections and continuous throughout the entire length and shall be provided with adequate steel brackets or equivalent fixing of such design and spacing between brackets shall be such that to avoid any deflection during the normal operation. Guide rails section shall be adequate to withstand the forces resulting from the application of the safety gear when stopping the counter weights or fully loaded car. The guide shoes or their lining shall be easily renewable, adjustable and self-lubricated. Guides shall be of such length that it shall not be possible for any of the car or the counter weight shoes to

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	run off the guides.
10.10	**BUFFERS**
	Sufficient number of buffers of spring loaded type shall be fitted below the Elevator car and counter weights. The buffers shall be capable of stopping the car or counter-weights without permanent damage or deformation to itself or any part of the Elevator equipment. The number of buffers shall be so fixed as to ensure proper sharing of the impact loads by all of them.
10.11	**EMERGENCY SAFETY DEVICES AND BRAKES**
	The Elevator shall be provided with safety device attached to the Elevator car frame and placed beneath the car. The safety device shall be capable of stopping and sustaining the Elevator car up to governor tripping speed with full rated load in car. The application of the safety device shall not cause the Elevator platform to become out of level in excess of 3 cm/m measured in any direction. Slack rope switches, if necessary, shall also be provided. The Elevator vendor shall also provide personnel evacuation system during the power failure to the Elevator. The Machine shall be provided with direct current spring set, solenoid release 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 that it gets applied automatically in the event of power failure.
10.12	**AUTOMATIC RESCUE DEVICE (ARD)-(BATTERY DRIVE)**
	Contractor shall provide a modern advanced electronic drive system of "RESCUING Passengers Trapped in an ELEVATOR" in case of power failure. In addition to the above, bell and cranking device to be provided with hand wheel connected with motor shaft for manual lowering of elevator to the nearest landing level. For all Elevators with ARD, an audio & visual indicator shall be provided inside the Elevator car to alert the person trapped inside that he/she is being rescued. Capacity of battery shall be such that minimum three rescue operations can be performed without recharging. ARD panel shall be suitable for floor mounting.
10.13	**OVERLOAD DEVICE**
	Every passenger Elevator shall be provided with an overload device, which will prevent the Elevator from starting in case the Elevator car is loaded to 110 percent of the rated capacity of the Elevator or more. Elevator shall remain stationery with door open. Audio & visual warning device (Load weighing device) shall be provided to alert the passenger in case of overload.
10.14	**OVER SPEED GOVERNOR AND GOVERNOR ROPES**
	Governor shall be located where there is sufficient room for their proper operation and where they cannot be struck by the Elevator car or counter weight in the event of over run. Each governor shall be marked with tripping speed in terms of car speed in m/sec and the motor control and brake control circuit shall be opened before or at the time the governor trips. As per IS 14665 (part4/Sec 4):2001, the nominal rope diameter for over speed governor shall be minimum 6mm. However for elevators where travel height is more than 90 meters, the nominal rope diameter for over speed governor shall be minimum 8mm.
10.15	**LEVELLING DEVICE**
	The Elevator shall be provided with a two-way automatic levelling device. The levelling device shall take care of overrun and under run of the car and rope stretch, such that car floor is within 6.0 mm from the landing level at all floors while in operation. 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 care is being levelled to floor.

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10.16	**MACHINE ROOM AND OVERHEAD STRUCTURES**
	All the overhead machinery shall be supported on beam to be furnished by the contractor. The machinery support beam shall rest on top of or be designed to be framed into the contractor's structural steel frame for the boiler house. The Elevator drive controller and all other apparatus and equipment of Elevator installation, except such apparatus and equipment which function in the machine room shall be located at the top of the Lift well. Adequate machine room and hoist way lighting shall be provided by the Elevator vendor. The maximum loads transmitted by the single heaviest equipment both during erection and maintenance of the Elevator to the machine room floor and other structures like guides etc. shall be furnished by the Elevator vendor within 15 days of placing the award letter. Sound reducing materials below machines in machine room shall be provided. Machine room shall be provided with minimum 200 Lux illumination. **MACHINE ROOM Air Conditioning:** Each Machine room shall be provided with 1 no. of 2 tonne A/C unit. (minimum).
10.17	**TERMINAL STOPPING AND FINAL LIMIT SWITCHES**
	The Elevator shall be equipped with an automatic stopping device arrangement to bring the car to a stop at the terminal landings independent of the regular operating device in the car. Such stopping device shall act independently of the operating device, the final limit switches and buffer.
	Final limit switches shall be provided to stop the car automatically within the top and bottom clearance independent of normal operating device and the terminal stopping device. The final limit switch shall act to prevent movement of the car under power in both directions of travel and shall after operating, remain open until the Elevator car has been moved by a hand operating mechanism within the limits of normal travel. Elevator shall be suitable for continuous 24 hours round the clock operation.
11.0	**ELECTRICAL EQUIPMENT AND CONTROLS**
11.1	**OPERATION AND INTERLOCKS**
	1. Selective duplex collective, automatic operation with or without attendant through illuminated push button station located inside the lift car. 2. Door opening shall be automatic door operation and electronic door protection system for opening/ closing of car and landing doors. 3.Car operating panel with luminous buttons, car position indication in car (both visual and audio) combined with direction arrows, overload warning indicator, battery operated alarm bell and emergency light and fan & hands free speaker telephone set with suitable battery charger & controls. 4. Emergency indicator to indicate the location of elevator in case of elevator being stuck up between the floors through automatic flashers (both audio and visual). 5. Electronic door detector (infra red curtain type). 6. Two push button stations, one for upward movement and the other for down ward movement at each intermediate landing and one push button at each terminal landing shall be provided in order to call the car. Digital hall position indicator at all floors, tell lights at all floors shall also be provided by the bidder. 7. For facilitating movement of visually & hearing impaired persons, hall lantern and car arrival chimes shall be provided. 8. All fixtures shall be in stainless steel face plates. 9. Push buttons shall be fixed in the car holding the doors open for any length of the time required. 10. All other safety/ protection/ operation interlocks as required by IS: 14665 (latest edition).
11.2	**ELEVATOR DRIVE**
	The Elevator drive shall be equipped with automatic electromagnetic coil type brakes. The Elevator shall be driven by a drive suitable for method of control offered by the Elevator vendor. No friction gearing or clutch mechanism shall be used for connecting the main driving gear to the sheaves.
11.3	**ELECTRIC MOTORS**

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	Motors shall be as per IS 325 and suitable for the 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, 50HZ (+3% to -5% variation). Motor shall be provided with thermal class 130 (B) or better insulation. supply suitable for frequent starting with S4 duty class (S3 duty class also acceptable, if necessary to that application and subject to end user acceptance), CDF 40%, Maximum 150 starts per hour at 50 Deg. C ambient and with IP 54 protection class. Motor pull out torque shall be at least 240% of rated torque. Motor shall be of TEFC type. Motor insulation shall be class F or superior with temperature rise limited to 70 Degree Celsius. Motor paint shade shall be RAL 5012(tentative).
11.4	**CONTROLLERS**
	The controllers shall be designed to start, accelerate, stop and reverse the Elevator when the appropriate push buttons are pressed. It shall be arranged so as to provide maximum convenience to the operator. Contact finger
	Buttons shall be easy to adjust and replace. The speed control device shall be such as to give smooth, easy and accurate speed control. The Elevator controls shall be housed in dust and vermin proof enclosures. The controls shall be wired with stranded copper conductor cables. All equipment mounted shall be neatly labelled as per wiring diagram. Ventilating louvers are to be provided in the panels. Control panel shall be suitable for floor mounting.
11.5	**CABLES AND INTERNAL WIRING**
	Wiring shall be done as required to interconnect all Elevator electrical equipment including all power wiring from the main supply source in the machine room. Power cables shall be 1100 V grade multi core, stranded with XLPE insulation, FRLS type ST2 inner sheathed, galvanised steel wire armoured and overall extruded FRLS, Type ST2 PVC outer sheath. If unarmoured cables are used all the cabling/wiring between the equipment in the lift machine room and between machine room and equipment in the lift well and at the landings shall be wired in HDP conduit/ galvanised steel conduit. The circular trailing cables shall conform to IS 4289 Part-I (Elastomer insulated) or IS 4289 Part II (PVC insulated) / Flat type trailing cable shall conform to IEC 60227-06. All other cables shall conform to latest edition of IS: 7098, IS:1554 & IS:5831. Following FRLS properties shall be complied with. a) Oxygen index of min. 29 (as per IS:10810 Part-58) b) Acid gas emission of max. 20% (as per IEC-754-I). c) Smoke density rating shall not be more than 60% (as per ASTMD-2843). All cables shall have FRLS properties. **LT Cable:** 1100 volt, 90 Deg.C rating, heavy duty power cables with stranded aluminium Conductor, extruded XLPE insulation, extruded HRPVC,FR-LSH inner sheath, aluminium round wire armour for single core cables and galvanized steel strip /wire armour for three (3) core cables, and extruded HRPVC, FR-LSH overall sheath. **Trailing Power cable:** 1100 V Grade flexible trailing cable shall be tinned copper of Class - 5 of IS : 8130, heat resistant elastomeric compound based on EPR insulation, inner sheath of heat resistant elastomeric compound PCP sheath, nylon cord reinforcement and heat resistant, oil resistant and flame retardant heavy duty elastomeric compound FRLS CSP outer sheath. **Control Cables:** 1100 Volt grade, 85 deg C rating, control cables with stranded copper conductors, HRPVC Insulation, extruded HRPVC, FRLS Inner sheath, round wire/strip armour as specified elsewhere in the specification and extruded HRPVC, FRLS overall sheath. The cables shall be suitable for use in 1100V non-effectively earthed system. Control cable shall generally conform to IS: 1554 latest and

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	have ISI mark. Armour shall be GS.
11.6	**CABLING AND EARTHING**
	Earthing shall be carried out as per IS 14665, IS 3043 and Indian Electricity Rules. The Elevator structures, motor, frames, metal cases and all electrical equipment including conduit, cable armouring and guards shall be properly bonded and earthed by two separate and distinct connections. The earth connection station mat shall be done by the owner.
11.7	**POWER SUPPLY**
	Each Elevator shall be provided with a separate three phase, three wire 415V feeder of adequate rating for lighting, air conditioner and control panels will be provided in the machine room by BHEL. If single phase power supply required for running any of above items, then vendor has to consider suitable transformer in their scope. The junction box having MCCB/MCB/ELCB Isolation of adequate rating shall be arranged by the vendor to receive the above supplies. The Elevator vendor shall also indicate the proposed location of junction box in the machine room. All further cabling and wiring from the junction box shall be carried out by the Elevator vendor. The vendor shall arrange to tap power supply required for constructional purposes from the point terminated by the owner.
	Junction box (JB) shall be made of Fire retardant material. Material of JB shall be Thermoplastic or thermosetting or FRP type. The box shall be provided with the terminal blocks, mounting bracket and screws etc. The cable entry shall be through galvanized steel conduits of suitable diameter. The JB shall have suitable for installing glands of suitable size on the bottom of the box. The JB shall be suitable for surface mounting on ceiling/structures. The JB shall be of grey color RAL 7035. All the metal parts shall be corrosion protected. Junction box surface should be such that it is free from crazings, blisterings, wrinkling, colour blots/striations. There should not be any mending or repair of surface. JB's will be provided with captive screws so that screws don't fall off when cover is opened. JB's mounting brackets should be of powder coated MS. Terminal blocks shall be 1100V grade, of suitable current rating, made up of unbreakable polyamide 6.6 grade. The terminals shall be screw type or screw-less (spring loaded) / cage clamp type with lugs. Marking on terminal strips shall correspond to the terminal numbering in wiring diagrams. All metal parts shall be of nonferrous material. In case of screw type terminals the screw shall be captive, preferably with screw locking design. All terminal blocks shall be suitable for terminating on each side the required cables/wire size. All internal wiring shall be of cu. Conductor PVC wire. Vendor has to provide 20% spare terminals for JB.
12.0	**OTHER REQUIREMENTS**
	Electric high speed door operators for the opening and closing of the car doors and landing doors shall be furnished and installed. The car and landing doors shall be mechanically connected and shall move simultaneously in opening and closing. The car door and landing door shall be power closed and shall be controlled in opening and closing by oil cushioning mechanism built into the gear unit or alternate arrangement equally / better than this. Necessary lockable switches shall be provided in the Elevator machine room to control the operation of the door. Should the electric power fail, it must be possible for the doors to be opened from within the car, provided the car is exactly at the landing level. Overload relays shall be provided to protect the drive motor against overload or a power failure. Suitable protection shall be provided on the controller to protect the Elevator equipment from phase reversal, low voltage. Suitable arrangement shall be provided to intimate unit control room during emergency in the form of audio-visual alarm. Complete set of special tools and tackles required shall be supplied along with Elevator. Each tool and tackle shall be stamped so as to be identified easily for its use and size. Tools shall be supplied in a steel tool box. The list of tools and tackles shall be furnished along with the offer. One number Fire

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	extinguisher (suitable for electrical fire) shall be provided along with each elevator.
13.0	**SPARES,TOOLS & TACKLES**
13.1	**TOOLS:**
	Any special tools & tackles required for the entire equipment to disassemble, assemble or maintain the units, they shall be included in the quotation and furnished as part of the initial supply of the machine. List of special tools & tackles shall be decided by bidder as per his proven practice. When special tools are provided, they shall be packaged in separate, boxes with lugs and marked as "Special Tools for (tag / item number)."Each tool shall be stamped or tagged to indicate its intended usage. Levers and eye bolts for the removal of parts to be serviced shall be submitted with special tools.
13.2	**START UP & COMMISSIONING SPARES**
	Start-up & Commissioning Spares shall be part of the main supply of the Elevators. Start-up & commissioning spares are those spares which may be required during the start- up and commissioning of the equipment/system. All spares required for successful operation till commissioning of elevator shall come under this category. Bidder shall provide an adequate stock of such start up and commissioning spares to be brought by him to the site for the equipment erection and commissioning. The spares must be available at site before the equipment's are energized. The List of such spares to be provided during bidding stage.
13.3	**RECOMMENDED SPARES**
	Bidders shall also furnish the Recommended spares list along with the offer required for 3 years of normal operation of the plant and should be independent of the list of the mandatory spares. Prices of recommended spares will not be used for evaluation of the bids. The price of these spares will remain valid up to 6 months after placement of Notification of Award for the main equipment.
13.4	**MANDATORY SPARES:**
	Bidder to quote for mentioned mandatory spares with break up price. The List of mandatory spares is Provided in **ANNEXURE-VI.** Note : If, Mandatory spares as per ANNEXURE-VI are not applicable to vendor Elevator design, vendor shall quote Equivalent/ applicable spares against each items. * Unless otherwise stated, a set shall mean complete replacement for one equipment. 1. Any change in size, material, design etc, which obviates one to one replacement of the part shall be considered a different type. 2. Wherever quantity has been specified as percentage (%), the quantity of mandatory spares to be provided by contractor shall be the specified percentage (%) of the total population of the plant. In case the quality so calculated happens to be a fraction, the same shall be rounded off to next higher whole number. 3. Whenever 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 for these shall be furnished in the bid. 4. 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 offered design with quantities generally in line with the approach followed in the above list. 5. Price of each and every item is to be given separately. **Bidder shall quote for the "Mandatory Spares Part List", and it will be considered for L1 evaluation.** Initial spare parts items shall be handed over separately and shall not be mixed with

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	the supply of the main equipment parts. Spares shall be sent in pre-decided lots in containers/secure boxes. All boxes/containers are to be distinctly marked in red color with boldly written "S" mark on each face of the containers. Spares shall not be dispatched before dispatch of corresponding main equipment's. Each item shall be labelled in English and be packed against damage and sealed to prevent deterioration from corrosion. The protection shall be sufficient for a minimum of 10 years' storage in a dry weatherproof building. All spares supplied under this contract shall be strictly inter-changeable with the parts for which they are intended for replacements. All the Initial spares shall be manufactures along with the main equipment components as a continuous operation as per same specification and quality plan. Any special tools & tackles required for the entire equipment to disassemble, assemble or maintain the units, they shall be included in the quotation and furnished as part of the initial supply of the machine.
14.0	**DRAWINGS / DOCUMENTS**
	The following preliminary documents / drawings should be enclosed along with the offer without fail. i) Detailed description of the system offered. ii) List of thermal power where the offered system is in operation. iii) Performance certificate of the system offered. iv) Write-up on interlocks, controls and safety devices provided. v) General Arrangement of Elevator (including hoist way, pit well etc.) vi) General Arrangement of machine room and equipment in machine room. vii) Electrical control scheme with legend and write-up. viii) Machine room Air-Conditioning details.
	ix) Foundation and loading details of machine room floor and the concrete structure. x) Filled in vendor data sheet for Elevator, Main motor and Door operator motor. xi) Filled in vendor quality plan. xii) The major components of Elevator with weight details to be indicated by the vendor in the offer itself. xiii) The make, type, capacity, range of all bought out items xiv) Any deviation from the enquiry specification shall be indicated in the "Sub-delivery Enquiry Deviation Format" attached along with the enquiry. No deviations, unless explicitly taken up by vendor in the enquiry stage itself in the said format and accepted by BHEL in writing, shall be considered after firm order. In case no deviations are there, vendor to indicate "No-deviation" in the fully filled up format. The following documents / drawings shall be submitted within 15 days from the firm order. i) Elevator General Arrangement drawings for BHEL/Customer approval. ii) Elevator Technical Datasheet Separate contract-wise drawing approvals shall be obtained by vendor before manufacture of elevators.
15.0	**ERECTION AND COMMISSIONING**
1.	The erection and commissioning of elevators & accessories shall be done by bidder. Bidder shall include complete erection, pre-commissioning & post- commissioning check-up, start-up, testing and trial runs till handing over at site under his scope of work.
2.	TA/DA, boarding and lodging shall be borne by the bidder and shall be included in quoted rate.

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16.0	**PERFORMANCE GUARANTEE**
	All performance tests for elevators shall be carried out in accordance with any latest Indian codes/standards. 1) Bidder shall furnish Performance guarantee for the design, manufacture, material, safe and trouble-free operation of the Elevators and its accessories 2) Bidder shall guarantee and demonstrate the rated capacity of the elevator. 3) The Bidder shall ensure a design of the equipment to achieve an average target availability of 90%. Noise level-≤85 dB (A) at 1m horizontal distance from equipment/enclosures and 1.5m above operating floor is to be guaranteed After the completion of the installation, maintenance and service for the equipment furnished under this specification shall be provided by the vendor for a period of eighteen months. This service shall include monthly inspections of the installation during regular working hours by trained employees and shall include all necessary adjustments, greasing and oiling, cleaning, supply of genuine standard parts to keep the equipment in proper operation except any part made necessary by misuse, accidents or negligence caused by others.
17.0	**ACCEPTANCE**
	After erection, the performance of the Elevator shall be tested for ascertaining the conformity with the specification and upon satisfactory completion of the tests, the Elevator will be taken over. The responsibility for obtaining commissioning and handing over protocol signed by the customer lies with the Elevator vendor.
18.0	**WARRANTY**
1.	The Bidder warrants that the equipment's/items shall be free from defects in the design, engineering, materials and workmanship of the Plant and Equipment supplied and of the work executed. The Warranty Period shall be twenty four (24) months from the date of delivery or eighteen months (18) months from the date of commissioning, whichever first occurs. If during the Defect Liability Period any defect should be found in the design, engineering, materials and workmanship of the Plant and Equipment supplied or of the work executed by the Bidder, the Bidder shall promptly, in consultation and agreement with BHEL regarding appropriate remedying of the defects, and at its cost, repair, replace or otherwise make good (as the Bidder shall, at its discretion, determine) such defect as well as any damage to the Facilities caused by such defect.
2.	In case of failure of the equipment to meet the guarantee, CUSTOMER /BHEL reserves the right to reject the equipment. However, CUSTOMER /BHEL reserves the right to use the equipment until new equipment supplied by bidder meets the guaranteed requirement.
19.0	**FIRST FILL OF CONSUMABLES:**
1.	Bidder's scope shall also include supply and filling of all chemicals, reagents, resins, lubricants, grease, filters and consumable items for operation up to COD including top up requirements at the time of issuance of PAC/declaration of COD. All lubricants proposed for the plant operation shall be suitable for all operating and environmental conditions that will be met on site consistent with good maintenance procedures as instructed in the maintenance manuals.

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2.	Detailed specifications for the lubricating oil, grease, gases, servo fluids, control fluids, chemicals including items qualities and quantities required per month of the plant operation for the CUSTOMER /BHEL's approval herein shall be furnished eighteen (18) months prior scheduled COD of the 1st unit. On completion of erection complete list of bearings/equipment giving their location and identification marks shall be furnished to CUSTOMER along with lubrication requirements. All types of chemicals, consumables, lubricants and grease shall be readily obtainable locally and the number of different types shall be kept to a minimum. For each type and grade of lubricant recommended, bidder shall list at least three equivalent lubricants manufactured by alternative companies.
20.0	**TRAINING**
	Successful bidder shall provide comprehensive training for CUSTOMER Consultant Engineering, O&M, Erection & Commissioning staffs at site covering all aspects of the Elevators - Operation & Maintenance, Troubleshooting etc for minimum 2 man-days.
21.0	**CONFLICT**
	Bidder's equipment shall be designed for and shall meet the service, performance and minimum level of quality requirements specified. Bidder shall be solely responsible for advising CUSTOMER in writing of any conflicts between the specifications and Bidder's design, including performance and levels of quality. Bidder agrees that its obligations, liabilities and warranties shall not be diminished or extinguished due to its meeting the requirements of the Specification.

22.0 GENERAL REQUIREMENTS:

S.No	Description
1)	Metric unit shall be used in the drawings and in the any displays on the equipment's. Special attention should be taken that the unit of pressure shall be in dual scales of kPa and kg/cm^{2}G. For instance the pressure gauges should have dual unit's indication.
2)	Descriptions in the drawings, in the documents, and in the displays shall be in English
3)	All rotating parts such as coupling shall be covered with suitable protective guards. Guards shall be easily removable type.
4)	The equipment shall be designed to withstand the corrosive and moist environment in which these are proposed to operate.
5)	Noise level produced by any rotating equipment individually or collectively shall not exceed 85 dB measured at a distance of 1.0 meters from the source in any direction and 1.5m above operating floor.
6)	The overall vibration level shall be as per ISO 10816.
7)	Suitable drain connections shall be provided.
8)	The equipment shall be suitable for stable operation continuously.
9)	Corrosion allowance: Corrosion allowance for entire equipment shall be in accordance with latest applicable Indian / International standard.
10)	Unless otherwise specified , flanges shall be in accordance with ANSI B16.5 Class 150

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S.No	Description
11)	Name plate: All equipment shall be provided with nameplates indicating the item number and service name. Name plates shall be of 304 Stainless steel plate and placed at a readily visible location. Nameplate of main equipment shall have enough information, which will be confirmed during engineering phase. Stainless steel nameplates for all instruments and valves shall be provided.
12)	Rotation arrows shall be cast in or attached with stainless steel plate on each item of rotation equipment at a readily visible location.
13)	Unless otherwise specified, all equipment items where the weight exceeds 15 kg shall be provided with suitable lifting lugs, ears or ring bolts or tapped holes for lifting rings. Minimum shock factor for lifting lugs shall be minimum 2.0. The position of lifting lugs and reference dimension shall be shown on GA and/or outline drawings. NDT shall be conducted for lifting lugs. When any spreader bars are required for lifting and laydown, the bidder shall provide spreader bar with equipment.
14)	Skid Mount/Transportation: Equipment shall be fabricated as skid mount design as much as practical to minimize erection at the site.
15)	If the driver/driven equipment train is in the resonance condition or any vibration problems occur, the bidder shall solve the problems in a timely manner.
16)	Bidder shall provide the necessary gaskets.
17)	All the surfaces of the carbon steel should be rust prevented before shipment for the period of at least 12 months for storage and construction.
18)	Bidder to provide capacity of crane or hoist required for material handling and the details of heaviest component to be handled.
19)	The list of all Bought out items with makes and country of origin to be mentioned along with offer to be submitted.
20)	Quality Plan to be submitted along with the offer.
21)	Cost towards the participation in discussions/meetings, providing technical assistance during technical discussions/meetings with customer for approval of drawing/documents etc. TA/DA, boarding and lodging to attend these meetings shall be borne by the bidder and shall be inclusive in supply portion.
22)	Material of construction for all equipment/components shall be subject to CUSTOMER / BHEL approval during detail engineering. Accordingly bidder shall consider MOC for all equipment/component as per best engineering practice, global standard and global references.
23)	Bidder to provide sub vendor list and Bidder shall strictly adhere to **CUSTOMER approved vendor list** . In case bidder proposes an additional vendor for an item or vendor approval is required for any new item, acceptance shall be subject to approval by CUSTOMER / BHEL before placing order and bidder shall submit relevant documents as per attached **Sub-Vendor Questionnaire.**
24)	It shall be the complete responsibility of the successful bidders to obtain “Sub Vendor Approval” from BHEL / CUSTOMER for all equipment’s & components. Any delay in sub vendor’s approval should not affect the project schedule. If any of the sub vendors does not have the approval of CUSTOMER / BHEL, the same may be replaced with another CUSTOMER /BHEL approved sub-vendor only, without any price implications to BHEL.

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S.No	Description
25)	The modalities of inspection (Stage, Final, In-process) shall be finalized during detail engineering after submission of quality assurance plan (QAP). It shall be reviewed by the CUSTOMER consultant and BHEL. Bidder shall follow the procedures of inspection as per the approved QAP. Bidder has to submit the following documents along with inspection call and if any other documents required as per approved QAP. - Raw material inspection certificate - Internal test reports - Statutory certificates as required. - All inspection & testing shall be carried out based on the following documents: a. Relevant Standards b. Specifications c. Approved drawings d. Data Sheets e. Calibration certificate for all the measuring instruments f. Bidder should also coordinate in getting the MDCC's (Material Dispatch clearance certificate) and all types of IC's (Inspection Certificates) from the CUSTOMER along with BHEL.
26)	During detail engineering, bidder to strictly adhere to BHEL/ CUSTOMER drawing formats, document numbering, quality plan & FQP formats
27)	The identification and numbering of equipment, systems, items, etc. of supply, as well as of all documents and drawings shall be in accordance with reference Designation System for Power Plants - KKS system.
28)	Complete detail engineering drawings, calculations, selection of components etc. shall be reviewed & subject to approval of BHEL/ CUSTOMER during detail engineering
29)	Bidder shall furnish necessary inputs & drawings of all equipment in editable Auto CAD/ MS-Word /Excel format.
30)	During detail engineering, successful bidder shall ensure flow of drawings/documents as per schedule. Any comments from BHEL/ CUSTOMER should be addressed timely by the bidder.
31)	Bidder to note that list above is not exhaustive and any work /items required for completing the smooth operation and ensuring satisfactory running of the machines till final hand over to the end user shall also be in the scope of the bidder.
32)	Bidder shall submit the signed and stamped copy of all the pages which constitutes this technical enquiry specification signed by authorized signatory and clearly mentioning each clause under following two categories to avoid any ambiguity in scope understanding & the scope division along with technical offer. a. "Accepted without deviation and considered in scope of work" b. "Not considered in scope of work"
23.0	**PACKING AND FORWARDING**
1)	All elevator items except Mandatory Spares to be packed in **Steel container** and dispatched to site. Vendor to choose suitable sized container to accommodate the elevator and its accessories. Vendor can choose used container, which shall have leak tight and rain water should not enter into the

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S.No	Description
	internals of container during storage in the outer yard of power plant. The container shall be provided with lock and key. The key shall be retained with Supplier and packed material shall be dispatched to site. Before erection starts the container shall be opened in presence of BHEL site store concern person for verifying the materials. All items required for assembling shall be packed in container only. Vendor to ensure the same before generating packing slip. Evaluation will be made for total cost to BHEL project wise **Note: Packing container shall be non-returnable.**
2)	The mandatary spares shall be wrapped in polythene bags & packed in a strong rigid wooden box and send to BHEL BAP Ranipet stores.
3)	Equipment and materials in wooden cases or boxes shall be properly cushioned to withstand the abuse of handling, transportation and storage. Packing shall include preservatives suitable to tropical conditions. All machine surfaces and bearings shall be coated with oxidation preventive compounds. All parts subject to damage when in contact with water shall be coated with suitable grease and wrapped in heavy asphalt or tar impregnated paper.
4)	Each container should have the following inscriptions and signs stenciled with an indelible ink legibly and clearly: a. Destination b. Package Number c. Gross and Net Weight d. Dimensions e. Lifting places f. Handling marks and the following delivery marking
5)	Each container or shipping units shall be clearly marked or stenciled on at least two sides with project details as per enquiry.
6)	Each mandatary spare package box has to contain a packing list in a waterproof envelope. All items are to be clearly marked for easy identification against the packing List. All cases, packages etc. are to be clearly marked on the outside to indicate the total weight where the weight is bearing and the correct position of the slings are to bear an identification mark relating them to the appropriate shipping documents. All stencil marks on the outside of cases are either to be made in waterproof material or protected by shellac or varnish to prevent obliteration in transit.
7)	**The packing slip shall contain the following information: -** Customer name, Name of the equipment, Purchase Order number with Date, Address of the delivery site, Name and Address of the Sender, Serial Number of Elevator, BHEL item Code, Gross Weight and Net weight of Supplied items.
24.0	**DOCUMENTATION**
A	**DOCUMENTS TO BE SUBMITTED ALONG WITH THE OFFER**
	The Bidder shall submit all documents, drawings, diagrams and all such information, which are necessary to fully understand the offer for techno – commercial evaluation as specified.
B	**DOCUMENTS TO BE SUBMITTED AFTER AWARD OF CONTRACT**

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S.No	Description
	The Successful bidder shall submit necessary data, documents and drawings for review, approval as specified. All necessary GA drawings, sections, sub-assembly drawings, specifications of main and sub components and necessary set of operation & maintenance manual as asked by CUSTOMER must be furnished by bidder in soft and hard copy forms. Unless agreed otherwise, Ten (10) hard copies and five (05) sets of electronic copies of all documents are to be submitted in the English language through pen drive. Electronic Copies shall be submitted in primary original data format (e.g. DOC, XLS, DWG) as well as in a printable non-proprietary document format (e.g. PDF). However all the engineering related information shall be furnished in soft form to BHEL.
25.0	**QUALITY ASSURANCE AND TESTING**
	i) Vendor shall prepare and provide Quality plan along with enquiry. This QP will be reviewed by BHEL and if any comments given by BHEL shall be incorporated by vendor. ii) In case of order receipt, this QP will be submitted for BHEL/ CUSTOMER consultant approval. Any comments given by BHEL/ CUSTOMER consultant shall be incorporated by vendor for further approval by BHEL/ CUSTOMER consultant. iii) Elevators are subject to inspection by BHEL & CUSTOMER and inspection call shall be given 15 days in advance. v) Materials can be despatched only after obtaining CHP clearance & MDCC clearance from BHEL/ CUSTOMER consultant.
26.0	**O&M MANUALS**
	Vendor to furnish standard O&M manuals for each capacity of elevator, immediately after the release of first purchase order for BHEL's further use (Two copies of CD-ROM). The O&M manual prepared shall be such that the same shall be usable along with the relevant drawing for each project. Project wise O&M manuals along with project-wise details, if any, has to be updated by vendor and handed over to site (Customer & BHEL/Site, after commissioning of elevator) in necessary format as desired by customer. All necessary GA drawings, sections, sub-assembly drawings, specifications of main and sub components and necessary set of operation & maintenance manual as asked by CUSTOMER must be furnished by bidder in soft and hard copy forms. For all documents softcopy format shall be searchable pdf, however in addition all drawings, diagrams shall be supplied in ACAD or other editable format and all lists in Excel format. Further break up of technical documents will be discussed during finalization of the purchase contract. Unless agreed otherwise, Ten (10) hard copies and five (05) sets of electronic copies of all documents are to be submitted in the English language through **pen drive**. In addition However all the engineering related information shall be furnished in soft form to BHEL.

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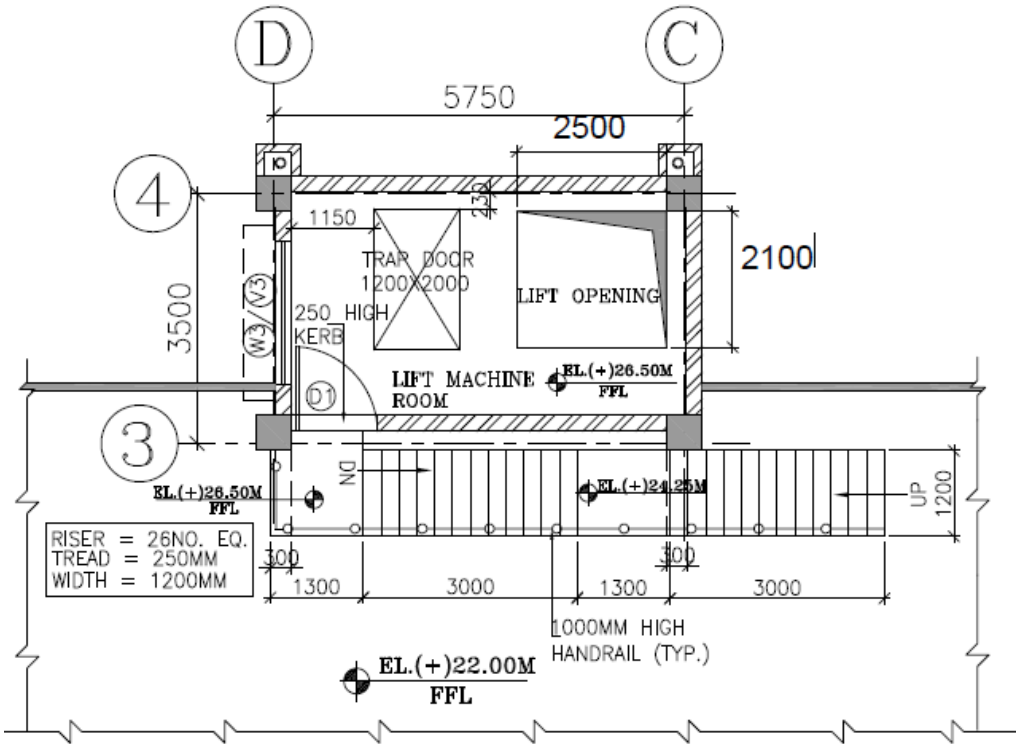
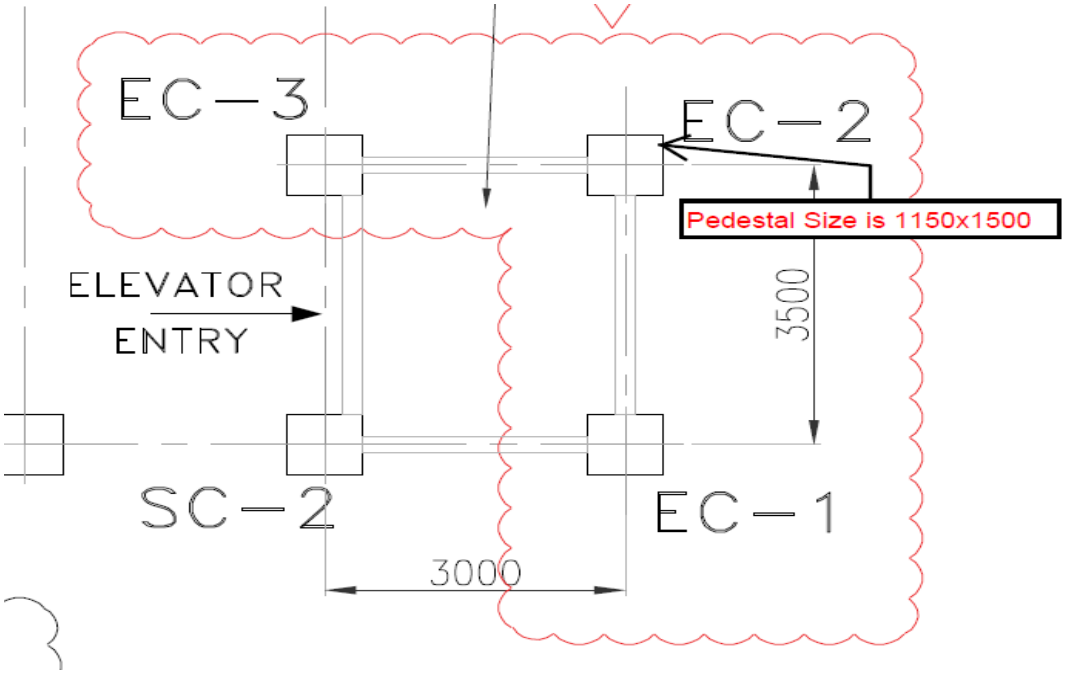
27.0 SHAFT AREA

TENTATIVE SHAFT AREA FOR ELEVATOR IS AS PER BELOW.

A. FOR **GYPSUM DEWATERING** BLGD



B. FOR **BALL MILL** BLGD



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28.0 ANNEXURE

ANNEXURE-I

LIST OF DEVIATIONS/EXCEPTIONS TO THE ENQUIRY DOCUMENT

Sl No	Clause No	Page No	Description of Deviation

Note: Enlarge the table to incorporate items

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DESIGNATION ----------

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ANNEXURE – II- SCHEDULE OF GUARANTEES

Sl. No	Description			Data
1.	Rated elevator load capacity	Kg	:	_____Bidder to provide
2.	Noise level at a distance of 1.0 meter from the equipment at site and 1.5 m above operating floor	dB(A)	:	_____Bidder to provide
3.	Availability (%)		:	_____Bidder to provide
4.	Scheduled Maintenance (Minor Overhauls): Recommended intervals between maintenance outages	hours	:	>25000 hours operation.
5.	Scheduled Maintenance (Major Overhauls): Recommended intervals between maintenance outages	hours	:	>75000 hours operation.

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NAME ----------

DESIGNATION ----------

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		Bidders Acceptance/ Comments
ANNEXURE-III : MOTOR SPECIFICAITON	Refer Enclosed specification.	
ANNEXURE-IV Painting Schedule	Refer Enclosed specification.	
ANNEXURE-V : ELEVATOR DETAILS	Refer Enclosed specification.	
ANNEXURE-VI : MANDATORY SPARES	Refer Enclosed specification.	
ANNEXURE-VII : MOTOR DATA SHEET	Refer Enclosed specification	

SIGNATURE OF BIDDER ----------

NAME ----------

DESIGNATION ----------

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CHAPTER 17 : AC & DC MOTORS

1.00 MOTORS

1.1 SCOPE

This specification is intended to cover design, manufacture, assembly and testing of AC Squirrel Cage Induction Motors for use in Thermal Power Plants and is supplement to the driven equipment specifications under which these motors are being procured for the project.

SITE CONDITIONS

Site conditions are covered in 'Project Data', contained in specification of the driven equipment.

1.2 Gases, Fumes & Dust Particles

1.2.01 General - Sulphur dioxide and/or trioxide fumes mildly present. Climate is tropical, conducive to fungus growth.

1.2.02 **Dust Particles**

1 Outdoor locations - Heavily dusty with abrasive dust and coal particles of size five (5) to hundred (100) microns present in atmosphere in large quantity.

2 Indoor Locations.

2.1 Coal conveyors - As for outdoor as per clause 1.02.02.1 above.

2.2 Other locations - Lightly dusty with abrasive dust and coal particles of size five (5) to twenty (20) microns present in atmosphere.

1.2.03 **Special Fumes**

1 Water treatment plant and acid cleaning room - Acid and alkali fuses present.

2 Fuel oil pumping areas & Hydrogen generation plant - Explosive fuses (flameproof motors required).

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

1.3 **LOCATION OF MOTOR -** As required

1.4 **SPECIFICATIONS & STANDARDS**.....Motors shall comply with the latest revisions of all relevant standards of BIS (IS-325, IS-900, IS-996, IS-1231, IS-1885, IS-2148, IS-2223, IS-2253, IS-2254, IS-2848, IS-3202, IS-4029, IS-4691, IS-4722, IS-4728, IS-4889, IS-6362, IS-7816, IS-8223, IS-8789 , IS: 12615, IS:3177 and IEC : 60034 3Φ Induction motor) except as modified herein or in driven equipment specification.

Motors conforming to BS or IEC Publications, which ensure equivalent quality shall also be acceptable.In case of any difference between IS Specification/International Standards (IEC; NEMA etc.), this motor specification prevails.

1.5 TYPE

1.5.1 AC Motors:

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

b) Continuous duty LT motors upto 160 KW Output rating (at 50 deg. C ambient temperature), shall be **Efficiency class-IE2,** conforming to IS 12615, or IEC:60034-30.

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

1.5.2 DC Motors Shunt wound.

1.6 **VOLTAGE (NOMINAL)**

1.6.1 **LV Motors**

For motors upto and including 200 KW - Four hundred fifteen (415) V.

1.6.2 **MV MOTORS**

For motors above 200kW upto and including 1500kW, Three point three (3.3) kV.

For CHP conveyors motor above 160 kW, 3.3 kV, AC supply is to be used. However all the motors on stacker reclaimer shall be on 415 V AC only.

1.6.3 **HV Motors**

For motors above 1500kW - eleven(11) KV

1.6.4 All motors are to be designed for system grounding described in "System Particulars" under site information of the Driven Equipment Specification.

1.7 **FREQUENCY (NOMINAL)** - fifty (50) Hertz

1.8 NUMBER OF PHASES - Three (3)

1.9 SPEED - As required by the driven equipment

1.10 TYPE OF STARTING :

Direct on-line (VFD/Soft-starter/star/delta starting in special cases)

1.11 DUTY

1.11.1 Continuous motor rating shall be arrived at considering 15% margin over the duty point input or 10% over the maximum demand of the driven equipment,

whichever is higher, considering highest system frequency and voltage variation. Crane motors shall be rated for S4 duty, 40% cyclic duration factor. If however, a higher margin is stipulated in the accompanying driven equipment specification, the higher stipulated margin shall prevail.

1.11.2 All HT motors shall have vibration pads for mounting vibration detectors.

1.11.3 All motors shall be designed to withstand hundred twenty (120) percent of rated speed without any mechanical damage for two (2) minutes.

1.11.4 Motors shall be designed to keep torsional and rotational natural frequencies of vibration of the motor and driven equipment atleast twenty five (25) percent above or below, preferably above the motor operating speed (to avoid resonance in vibration over the operating speed) range.

1.11.5 All LV motors rated 0.37kW and higher with S1 duty shall be compulsorily be of energy efficiency level IE 2 as per IS 12615:2011.

Motors rated above 37kW shall have efficiency higher than 0.92 and high power factor of atleast 0.88.

1.12 SUPPLY VARIATIONS

Motors shall be capable of running continuously at full load under following variations in power supply:

1.12.1 All equipments shall be suitable for rated frequency of 50 Hz with a variation of (+) 3% and (-)5%, voltage variation of ($\pm$) 6% for 11 kV & 3.3 kV and ($\pm$)10% for 415V and 10% (absolute sum) combined variation of voltage and frequency unless specifically brought out in the specification.

1.13 ABNORMAL CONDITIONS CAPABILITY

Motor shall have following capabilities as specified design ambient temperature:

1.13.1 The motors shall also be capable of running up again after voltage collapse to about 40% for approximate duration of 0.5 sec. Subsequent rise in voltage to 70% and further to 80% and 100%, the total duration not exceeding 20 sec.

1.13.2 Low Voltage Running :

Motor shall be capable of running satisfactorily at seventy five (75) percent nominal voltage for five (5) minutes.

1.13.3 Momentary Low Voltage Withstanding :

Motor, when running at full load, shall not stall when voltage drops down to seventy (70) percent nominal voltage for one (1) minute.

1.14 STARTING CAPABILITY

1.14.1 Low Voltage Starting :

Motor shall be capable of starting and accelerating to full speed at full load (including loaded equipment e.g. mills and conveyors etc) at eighty (80)

percent nominal voltage at motor terminals. Mill motors may be permitted to start with terminal voltage not below 90%.

1.14.2 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 eg mills and conveyors etc) of driven equipment. No additional start will be made till lapse of further thirty (30) minutes.

1.14.3 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 e.g. mills and conveyors etc) of driven equipment. No additional start will be made till lapse of further thirty (30) minutes.

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

1.14.5 Break-away Starting Current .....Breakaway starting current as percent of full load current for various motor ratings shall not exceed the values given below:

1.14.5.1 Motors above 1500 KW upto 4000kW ..... 600% without any positive tolerance except for ID Fan Motor.

1.14.5.2 Motors above 4000 KW ..... 450%. Not subject to any positive tolerance.

1.14.5.3 For D.C. Motors the starting current shall be limited to 2 times full load current.

1.14.5.3 **Starting voltage requirement**

a) All Motors (except Mill Motors)

- 80% of rated voltage for Motors upto 4000 kW
- 75% of rated voltage for Motors above 4000 kW

b) For Mill Motors:

- 85% of rated voltage for Motors above 1000 kW
- 90% of rated voltage for Motors below 1000 kW

Except AOP & JOP motors running on D.G emergency supply, starting voltage shall be 80%.

1.14.5.4 **Starting Time**

1.14.5.4.1 For motors with starting time upto 20 secs. at minimum permissible voltage during starting, the locked rotor withstand time under hot condition at highest voltage limit shall be at least 2.5 secs. more than starting time.

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

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

1.14.5.5 **Torque Requirements:-**

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

1.14.5.5.2 Pull out torque at rated voltage shall not be less than 205% of full load torque. It shall be 275% for crane duty Motors.

1.15 **SAFE STALL TIME**

1.15.1 To avoid problem in selecting standard protective relays without using speed switches, safe stall time under hot conditions (corresponding to 110% nominal voltage at motor terminals) shall be more than the accelerating time (corresponding to 80% nominal voltage at motor terminals) by the following minimum values :

1.15.1.01 Two (2) seconds, where accelerating time (at 80% nominal voltage) does not exceed 20 seconds.

1.15.1.02 Three (3) seconds, where accelerating time (at 80% nominal voltage) exceeds 20 seconds.

1.15.1.03 At no stage, speed switch shall be provided to achieve the above requirements mentioned under Clause No. 1.14.5.4

1.16 **CLASS OF INSULATION**

1.16.1 LV Motors ..... Class F.

1.16.2 MV & HV Motors ..... Class F

1.16.03 However temperature rise shall be restricted to limits corresponding to Class 'B' insulation for both HT & LT motors. The temperature under abnormal running conditions shall be limited to 5°C above class 'B' limits.

1.16.04 The value of the polarization index for motors above 200kW should not be less than 2 when determined according to IS: 7816.

1.17 **TEMPERATURE RISE UNDER NORMAL CONDITIONS**..... Temperature rise over specified design ambient temperature when motor is running with full load at nominal supply voltage & frequency shall not exceed the values given below:

S.No.	Specified Design Ambient Temperature	Thermometer Method	Resistance Method
1.17.01	50°C	60°C	70°C
1.17.02	45°C	65°C	75°C
1.17.03	40°C	70°C	80°C

1.18 **BUS TRANSFER WITHSTAND CAPABILITY**

Motors will be connected to an automatic bus transfer system and hence may be subjected to one hundred and fifty (150) percent of the nominal voltage during changeover of buses due to the vector difference between the residual voltage and incoming supply voltage and the duration of this condition may be one second. Motors shall be capable of withstanding the voltage and torque stresses developed under such conditions without damage. The manufacturer/ vendor shall indicate the special precautions taken to meet the above requirements and confirm.

1.18.01 That about 5000 bus transfers, in lifetime of motor, shall not puncture its insulation.

1.18.02 That motor shall be capable of withstanding heavy inrush transient current caused by such bus transfers without damage.

1.18.03 That the motor windings shall be adequately braced to satisfactorily withstand mechanical stresses under these conditions.

1.18.04 The motor and driven equipment shafts shall be adequately sized to satisfactorily withstand transient torques under these conditions.

1.19 **TYPE OF ENCLOSURE**

1.19.01 Outdoor Motors ..... IP 55 (Additional canopy to be provided by EPC contractor.

1.19.02 Indoor Motors ..... IP 55

1.19.03 IP-55 degree of protection shall be achieved without application of any compound, putty etc.

1.19.04 Motor located in hazardous area shall have flameproof enclosure conforming to IS: 2148 /Equiv. as detailed below:

a) Fuel Oil area : Group IIB
b) Hydrogen generation plant area : Group IIC (or Group-I, Div-II as per NEC or Class-1, Gr-B, Div-II as per NEMA/IEC60034).

1.20 **METHOD OF COOLING**

1.20.1 Method of cooling shall be IC 411 (TEFC), IC 511 (TETV) or IC 611 (CACA). However, motors rated 3000kW or above can be closed air circuit water cooled (CACW).

1.20.2 Large capacity motors not available with above types of cooling may be accepted with IC 81 W for IC 91 W (CACW) cooling subject to the approval of the Owner.

1.21 **TYPE OF MOUNTING** ..... As required for the driven equipment.

1.21 **MAXIMUM MECHANICAL VIBRATIONS**

1.21.01 Noise level for all the motors shall be limited to 85dB(A) except for BFP motor for which the maximum limit shall be 90dB(A). Vibration shall be limited within the limits

prescribed in IS: 12075 / IEC 60034-14. Motors shall withstand vibrations produced by driven equipment. HT motor bearing housings shall have flat surfaces, in both X and Y directions, suitable for mounting 80mmX80mm vibration pads.

1.21.02 Noise level

The noise level of motors shall not exceed 85 db (A) at 1m from operating motor measured in accordance with IS: 10265.

1.21.03 Motor body shall have two earthing points on opposite sides.

1.21.04 11 KV motors shall be offered with Separate Insulated Connector (Elastimould or Equivalent make) as per IEEE 386. The offered Elastimould terminations shall be provided with protective cover and trifurcating sleeves. Elastimould termination kit shall be suitable for fault level of 25 KA for 0.17 seconds.

1.21.05 3.3 KV motors shall be offered with dust tight phase separated double walled (metallic as well as insulated barrier) Terminal box. Suitable termination kit shall be provided for the offered Terminal box. The offered Terminal Box shall be suitable for fault level of 250 MVA for 0.12 sec. Removable gland plates of thickness 3 mm (hot/cold rolled sheet steel) or 4 mm (non magnetic material for single core cables) shall be provided.

1.21.06 The spacing between gland plate & centre of terminal stud shall be as per Table-I.

TABLE - I

DIMENSIONS OF TERMINAL BOXES FOR LV MOTORS

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

Above 125 KW-upto 200 KW 203

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

1.21.07 All motors shall be so designed that maximum inrush currents and locked rotor and pullout torque developed by them at extreme voltage and frequency variations do not endanger the motor and driven equipment.

1.21.08 For motors rated 1500 KW & above, neutral current transformers of PS class shall be provided on each phase in a separate neutral terminal box.

1.21.09 The ratio of locked rotor KVA at rated voltage to rated KW shall not exceed the following (without any further tolerance) except for BFP motor.

(a)	Below 110KW	:	10.0
(b)	From 110 KW & upto 200 KW	:	9.0
(c)	Above 200 KW & upto 1000KW	:	10.0
(d)	From 1001KW & upto 4000KW	:	9.0
(e)	Above 4000KW	:	6 to 6.5

1.22 **WINDING & INSULATION**

(a)	Type	:	Non-hygroscopic, oil resistant, flame resistant
(b)	Starting duty	:	Two hot starts in succession, with motor initially at normal running temperature.
(c)	11kV & 3.3 kV AC motors	:	Thermal class 155 (F) insulation. The winding insulation process shall be total Vacuum Presure Impregnated i.e resin poor method. Thelightning Impulse& interturn insulation surge withstand level shall be as per IEC-60034 part-15
(d)	240VAC, 415V AC & 220V DC motors	:	Thermal Class(B) or better

1.23 **DIRECTION OF ROTATION**

1.23.1 As needed by driven equipment.

1.23.2 The 3 phase motor shall, however, be suitable for operation in both directions of rotation. A plate showing direction of rotation as determined by the phase sequence on the terminals marking shall be screwed at non-driving end of the body of the motor.

1.23.3 If, in the case of HT motors, fan is suitable for only one direction of rotation, the fan shall be so designed that with the slight modification work, it can be made suitable for other direction of rotation also. No extra material shall be required for doing above modification work.

1.24 **BEARINGS**

1.24.1 General ..... Greased ball, roller and/or sleeve bearing shall be rated for minimum standard life of 20,000 hours taking bearing and driven equipment loads into account. Loss of grease shall be scarce and it shall not creep along shaft into motor housing.

Bearing shall be effectively sealed against dust ingress and shall be pressure grease gun lubricated.

If the bearings are oil lubricated, a drain plug shall be provided for draining residual oil and oil level gauge shall be provided to show precisely oil level required under standstill and running conditions.

Unless otherwise approved, bearing lubricating system shall be such that no external forced oil or water is necessary to maintain required oil supply to keep bearing temperature within design limits.

For MV & HV motors, the bearings shall be insulated wherever necessary to prevent damage to motor bearings from shaft current.

When pressure oiling is required for horizontal motors, bearings shall be sleeve type arranged for pressure oiling supplied from lubrication system of driven machine, with ring oiling for starting and emergency duty. Ring oiling system shall be adequate for starting and continuous operation of motor for at least half an hour, without pressure oiling system in operation. Oil sight flow gauges shall be provided to indicate oil flow through each bearing.

Lubricants shall be selected for prolonged storage and normal use of motors in tropical climate and shall contain corrosion and oxidation inhibitors. Greases shall have suitable bleeding characteristics to minimize setting. The selected lubricants shall be indigenously available.

Sleeve bearings for use with motors having flexible coupling with limited end play, shall have adequate axial end play to prevent transmission of thrust from driven equipment to motor bearings.

Bearings shall be of reputed make subject to the approval of the Owner/Consulting Engineer.

1.24.2 Large motors ..... Large motors shall preferably have spherically seated babitted, ring forced, feed lubricated, water-cooled bearings. If anti-friction bearings are provided, these shall be roller bearings rated for a minimum standard life of 30000 hours taking all bearing and driven equipment loads into account.

1.25 **SHAFT EXTENSION** ..... Key slotted bare shaft extension of required length with key on driving end.

1.26 **DRAIN HOLES** ..... Two (2) drain holes with plugs, one (1) on either end of motor at the bottom most point.

1.27 **LIFTING DEVICES** ..... Motors shall be provided with eyebolts, lugs or other means to facilitate safe lifting.

1.28 **DOWEL PINS**..... It shall be possible to drill holes vertically inclined through motor feet or mounting flange for installing dowel pins after assembling motor and driven equipment, before despatch (for completed driving + driven

equipment assembly) or at site after erection (for separate supplies of above equipment).

1.29 **CENTERING SPIGOT**..... Flange mounted motor shall have centering spigot to match driven equipment socket.

1.30 **EASE OF MAINTENANCE**..... Motor shall be so constructed that it can be de-assembled and reassembled with ease.

1.31 **NAMEPLATES**..... Motor shall have nameplate(s) showing diagram of connections, all particulars as per IS: 325 and following additional information:

In addition, an arrow block shall be screwed on to the body of motor on the non-driving end to indicate direction of rotation of motor.

1.31.1 Temperature rise under normal/abnormal conditions.

1.31.2 Type of bearing and recommended lubricants.

1.32 **FINISH**..... Motor shall have glossy, light grey finish No. 631 as per IS: 5 for withstanding site conditions as per Clause 1.00 above.

All sharp edges and scales shall be removed from the surface, which shall then be thoroughly degreased, de-rusted and given two (2) coats of primer and two (2) coats of finish paint. It is preferred that a phosphate coat is given to motor prior to application of primer coat. Motors for water treatment plant shall have Zinc Chromate base with acid resistant Epilex 4 paint.

1.33 **TERMINAL BOXES**

1.33.1 General .....Motors shall be provided with separate terminal boxes for main, space heaters, embedded temperature detectors, bearing temperature indicators and moisture detectors terminals. When it is not possible to provide LT motors with separate terminal box for space heater terminals, space heater terminals shall be adequately segregated from the main terminals in the single box. Terminal boxes shall be weatherproof and water-tight confirming to minimum IP-55 degree of protection with removable front cover for making connections. IP-55 degree of protection shall be achieved without application of compound. Space between and around terminals shall be adequate for easily connecting aluminium conductor cables. Terminal box arrangement shall be to the approval of the Owner /Consulting Engineer. All terminal boxes shall be suitable for proper termination of the type and tentative size of cables specified in Clause 1.34 below, however, exact size of cables shall be furnished by Owner during engineering stage.

The terminal boxes shall be complete with cable glands and termination accessories as required. Suitable non-magnetic material construction shall be adopted for terminal boxes where single core cables are to be terminated. All HT motors shall be provided with phase segregated terminal box.

Terminal bushings and clamps shall be non-absorbent, non- inflammable, insulated material for connecting with cable.

1.33.2 **Main Terminal Box**

1.33.2.1 LV Motors ..... Main terminal box shall be capable of being turned through 360 degrees in steps of 90 degrees.

1.33.2.2 MV & HV Motors ..... Motor shall be provided with two (2) terminal boxes for stator terminals. One (1) terminal box shall be for phase terminals while other one for forming star connection. These should be interchangeable to facilitate cable routing.

Neutral terminal box for HT motors rated above 1500 KW shall be suitable for mounting of three (3) Nos. wound/bar primary/ring type cast resin insulated current transformers for differential protection. These transformers shall be supplied and mounted in the motor terminal box. In addition to above, 3 Nos. of identical current transformers shall be supplied loose for mounting in the switchgear. Stator phase terminal box may either be phase segregated of standard terminal box suitable for both top and bottom entry of cables (i.e. they should be capable of being turned through 180 Degrees). The terminal box shall be designed for termination of XLPE cables using heat shrinkable or push on type terminating Kit. Terminal leading shall be stud type or leading wire type.

1.33.2.3 Cable End Boxes.....Terminal Boxes shall be provided with cable end boxes having cable lugs and cable glands for cables of sizes as specified in Clause 1.34 below.

Cable box shall be suitable for glanding the cables; and shall have adequate space between cable glands terminating studs to allow suitable bends of cable inside the cable box for all 3 phases of relevant cable sizes specified.

1.33.2.4 The terminal boxes shall be capable of withstanding at the terminals the system fault level (as indicated below) without rupture for a duration of atleast 0.25 seconds.

Min. fault level for MV Motors - 40 KA

Min. fault level for LV & HV Motors - 50 KA

1.33.2.5 **PHASE TO PHASE/ PHASE TO EARTH AIR CLEARANCE:**

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

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

1.33.2.6 Terminal Accessories.....Each terminal end shall be furnished with bimetallic washers, spring washers, nuts and crimp type aluminium (preferably tinned) lugs suitable for cables of sizes as specified in Clause 1.34 below.

1.34 **TYPE AND SIZE OF CABLES**

1.34.1 **Space Heaters**

1.34.1.1 For LV Motors: Two point five (2.5) mm^2, two (2) core copper conductor PVC insulated, armoured and FRLS PVC sheathed heavy duty 650/1100 V grade cable to IS: 1554 (Part-I).

1.34.1.2 For MV & HV Motors: Six (6) mm^2 two core aluminium conductor PVC insulated armoured and FRLS PVC sheathed heavy duty 650/1100V grade cable to IS: 1554 (Part-I).

1.34.2 For Embedded Temperature Detectors two sets of six (6) Twisted triad 0.5 mm^2 ATC copper conductor armoured, shielded cable, 650/1100 V Grade IS: 1554 (Part-I). For bearing temperature, RTDS, two (2) sets of four (4) twisted triad 0.5 mm^2, ATC copper conductor armoured shielded 650/1100 V Grade, IS: 1554 (Part-I).

1.34.3 Bearing Temperature Indicators - For each indicator, 0.5 mm^2 six (6) tarnished triad ATC copper conductor, PVC insulated, shielded armoured and FRLS PVC sheathed heavy duty 650/1100 V grade cable as per IS: 1554 Part-I. Two (2) cables one (1) for each bearing temperature indicator.

1.34.4 For Moisture Detectors.....As for space heaters as per Clause 33.01.01 above.

1.34.5 **For Main Terminals**

LT Motors

1. Three (3) core cables .....Stranded aluminium conductor, XLPE insulated, colour coded, laid up, PVC sheathed, GI wire / strip armoured, FRLS PVC jacketed overall, 650 / 1100V grade, heavy-duty cables as per IS: 1554 (Part-I).

2. Single core cables .....Stranded aluminium conductor, XLPE insulated, hard drawn aluminium wire/ strip armoured FRLS PVC jacketed overall, 650 / 1100V grade, heavy duty cable as per IS: 1554 (Part-I).

HT Motors

1. Three (3) core cables ..... stranded aluminium conductor, XLPE insulated, screened colour coded, laid up, PVC sheathed, GI wire/strip armoured FRLS PVC jacketed overall, 6.6 KV / 11 KV grade, heavy duty cables as per requirement for unearthed system as per IS: 7098 (Part-II).

The size and no. of cable to be intimated to the successful bidder during detailed engineering and the contrcator shall provide terminal box, cable gland and lugs suitable for the same.

Cable size may be increased in some cases because of large number of cables in under-ground ducts or because of vaoltage drop consideration. The supplier shall supply with terminal box and cable accessories suitable for higher size of cable at no extra cost.

1.35 **EARTHING**

1.35.01 General..... Two (2) grounding terminals one (1) on either side at the bottom suitable for connecting mild steel/GI flat/GI wire grounding conductor, size of grounding conductor shall be decided during detailed engineering.

1.35.02 LV Motors.....At each earthing point, two (2) drilled and tapped holes with hexagonal head bolts, plain washers, spring washers and tinned lugs (for motors upto 5.5 KW) for size of conductor specified shall be provided.

1.35.03 MV & HV Motors.....Non-corrodible metallic grounding pad shall be welded or brazed at each earthing point. The size of grounding pad shall be 75x65x25 mm. Grounding pad shall have 40 mm apart two (2) drilled and tapped holes with hexagonal head bolts, plain washers and spring washers for size of conductor specified. In addition, one suitable earthing terminal shall be provided inside the stator phase terminal box for earthing metallic shield of XLPE cables.

1.36 **EMBEDDED TEMPERATURE DETECTORS**.....HT motor shall be provided with six (6) Nos. duplex resistance temperature detectors (RTDs) embedded in stator winding at locations where high temperatures are expected. In addition one (1) duplex type RTD shall be provided in each bearing. The RTDs shall be 3 wire duplex platinum resistance type having a value of 100 ohms at 0 Deg.C

1.37 **BEARINGS TEMPERATURE INDICATORS**..... HT motors shall be provided with dial type two (2) bearing temperature indicators and will have two (2) sets of contacts, each set having 2 NO + 2 NC contacts rated for 5A at 240V AC and 0.5A at 220V DC. One set will be set to operate at lower value to give alarm and other set at a higher value to trip the motor.

1.38 **SPACE HEATERS**.....Valve / Damper actuator motors; and Motors above 30 KW shall be provided with one (1) or two (2) space heaters suitable for 240V, 50 Hertz single phase AC supply and of adequate capacity to maintain motor internal temperature above dew point to prevent moisture condensation or deterioration of insulation during shut down. Heaters shall be mounted inside the motor in accessible locations so that their removal and replacement is simple. Motors upto 30 kW shall have stator windings suitable for connections to 24V, 50 Hz AC supply for space heating.

Motors upto 30 kW shall have stator windings suitable for connection to 24V, 50 Hz ac supply for space heating

The terminals of space heaters shall be brought out to a separate totally enclosed dust proof and weatherproof terminal box.

1.39 **HOT AIR TEMPERATURE DETECTOR**

If the motor is of CACA or CACW enclosure, a thermometer with alarm contracts in hot air circuit shall be provided.

1.40 **WATER FLOW INDICATOR**

If the motor is of CACW enclosure a provision shall be made for visual indication of water flow and flow switch shall also be provided with alarm contacts. Thermometers shall be provided in water inlet and outlet circuits.

1.41 **MOISTURE DETECTORS**.....Motors with type of cooling 1C 81W or 1C 91 W shall be provided with moisture detectors for raising alarm in the event of water tube failure.

1.42 **BED PLATE**.....Whenever motor is supplied with driven equipment the Supplier shall ensure that bed plate suits both motor and driven equipment and is adequately braced to keep vibration and misalignment within allowable limits to the approval of driven equipment and motor manufacturers.

1.43 **OTHER ACCESSORIES**..... Motor shall be supplied with all accessories and parts other than those, specified above which are necessary and/or useful for efficient operation.

1.44 **TYPE TEST**

1.44.01 **HT MOTORS**

a) The contractor shall carry out the type tests as listed in this specification on the equipment to be supplied under this contract. The bidder shall indicate the charges for each of these type tests separately. The type tests charges shall be paid only for the test(s) actually conducted successfully under this contract.

b) The type tests shall be carried out in presence of the Purchaser's representative, for which minimum 15 days notice shall be given by the contractor. The contractor shall obtain the Purchaser's approval for the type test procedure before conducting the type test. The type test procedure shall clearly specify the test set–up, instruments to be used, procedure acceptance norms, recording of different parameters, interval of recording, precautions to be taken etc. for the type test(s) to be carried out.

c) In case the contractor has conducted such specified type test(s) within last five years as on the date of bid opening, he may submit during detailed engineering the type test reports to the Purchaser's for waival of conductance of such test(s). These reports should be for the tests conducted on the equipment similar to those proposed to be supplied under this contract and test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client. The Purchaser's reserves the right to waive conducting of any or all the specified type test(s) under this contract. In case type tests are waived, the type test charges shall not be payable to the contractor.

d) Further the Contractor shall only submit the reports of the type tests as listed in "LIST OF TESTS FOR WHICH REPORTS HAVE TO BE SUBMITTED" and carried out within last five years from the date of bid opening. These reports should be for the test conducted on the equipment similar to those proposed to be supplied under this contract and the test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client. However if the contractor is not able to submit report of the type test(s) conducted within last five years from the date of bid opening, or in the case of type test report(s) are not found to be meeting the specification requirements, the contractor shall conduct all such tests under this contract at no additional cost to the Purchaser's either at third party lab or in presence of client representative and submit the reports for approval.

e) **LIST OF TYPE TESTS TO BE CONDUCTED**

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

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

ii) Measurement of noise at no load.

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

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

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

f) **LIST OF TESTS FOR WHICH REPORTS HAVE TO BE SUBMITTED**

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

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

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

iii) Lightning Impulse withstand test on the sample coil shall be as per clause no. 4.3 IEC-60034, part-15

iv) Surge-withstand test on interturn insulation shall be as per clause no. 4.2 of IEC 60034, part-15

1.44.02 **LT Motors**

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

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

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

The following type test reports shall be submitted for each type and rating of LT motor of above 50 KW only

i) Measurement of resistance of windings of stator and wound rotor.
ii) No load test at rated voltage to determine input current power and speed.
iii) Open circuit voltage ratio of wound rotor motors (in case of Slip ring motors)
iv) Full load test to determine efficiency power factor and slip .
v) Temperature rise test.
vi) Momentary excess torque test.
vii) High voltage test.
viii) Test for vibration severity of motor.
ix) Test for noise levels of motor(Shall be limited as per clause no 1.21.01 of this section)
x) Test for degree of protection and
xi) Over speed test.
xii) Type test reports for motors located in fuel oil area having flame proof enclosures as per IS 2148 / IEC 60079-1

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

1.45 **INFORMATION WITH PROPOSAL**

1.45.1 AC Motor Data Sheet.

1.45.2 Dimension Drawing/Foundation load details of motor and driven equipment.
1.45.03 Manufacturer's catalogue showing constructional details.

1.46.00 **INFORMATION ON AWARD OF CONTRACT**.....Within six (6) weeks from the date of award of the Contract, following shall be furnished:

1.46.01 Motor Data Sheet.

1.46.02 Certified binding dimension drawing of motor complete with all accessories and fittings specifically showing terminal boxes, terminal spacing and sizes, earthing connections and sizes thereof, mounting details, lifting lugs, final foundation loads and dimensions with tolerances of centering spigot (where needed), shaft extension and key.

1.46.03 Following characteristics curves:

1.46.03.01 Torque-speed curves for motor at eighty (80), hundred (100) and hundred ten (110) percent rated voltage as well as torque-speed curve for driven equipment.

1.46.03.02 Current-speed curves at eight (80), hundred (100) and hundred ten (110) percent rated voltage

1.46.03.03 Current-time curves at eighty (80), hundred (100) and hundred ten (110) percent rated voltage.

1.46.03.04 Thermal withstand curves for hot and cold at eighty (80), hundred (100) and hundred ten (110) percent rated voltage.

1.46.03.05 Efficiency, power factor, current and speed versus power output curves.

1.46.03.06 Speed-time curves at eight (80), hundred (100) and hundred ten (110) percent rated voltage.

1.46.03.07 Negative phase sequence current withstand characteristics.

1.47 COMMISIONING CHECK LIST (HT MOTORS)

A PRELIMINARY CHECKS

Check the following:

1. Check the name plate details according to specification. Discrepancies, if any, to be satisfactorily resolved.

2. Check tightness of all bolts, clamps and connecting terminals.

3. Check body earthing

4. Check whether bearing lubrication is adequate

5. Check clearance inside terminal box

6. Checking stator (motor air gap) Check – Grease lubrication (for ball or roller bearing) is adequate if the motor was in storage for very long period replace the grease, by fresh grease after flushing the bearing clean. Excess grease in the bearing (housing … is overheat of bearings) Check 0 the free rotation of the rotor in decoupled condition. Check the air gap between stator and rotor at four positions 90o apart at driving and non-driving end. Compare the recorded values with factory results. For slip ring motors : with starting resistances.

   a) Check the variation of resistance
   b) Check brush lifting and slip ring short.

B COMMISSIONING CHECKS

1. Meggar tests of motor winding and cables
2. Continuity check of motor windings control and power cables
3. Measure resistance of motor winding (in case of large motors)
4. Control and interlocks should be checked
5. Motor protection relay to be calibrated
6. Phase sequence and direction of rotation
7. Other than DOL scheme to be checked example trafo starts
9. Measure starting current starting timer and no load current
10. On load operations starting and running currents (observed vibrations, temperatures of bearings and body)
11. On load operation, starting and running currents (observed vibrations, temperatures of bearings and body)
12. In case of forced water cooling of start or check winding temperatures as ready by built in RTDs.
13. Water level (start up cooling) low to be checked for limit switch operation.

1.48 COMMISIONING CHECK LIST (LT MOTORS)

A PRELIMINARY CHECKS

Check the following:

1. Check the name plate details according to specification. Discrepancies, if any, to be satisfactorily resolved.
2. Check tightness of all bolts, clamps and connecting terminals.
3. Check body earthing
4. Check whether bearing lubrication is adequate
5. Check clearance inside terminal box

B COMMISSIONING CHECKS

1. Meggar tests of motor winding and cables
2. Continuity check of motor windings control and power cables
3. Over load and short circuit relay tests and settings
4. Control and interlocks should be checked
5. Phase sequence and direction of rotation
6. Operation of timer in case of star delta starting
7. Measure starting current starting timer and no load current
8. On load operations starting and running currents

1.49 DC MOTOR SPECIFICATION

DC Motor will be of continuous duty type totally enclosed fan cooled (TEFC) having IP-54 degree of protection suitable for 220 V DC supply. DC motor will be shunt wound type having high torque characteristic suitable for Bi-directional rotation at rated speed and output. The general constructional features and details of DC motor will be in line with details/ particulars stipulated in the specification for AC squirrel cage induction motors.

Contractor will furnish the data in respect of DC motors.

DATASHEET

	Auxiliary power supply	
1.1	**HV supply**	
	11kV, 3Φ, 3W, 50 Hz non effectively earthed	Motors rated above 1500 kW
	Fault level	50 kA for 1 second
1.2	**MV supply**	
	3.3kV, 3Φ, 3W, 50 Hz non effectively earthed	Motors above 200kW upto and including 1500kW
	Fault level	40 kA for 1 second
1.3	**LV supply**	
	415V, 3Φ, 3W, 50 Hz effectively earthed	Motors below and including 200kW
	Fault level	50kA for 1 second
	110V, 1Φ, 2W, 50 Hz effectively earthed	Lighting, space heating, AC control and protective devices
1.4	**DC supply**	
	220V,2W, unearthed	DC alarm, control and protective devices.
	Fault level	25 kA for 1 second
2	Range of variation	As indicated in the specification
2.1	AC supply	
	voltage	------
	Frequency	------
	Combined voltage & frequency	--------
2.2	DC supply	198 to 240 V
Note: During starting of largest motor, the voltage may drop to 80% of the rated voltage for a period of 60 seconds. All electrical equipment while running shall successfully ride over such period without affecting system performance.		

Annexure IV- Painting Schedule

Sl No	SURFACE LOCATION	PGMA	SURFACE PREPARATION	PRIMER		FINISH		TOTAL DFT IN (µm min.)
				PAINT	DFT (µm min.)	PAINT	DFT (µm min.)	
23	Supporting structures for Structures for Elevator	FW 285 FW 292	Blast cleaning to Sa 2½ (Near white metal) with surface profile 35-50µm	**Primer Coat:** One coat of Inorganic Zinc silicate primer to IS 14946 (Main coat primer); DFT- 80µm/coat (min) **Intermediate Coat:** One coat of polyamide cured Epoxy based MIO pigmented intermediate coat; DFT- 120µm/coat (min)	80 120	Two coats of Two Pack Aliphatic acrylic polyurethane paint to IS 13213; DFT- 30 µm/coat (min) Shade no: 632 of IS 5 (Dark Admiralty Grey)	60	260
24	Elevator and accessories	FW 293	Blast cleaning to Sa 2½ (Near white metal) with surface profile 35-50µm	Two coats of Epoxy Zinc phosphate primer as per IS 13238. DFT-35µ/coat	70	Two coats of Epoxy based Polyamide cured finish paint to IS 14209 DFT-35µ/coat Shade: Light grey Shade no. 631 of IS:5	70	140

ANNEXURE-V - ELEVATOR DETAILS

SL NO	DESCRIPTION	DETAILS
1	PROJECT	**PANKI, 1X660 MW**
2	Elevator Type & service	Rope & Pulley, Passenger cum goods Elevator
3	Area at Elevator to be installed	Ball Mill
4	Capacity (kg) of Elevator	1000 (minimum)
5	Quantity (Number (s))	1
6	Rated speed	1.0 meter/ sec for Passenger cum Goods Elevator.
7	Total travel (meter)	8.25
8	No. of floors to be served (Landing levels)	1 + 1 (GROUND FLOOR)
9	Landing level (ELEVATIONS)	To be Provided during detail Engineering

SL NO	DESCRIPTION	DETAILS
1	PROJECT	**PANKI, 1X660 MW**
2	Elevator Type & service	Rope & Pulley, Passenger cum goods Elevator
3	Area at Elevator to be installed	GDS BUILDING
4	Capacity (kg) of Elevator	1000(minimum)
5	Quantity (Number (s))	1
6	Rated speed	1.0 meter/ sec for Passenger cum Goods Elevator.
7	Total travel (meter)	22
8	No. of floors to be served (Landing levels)	2 + 1 (GROUND FLOOR)
9	Landing level (ELEVATIONS)	To be Provided during detail Engineering

SIGNATURE OF BIDDER ----------

NAME ----------

DESIGNATION ----------

DATE ----------

ANNEXURE-VI

MANDATORY SPARES:

(For Ball Mill Elevator & GDS Building Elevator)

	Item	**Quantity**
i	**Brake**	
	Tool to brake (**common** For Ball mill Elevator and GDS Elevator)	1no.
	Fan (common For Ball mill Elevator and GDS Elevator)	1no.
	Magnet coil with housing pads (common For Ball mill Elevator and GDS Elevator)	2no.
	Brake pads (common For Ball mill Elevator and GDS Elevator)	6no.
	Adjusting sleeve (common For Ball mill Elevator and GDS Elevator)	2no.
	Fixed brake disc (common For Ball mill Elevator and GDS Elevator)	2no.
ii	**Gear Box**	
	Gear Box complete (common For Ball mill Elevator and GDS Elevator)	1 set of each type & rating
	'O' ring (common For Ball mill Elevator and GDS Elevator)	2no. of each type
	Sealing ring (common For Ball mill Elevator and GDS Elevator)	2nos. of each type
	Bearing (common For Ball mill Elevator and GDS Elevator)	1 set of each type & size
iii	**Door front**	
	Bearing (common For Ball mill Elevator and GDS Elevator)	2nos
	Roller (common For Ball mill Elevator and GDS Elevator)	3nos
	Bushing (common For Ball mill Elevator and GDS Elevator)	2nos
iv	**Limit cams**	
	Sensor (common For Ball mill Elevator and GDS Elevator)	1no.
	Switch (common For Ball mill Elevator and GDS Elevator)	2nos
	Switch arm (common For Ball mill Elevator and GDS Elevator)	2nos.
v	**Sliding Door**	
	Rollers (common For Ball mill Elevator and GDS Elevator)	4no. of each type
vi	**Machinery**	
	Brake motor (common For Ball mill Elevator and GDS Elevator)	1 no

vii	**Cable trolley**	
	Ball bearing (common For Ball mill Elevator and GDS Elevator)	2no. of each type
	Limit Switches (common For Ball mill Elevator and GDS Elevator)	1 set of each type and size
	Main Suspension Rope for **Ball Mill Elevator**	1 full length for each type / each length and size
	Main Suspension Rope for **GDS Elevator**	1 full length for each type / each length and size
	Safety Gear (common For Ball mill Elevator and GDS Elevator)	1 no. of each type and size
	Over speed governor device (common For Ball mill Elevator and GDS Elevator)	1 no. of each type
	Guide rail for car for **Ball Mill Elevator**	1 set of each type
	Guide rail for car for **GDS Elevator**	1 set of each type
	Guide rail for counterweight for **Ball Mill Elevator**	1 set of each type
	Guide rail for counterweight for **GDS Elevator**	1 set of each type
	Load Cell (common For Ball mill Elevator and GDS Elevator)	2 set of each type

Note:

If, Mandatory spares as per ANNEXURE-VI are not applicable to vendor Elevator design, vendor shall quote Equivalent/ applicable spares against each items.

*** Unless otherwise stated, a set shall mean complete replacement for one equipment.**

1. Any change in size, material, design etc, which obviates one to one replacement of the part shall be considered a different type.
2. Wherever quantity has been specified as percentage (%), the quantity of mandatory spares to be provided by contractor shall be the specified percentage (%) of the total population of the plant. In case the quality so calculated happens to be a fraction, the same shall be rounded off to next higher whole number.
3. Whenever 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 for these shall be furnished in the bid.
4. 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 offered design with quantities generally in line with the approach followed in the above list. 5. Price of each and every item is to be given separately.

Bidder shall quote for the "Mandatory Spares Part List", and it will be considered for L1 evaluation.

Project Name: _____ Enq/NIT No_____ (Vendor to fill and submit along with offer)

ANNEXURE-VII MOTOR DATA SHEET

LT MOTOR DATA SHEET

S. NO.	LT MOTORS	Elevator Motor
A.	**GENERAL**	
1.	Quantity	
2.	Motor Manufacturer & Country of origin.	
3.	Motor type	
B.	**DESIGN AND PERFORMANCE DATA**	
1.	Frame size	
2.	Type of duty	
3.	Type of enclosure / Method of cooling/ Degree of protection	
4.	Applicable standard to which motor generally conforms	
5.	Efficiency IE3 of IS 12615 or above (vendor to fill up efficiency here	
6.a	Whether motor is flame proof	
6.b	If yes, the gas group to which it conforms as per IS:2148	
7	Type of mounting	
8	Direction of rotation as viewed from DE END	
9	Standard continuous rating at 40 deg.C. Ambient temp. as per Indian Standard (KW)	
10	Derated rating for specified normal condition i.e. 50 deg. C ambient temperature (KW)	
11	Maximum continuous load demand of driven equipment in KW	

BIDDER'S SIGNATURE & SEAL :

TO BE FILLED & ATTACHED ALONG WITH TECHNICAL OFFER

12	Rated Voltage (volts)	
13	Permissible variation of :	
13.a	Voltage (Volts)	
13.b	Frequency (Hz) (+3% to -5%)- vendor to specify	
13.c	Combined voltage and frequency 10% -vendor to specify	
14	Rated speed in RPM (at rated voltage and frequency)	
15	At rated Voltage and frequency:	
15.a	Full load current	
15.b	No load current	
16	Power Factor at	
16.a	100%/75%/50% load	
16.b	NO load	
16.c	Starting.	
17	Efficiency at rated voltage and frequency,	
17.a	100% load	
17.b	75% load	
17.c	50% load	
18	Starting current (amps) at	
18.a	100 % voltage	
18.b	85% voltage	
18.c	80% voltage	

BIDDER'S SIGNATURE & SEAL :

TO BE FILLED & ATTACHED ALONG WITH TECHNICAL OFFER

19	Minimum permissible starting Voltage (Volts) 85% of rated voltage upto 110KW , 80% above 110kw	
20	Starting time with minimum permissible voltage/80%/ 100%/ 110%	
20.a	Without driven equipment coupled	
20.b	With driven equipment coupled	
21	Safe stall time with 100% ,110% & 80% of rated voltage	
21.a	From hot condition	
21.b	From cold condition	
22	Torques :	
22.a	Starting torque at min. permissible voltage(kg-mtr.)/ rated voltage	
22.b	Pull up torque at rated voltage	
22.c	Pull out torque	
22.d	Min accelerating torque (kg.m) available at lowest permissible starting voltage should be 10% of rated torque	
22.e	Rated torque (kg.m)	
23	Stator winding resistance per phase (ohms at 20 Deg.C.)	
24	GD2 value of motors	
25	No of permissible successive starts when motor is in hot condition	
26	Locked Rotor KVA Input	
27	Locked Rotor KVA/KW	
28	Vibration limit :Velocity (mm/s)	

BIDDER'S SIGNATURE & SEAL :

TO BE FILLED & ATTACHED ALONG WITH TECHNICAL OFFER

29	Noise level limit (dBA)	
C.	**CONSTRUCTIONAL FEATURES**	
1.	Stator winding insulation	
1.a	Class & Type (minimum155 F)	
1.b	Winding Insulation Process	
1.c	Tropicalised (Yes/No)	
1.d	Temperature rise over specified maximum ambient temperature of 50 deg C	
1.e	Method of temperature measurement	
1.f	Stator winding connection	
2	Main Terminal Box	
2.a	Type	
2.b	Location(viewed from NDE side)	
2.c	Entry of cables(bottom/side)	
2.d	Recommended cable size(To be matched with cable size envisaged by owner)	
2.e	Fault level (MVA),Fault level duration(sec)	
2.f	Cable glands & lugs details (shall be suitable for power cable recommended by motor vendor (vendor scope)	
3	Type of DE/NDE Bearing	
4	Motor Paint shade	RAL 5012 Blue
5	Weight of	
5.a	Motor stator (KG)	
5.b	Motor Rotor (KG)	
5.c	Total weight (KG)	

BIDDER'S SIGNATURE & SEAL :

TO BE FILLED & ATTACHED ALONG WITH TECHNICAL OFFER

D.	List of accessories.	
1.	Space Heaters (Nos./Power in watts/supply voltage) for motor 30KW and above	
2.	Terminal Box for Space Heater (Yes/No)	
3.	Speed switch (Yes/No) No of contacts and contact ratings of speed switch	
4.	Insulation of bearing (Yes/No)	
5.	Noise reducer(Yes/No)	
6.	Grounding pads	
6.a	No and size on motor body	
6.b	Nos on terminal Box	
7.	Any other fitments	
E.	**List of curves. (All curves to be attached along with offer)**	
1.	Torque speed characteristic of the motor (enclosed yes / No)	
2.	Thermal withstand characteristic ((enclosed yes / No)	
3.	Starting. current Vs. Time ((enclosed yes / No)	
4.	Starting. current Vs speed (enclosed yes / No)	
5.	P.F. and Effi. Vs Load (enclosed yes / No)	

BIDDER'S SIGNATURE & SEAL :

TO BE FILLED & ATTACHED ALONG WITH TECHNICAL OFFER