



**TAMILNADU GENERATION & DISTRIBUTION CORPORATION
LIMITED. (TANGEDCO)**

2X660 MW UDANGUDI STPS, STAGE-I

VOLUME IIB & III

**TECHNICAL SPECIFICATION
FOR
WORKSHOP EQUIPMENT**

SPECIFICATION NO.: PE-TS-435-568-A001



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

221660/2021/PS-PEM-MAX

PEM-6666-0



TITLE

**2X660 MW UDANGUDI STPS
TECHNICAL SPECIFICATION
FOR
WORKSHOP EQUIPMENT**

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SECTION I

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SECTION – I

SPECIFIC TECHNICAL REQUIREMENTS

SUB-SECTION IA – Specific Technical Requirement (Mechanical)

SUB-SECTION IB – Specific Technical Requirement (Electrical)



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1.0 SCOPE OF ENQUIRY/ INTENT OF SPECIFICATION

- 1.1 This specification includes, but not limited to design (i.e. preparation and submission of drawing /documents including “As Built” drawings and O&M manuals), engineering, manufacture, fabrication, assembly, inspection / testing at vendor's & sub-vendor's works, painting, maintenance tools & tackles (as applicable), fill of lubricants & consumables, along with spares for erection, start up and commissioning as required, foundation bolts, nuts, lock nuts, washers, levelling pads, forwarding, proper packing, shipment and delivery at site of Workshop Equipments package and Street Light Maintenance Truck for 2X660 MW UDANGUDI STPS specified as above complete with all accessories for the total scope defined as per BHEL NIT & tender technical specification, amendment & agreements till placement of order.
- 1.2 The contractor shall be responsible for providing all material, equipment & services, which are required to fulfil the intent of ensuring operability, maintainability, reliability and complete safety of the complete work covered under this specification, irrespective of whether it has been specifically listed herein or not. Omission of specific reference to any component / accessory necessary for proper performance of the equipment shall not relieve the vendor from the responsibility of providing such facilities to complete the supply of **WORKSHOP EQUIPMENTS**.
- 1.3 It is not the intent to specify herein all the details of design and manufacture. However, the equipment shall conform in all respects to high standards of design, engineering and workmanship and shall be capable of performing the required duties in a manner acceptable to purchaser who will interpret the meaning of drawings and specifications and shall be entitled to reject any work or material which in his judgement is not in full accordance herewith.
- 1.4 The extent of supply under the contract includes all items shown in the drawings, notwithstanding the fact that such items may have been omitted from the specification or schedules. Similarly, the extent of supply also includes all items mentioned in the specification and /or schedules, notwithstanding the fact that such items may have been omitted in the drawing.
- 1.5 The general term and conditions, instructions to tenderer and other attachment referred to elsewhere are made part of the tender specification. The equipment materials and works covered by this specification is subject to compliance to all attachments referred to in the specification. The bidder shall be responsible for and governed by all requirements stipulated herein.
- 1.6 While all efforts have been made to make the specification requirement complete & unambiguous, it shall be bidders' responsibility to ask for missing information, ensure completeness of specification, to bring out any contradictory / conflicting requirement in different sections of the specification and within a section itself to the notice of BHEL and to seek any clarification on specification requirement in the format enclosed under Vol-III of the specification. In absence of any such clarifications, in case of any contradictory requirement, the more stringent requirement as per interpretation of Purchaser/Customer



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shall prevail and shall be complied by the bidder without any commercial implication on account of the same. Further in case of any missing information in the specification not brought out by the prospective bidders as part of pre-bid clarification, the same shall be furnished by Purchaser/ Customer as and when brought to their notice either by the bidder or by purchaser/ customer themselves. However, such requirements shall be binding on the successful bidder without any commercial & delivery implication.

- 1.7 The bidder's offer shall not carry any sections like clarification, interpretations and /or assumptions.
- 1.8 Deviations, if any, should be very clearly brought out clause by clause in the enclosed schedule; otherwise, it will be presumed that the vendor's offer is strictly in line with NIT specification.
- 1.9 In case all above requirements are not complied with, the offer may be considered as incomplete and would become liable for rejection.
- 1.10 Unless specified otherwise, all through the specification, the word contractor shall have same meaning as successful bidder /vendor and Customer/ Purchaser/Employer will mean BHEL and /or Customer including their consultant as interpreted by BHEL in the relevant context.

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PROJECT INFORMATION

**5.0.0 SITE CONDITION****5.1.0 Location and existing Infrastructure**

The plant location details are as follows:

Country	: India
State	: Tamil Nadu
Administrative district	: Thoothukudi
Next big cities to site	: Thoothukudi (approx.45 kms from site)
Road access	: East Coast Road – State high way (176)
Nearest Railway Station	: Thiruchendur (approx.12 kms from site)
Nearest Airport	: Vagaikulam (approx.60 kms from site)
Nearest Harbour	: Tuticorin (approx.45 kms from site)

The proposed power project will be located at Udangudi in Tamil Nadu. The proposed power project site is located at about 45km South of Thoothukudi. The proposed marine facilities for the power project will be built on the coast adjoining the power project. The site is accessible by well developed roads.

The town of Tuticorin has all infrastructural facilities and has number of Industries. Tuticorin is well connected by both state highways, National highways and has direct rail link with State Capital Chennai.

5.1.1 Soil Profile

A Preliminary soil investigation report and topographical survey has been carried out by Owner. The results are furnished in a separate annexure.

The Detailed geotechnical Investigation and Setting out survey will be performed by the EPC contractor, and will be the basis for the detailed engineering for the project. The geotechnical report shall contain recommendations for foundation design during detailed engineering.

5.1.2 Seismic intensity

Seismic Intensity	:	As per IS : 1893 Latest
Zone	:	II
Intensity	:	As per IS:1893-Latest

5.1.3 Tide Levels

The recorded tide levels with respect to the Chart Datum (CD) near the identified intake point are as follows:

Mean high water-Spring	CD + 0.99 m
Mean high Water-Neap	CD + 0.71 m
Mean low Water-Neap	CD + 0.55 m
Mean low water-Spring	CD + 0.29m
Mean sea level	CD + 0.64 m
Highest High Tide Level	CD+ 1.026 m
Lowest Low Tide Level	CD + 0.110 m



5.2.0 Meteorological conditions

Ambient Air Temperature

Maximum dry bulb temperature : 41 °C

Minimum dry bulb temperature : 17 °C

Relative humidity

Mean Maximum humidity (Summer) : 84%

Mean Minimum humidity (Summer) : 62%

Maximum humidity (Monsoon) : 97%

Minimum humidity (Monsoon) : 45%

Rainfall

Annual rainfall (Maximum) : 718.2 mm

Annual Rain fall (Minimum) : 384.1 mm

Twenty four (24) Hour max : 138.2 mm

High Flood Level

High Flood Level for site : RL 2.450 m

Wind

Mean Wind Speed (max) : 20.6 km/h

Wind direction : North, North East, North West, East

The details given are arbitrary and may vary. The contractor should collect the actual data from the Meteorological Department pertaining to the site location and design the plant accordingly.

Meteorological data corresponding to Tuticorin observatory station shall be adopted. These data can be collected from Regional Meteorological Centre, India Meteorological Dept, 50, College Road, Chennai – 600 006.

5.3.0 Design Requirements related to site conditions

5.3.1 Design Ambient Data

Rainfall data:

The maximum rainfall in a year to be considered for design is 718.2 mm. 24 hours maximum to be considered is 138.2 mm. Area drainage study as required is in Contractor's scope of work.

Wind data

Wind loads to be considered for design of structures shall be based on the design wind speeds arrived at based on IS : 875 (Part -3) – Latest Edition. The parameters for calculation of design wind speed as per IS : 875 (Part -3) – Latest Edition are elaborated under Volume II, Section 5 of Detailed Technical Specification - Civil.

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SECTION – IA**Specific Technical Requirement (Mechanical)**



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1.0 SYSTEM DESCRIPTION AND SCOPE OF WORK

Various types of equipment / machines which are included in bidder's scope of work and required for the maintenance and repair workshop of the power station equipment are given under: -

S. N.	EQUIPMENT NAME	TECHNICAL SPECIFICATION	ACCESSORIES	QTY.
1.0	Heavy Duty Lathe	900 mm SOB, 2000 mm DBC. Other parameters of the machine shall be as per manufacturer's standard	Square tool post, two (2) nos. dead centres, rotating centre, quick change tool post with set of tool holder, 3 jaw self-centering chuck, complete coolant system, oil gun & oil can, rear splash guard, steady rest and follow rest, one set (10 nos.) of carbide turning tools (standard), work light without bulb, chip tray, longitudinal stop.	1
2.0	Heavy Duty Lathe M/c-1	600 mm SOB, 1500 mm DBC. Other parameters of the machine shall be as per manufacturer's standard	Square tool post, two (2) nos. dead centres, rotating centre, quick change tool post with set of tool holder, 3 jaw self-centering chuck, complete coolant system, oil gun & oil can, rear splash guard, steady rest and follow rest, one set (10 nos.) of carbide turning tools (standard), work light without bulb, chip tray, longitudinal stop.	1
3.0	Shaper	Stroke-610 mm, other parameters of the machine shall be as per manufacturer's standard	Crank handle, tool holder attachment, Ram length adjustment control, one (1) no. high speed steel (HSS) cutting tool, machine vice, pulleys & v-belts as required, electric motor, starter, automotive lubricating pump, machine lamp without bulb.	1
4.0	Slotting machine	Stroke - 300 mm, other parameters of the machine shall be as per manufacturer's standard	Complete coolant system / equipment, lighting equipment, 3 jaw self-centring chuck of diameter 300 mm with back plate (steel body).	1
5.0	Universal Milling machine	Table - 1600 mm X 300 mm, other parameters of the machine shall be as per manufacturer's standard	Complete coolant equip. work light without bulb, indexing head. One (1) no. high speed steel milling cutter.	1
6.0	Radial Drilling Machine	Capacity drilling in steel 50 mm diameter, Radius of drilling arm: 1500 mm, other parameters of the machine shall be as per manufacturer's standard	Box table (500 mm X 500mm X 500 mm), complete coolant equipment with pump, motor, piping etc. Work light without bulb	1
7.0	Pedestal drill	16 mm diameter in steel, size of table – 600mm x 600 mm	Nil	1



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S. N.	EQUIPMENT NAME	TECHNICAL SPECIFICATION	ACCESSORIES	QTY.
8.0	Grinder	600 mm wheel diameter. Double wheel pedestal grinder	Eye protection shield, tool rest bracket, adjustable tool rest, One coarse grinding wheel and one fine grinding wheel, machine lamp.	1
9.0	Tube bending machine	1/2" to 4" NB, other parameters of the machine shall be as per manufacturer's standard	Formers of different sizes suiting machine capacity.	1
10.0	Power hacksaw	Job diameter - 225 mm, other parameters of the machine shall be as per manufacturer's standard	One (1) no. hacksaw blade, machine lamp without bulb.	1
11.0	A/C welding machine	Current range - 60 to 400 Amps, AC Welding Transformer, other parameters of the machine shall be as per manufacturer's standard	Welding cable with electrode holder (5 metres length), Earthing cable assembly (5 metres), Protective helmet with glass, pair of hand gloves, chisel, wire brush, Ammeter-voltmeter attachment	2
12.0	D/C welding machine	MG set, current range : 35 – 320 Amps, Rectifier welding sets other parameters of the machine shall be as per manufacturer's standard	Welding cable with electrode holder (5 metres length), Earthing cable assembly (5 metres), Protective helmet with glass, pair of hand gloves, chisel, wire brush.	1
13.0	Argon Arc welding set	Max continuous welding current @ 60% duty cycle 170 amps, welding current range: 5 to 220 Amps.	Nil	2
14.0	Soldering iron	25 Watts, 250 Volts	Nil	4
15.0	Welding tables	Size - 750 mm (length) X 500 mm (width) X 1000 mm (Height)	Nil	3
16.0	Pneumatic hammer	As per manufacturer standard.	Nil	1
17.0	Work benches	Carpenter type work bench, size – 750 mm x 500 mm x 1000 mm height	Nil	6
18.0	Fitter vice	Size – 150 mm.	Nil	6
19.0	Marking-off table	Size – 2000mm x 2000 mm, material of construction – cast iron.	Nil	1
20.0	Portable screens	Fabricated screen, size 6 ft high and 8 ft length	Nil	1
21.0	Corrugating rollers	Size 900mm & Sheet thickness 18 SWG.	Nil	1
22.0	Industrial Vacuum cleaner	Wet & dry type vacuum cleaner of tank capacity 40 Litter along with all accessories required for function of equipment.	Nil	1

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S. N.	EQUIPMENT NAME	TECHNICAL SPECIFICATION	ACCESSORIES	QTY.
23.0	Set of measuring tools		Nil	One (1) set of each measuring tool
a	Vernier Calliper	Size 0 to 300mm, least count 0.02mm.	Nil	-
b	Vernier depth gauge	Size 0 to 300mm, least count 0.02mm.	Nil	-
c	Inside calliper	0 to 150 mm	Nil	-
d	Outside calliper	0 to 150 mm	Nil	-
e	Inside Micrometre	Size 0 to 25mm, least count 0.01mm.	Nil	-
f	Outside Micrometre	Size 0 to 150mm, 0.01mm accuracy.	Nil	-
g	Dial gauge with magnetic stand.	Size 0 to 10mm, least count 0.01mm	Nil	-
h	V block	100 mm x 45 mm x 60 mm	Nil	-
i	Snap Gauges	As per manufacturer standard	Nil	-
j	Feeler Gauge	As per manufacturer standard	Nil	-
k	Thread Pitch Gauge	NTPC, Metric- As per manufacturer standard.	Nil	-
l	Slip Gauge block	As per manufacturer standard	Nil	-
m	Precision Level	As per manufacturer standard.	Nil	-
n	Steel measuring tape	5m long.	Nil	-
o	Steel Rule	150 mm , 300 mm, 600 mm, 1000mm	Nil	-
24.0	General Tools (one set consist as “a” to “t”).		-	-
a	Screw drivers	Dimension & Blade length (mm)- 3.2x0.5x200; 4.3x0.6x200; 5x0.6x125; 5x0.8x200.	Nil	1
b	Double ended spanners (mm x mm)	10x11; 12x13; 14x15; 16x17; 18x19; 20x22; 21x23; 24x26; 24x27; 25x28; 30x32.	Nil	1
c	Hammer Set	Ball Peen Hammer in 1 lb, 2 Lbs, Mallet Hammer 1 Lbs, Wooden Hammer	Nil	1
		Sledge Hammer	Nil	1



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S. N.	EQUIPMENT NAME	TECHNICAL SPECIFICATION	ACCESSORIES	QTY.
		10 Lbs Sledge Hammer	Nil	1
d	Hack Saw frame with blades	As per manufacturer standard.	Nil	1
e	Socket set	1/2" Sq Drive socket in size mm (10, 12, 14, 16, 18, 20, 22, 24, 26, 28 30,32)	Nil	1
f	Precision Level	As per manufacturer standard.	Nil	1
g	File set	Flat- 100,150,200,250 mm Round file - 150 mm Half Round file - 200 mm, 250 mm	Nil	10
h	Pipe Cutter	1/2" – 2"	Nil	1
i	Long nose plier	170 mm(L)	Nil	1
j	Round nose plier	25 mm(L)	Nil	1
k	Universal Plier & Cutter Plier	As per manufacturer standard	Nil	1
l	Cir Clip Plier (Inside /Outside)	As per manufacturer standard	Nil	1
m	Pipe wrench	Each - 0-3/4", 1 1/2", 0-2 1/2"	Nil	1
n	Right angle	12" Size	Nil	1
o	Chisel Set	Flat Chisel of 1/2", 3/4", 1" tip size	Nil	1
p	Bearing Puller set	Universal Puller Twin Grip of 6" opening size - 1	Nil	1
		Puller triple grip of 8" opening size -1 No.	Nil	1
q	Centre Punch	As per manufacturer standard.	Nil	1
r	Gasket Punch set	Punches of various sizes 6, 8, 10, 12, 16, 20, 22, 24 mm in a case.	Nil	1
s	Hand Lamps, without Bulbs, Sockets, Plugs & Cables	As per manufacturer standard.	Nil	1
t	Box for above tools	As per manufacturer standard.	Nil	1

Painting of workshop equipments: Following painting specification shall be followed for above workshop equipments except for item no. 11.0 12.0, 13.0, 14.0, 16.0, 18.0, 20.0, 21.0, 22.0, 23.0 & 24.0, for which, manufacture's standard painting specification shall be followed.

At Works

Surface Preparation:

Degreasing and surface preparation to SA 2 1/2.



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Prime coat:-	Solvent based IZS - VS of 60%. Zn Dust - 1.77 kg/ltr minimum. Zn dust by weight - minimum 85%. Pot life 12 hrs / 21 Deg.- Paint to meet compositional & performance specifications for SSPC Paint 20 , Level 1.
Intermediate coat:	Two component Zinc rich Primer meeting performance and compositional specifications of SSPC Paint 20 Level2
Sealer	Single pack Heat Resistant Silicon Acrylic Finish paint.
Finish	Single pack Heat Resistant Silicon Acrylic Finish paint
Total system:	Dry film thickness 150 microns.

Final shade of paint shall be as per manufacturer's standard only.

NOTES:-

- 1) Maintenance tools and tackles as required for the various machines, commissioning spares for various machines as applicable, first fill lubricant /coolant for each equipment is included in Bidder's scope of work.
- 2) Machines shall be supplied with the manufacturer's standard accessories & other accessories as indicated above. Bidder shall submit list of all other special accessories in their bid & furnish item wise price in the price bid.
- 2.0 **The followings shall also be included in bidder's scope of work: -**
- 2.1 Required numbers of machines in new / unused condition along with standard accessories and special accessories as listed above in the specification.
- 2.2 First fill of lubricants, oil, coolants etc. for all machines.
- 2.3 Painting of equipment shall be done by the bidder before despatch as per the attached painting schedule. Bidder shall also supply adequate quantity of loose touch up paint along with the equipment so that damage in transition, if any, can be taken care.
- 2.4 Base plates, Support plates, anchor bolts, foundation bolts and nuts, lifting lugs, eye bolts etc. if any. All commissioning spares shall be included in the scope of work of each equipment / item.
- 2.5 Terminal points for electrical shall be the power supply terminals in respective machines and power cable glands and lugs shall be in bidder's scope.
- 2.6 The electrical equipment supplied as a part of machine shall include isolating switch for power supply isolation incorporating mechanical safety as required.
- 2.7 Commissioning spares shall be included in the scope of work of the bidder.
- 2.8 A complete unused new set of special purpose service / maintenance tools & tackles shall be supplied with each machine. The tools shall be supplied in steel tool box & shall be of the best quality & specially protected against rusting in tropical climate.
- 2.9 Five (5) metres of power cable (spare) shall be supplied along with each machine / item.
- 2.10 Supervision of Erection & Commissioning (for applicable equipments / machines).
- 2.11 Any other works not covered above but required for the safe operation of the machines.



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3.0 CODES & STANDARD

The machines covered under the scope of work shall be new, of streamlined construction, rugged and vibration free in line with the Indian / international standard and practices.

4.0 SERVICES BY CUSTOMER

4.1 Draining arrangement of liquid coolant from source to the nearest drain.

4.2 Construction of Workshop building.

4.3 Pipe trench & cable trenches, doors / windows, rolling shutter, ramp and glass partition wall, if any.

4.4 Cable termination.

4.5 One no. EOT crane of 10 tonnes capacity.

4.6 Erection and commissioning of workshop machines.

5.0 DOCUMENTS AND DATA REQUIRED TO BE SUBMITTED AFTER PLACEMENT OF LOI

Following drawings and documents shall be submitted to BHEL for approval after the placement of LOI:-

- a) General arrangement drawing indicating overall dimensions, total weights, foundation details and bill of material for all types of machines including requirement of withdrawal space.
- b) Final details of motors (machine wise) indicating guaranteed power consumption as per BHEL's format.
- c) Manual calculation for selection of machines including authentic supporting literature (e.g. handbook / standards).
- d) Manual calculation for requirement of air / water quantity and pressure including authentic supporting literature (e.g. handbook / standards).
- e) Final filled up Data sheet "B" / Data sheet "C"
- f) Quality assurance plan being followed for all items of each type of machine starting from raw material to final product including routine and type test being conducted at works.
- g) Write - up on working principle and special safety features envisaged for each type of machines.
- h) Final requirement of air and water indicating quantity, pressure and terminal points, if any.
- i) Painting schedule.
- j) O & M manual.
- k) List of spares (commissioning).
- l) List of Tools and Tackles.
- m) Schedule of lubricants indicating quantity, make and trade name of at-least three manufacturers.



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- n) Data sheet of machines.

NOTE:-

- 1) The list of drawings and documents to be submitted after placement of order shall be forwarded to the successful bidder after award of contract.
- 2) Only manual calculation with authentic supporting literature shall be furnished (e.g. Hand book / standards / codes).
- 3) Drawings and documents not covered above but required to check safety of machines / system shall be submitted during detailed engineering stage without any commercial implication.

6.0 General requirement

01. All the drawings shall be prepared in Auto Cad - 2007 version or higher and required number of hardcopies and soft copies of all the drawings, documents, O & M and spare parts manuals shall be furnished to BHEL during detailed engineering stage as per Annexure – III enclosed with the NIT specification.
02. Inspection checklist / quality plan and recommended field quality plan for each machine and submitted to BHEL for approval after placement of order and any changes required by BHEL / CUSTOMER for the same shall be incorporated and adhered by the bidder without any commercial implications.
03. BHEL will require 21 days time to offer their comments on the drawings and documents being submitted by the bidder from the date of receipt.
04. All drawings including general arrangement, civil foundation drawing shall be furnished to BHEL during detailed engineering stage and shall include BOQ / BOM in tabular form indicating all major components including bought out items, standard as well as optional accessories which are covered under the bidder's scope of supply and their quantity, material of construction indicating its applicable code / standard, weight, make.
05. All drawings of each machine including general arrangement and foundation drawings shall be furnished to BHEL during detailed engineering stage and shall include / indicate the following details for clarity w.r.t. inspection, construction, erection and maintenance etc. :-
 - a) All drawings and documents shall bear BHEL's title block and drawing / document number. However, BHEL's drawing / document numbering scheme shall be furnished to the successful bidder after the placement of L.O.I.
 - b) All drawings shall indicate the list of all reference drawings including general arrangement and foundation drawings.
 - c) All drawings shall include / show plan, elevation, side view, cross - section, skin section, blow - up view and all major self manufactured, bought out items, standard as well as optional accessories which are covered under the bidder's scope of supply shall be labelled and included in BOQ / BOM in tabular form.



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- d) Specification / schedule of coolant / oil for oil cooler / lubricant / paint indicating atleast 3 trade name shall be made as a part of general arrangement drawing of each machine.
- e) Extreme location of various items / assembly due to movement shall be shown in dotted lines indicating the dimensions of the same from the extreme point of idle location.
- f) Location of motor (s), control panel along with dimensions shall be shown in the drawing.
- g) Space required for the door opening of panel shall be shown in dotted lines with dimensions in all the general arrangement drawing.
- h) Details of job feeding and withdrawal direction with arrow and its required space shall be shown in dotted lines with dimensions from some reference point like edge / centre of the machine.
- i) Location of operator and required space for his movement shall be shown in the general arrangement drawing in dotted lines with dimensions from some reference point like edge / centre of the machine.
- j) Requirement of withdrawal space for maintenance, if any, shall be shown in the general arrangement drawing in dotted lines with dimensions from the reference point like edge /centre of the machine.
- k) Recommended clearance / maintenance space around the machine shall be shown in the general arrangement drawing in dotted lines with dimensions from the reference point like edge / centre of the machine.
- l) Mounting details of each machine indicating size and required number of holes and the distances between them shall be indicated in the general arrangement drawing.
- m) Distance between the mounting holes and distances of the same from some reference point like centre line of machine / edge of the machine to ensure correct construction of foundation and to know maximum space required for civil foundation and mechanical equipment.
- n) Technical parameters of the machine shall be furnished (gearbox details, job rpm, vibration limit, noise level at a distance of 1.0 metre at a level of 1.5 metres above ground, V - belt details, details of pulley, details of all motors and hydraulics, whether the machine will be dispatched / delivered in the assembled condition or dismantled condition indicating the weight as the case may be, recommended capacity of E.O.T Crane, weight of heaviest (single) part / component of the machine, weight of machine along with accessories, job and total weight shall be furnished separately etc.) in all the general arrangement drawing and those shall be indicated in the drawing with dimensions to the extent possible. Details of electrical panel, wiring diagram, other relevant electrical and C&I details as applicable shall also be furnished.
- o) Details of cable entry for each machine shall be shown in all the 3 views (plan, elevation and side view).
- p) Hardness and type / method of hardening of various parts of each machine shall be indicated in the general arrangement drawing.



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06. Manual Calculation for motor (s) sizing shall be furnished to BHEL during detailed engineering stage for approval along with the copy of authentic supporting literature e.g. Hand book, National / international Standards etc in line with the technical specification.
07. O & M manual shall be furnished to BHEL for approval during detailed engineering stage along with the general arrangement drawing.
08. Drawing / data sheet of all accessories shall be furnished to BHEL for approval during detailed engineering stage indicating brief specification.
09. Operational write-up along with safety features and interlock / control details of each machine shall be furnished to BHEL separately for approval during detailed engineering stage.
10. Separate drawing for lifting arrangement of machine during erection shall be furnished to BHEL for approval indicating dimensions and details of lifting lugs, rope etc.
11. Civil foundation drawing of each machine shall be furnished to BHEL for approval during detailed engineering stage showing / including the followings: -
 - a) Scope of work by BHEL and vendor which shall be indicated with different legend or in the form of note.
 - b) Weight of moving parts, its frequency and its height from floor shall be furnished.
 - c) Recommended location of cable trench for feeding cable to machine shall be furnished along with the details of cable entry.
 - d) Civil loads per bolt (static and dynamic) shall be furnished in tabular form considering weight of maximum size of job and worst cutting force.
12. Separate general arrangement drawing of drive arrangement shall be furnished to BHEL for approval during detailed engineering stage.
13. Characteristic curve of motor shall be furnished to BHEL for approval during detailed engineering stage showing torque, speed, current & voltage.
14. Design of machines shall be such that no cooling water / air from external source shall be required for cooling of any part of machine. Necessary cooling arrangement, as required, shall be provided by the bidder in their machines.
15. First fill of all oil, lubricants, coolants etc. shall be included in scope of work of the bidder for each machine and shall be supplied along with the machine and **price for the same shall be taken care in the price bid, if any.**
16. Filled up sketch indicating various dimensions for the space requirements of each equipment, centre line of job feeding and its dimension from some reference point like the centre line of machine or edge of the machine, location of operator, direction of job feeding & withdrawal and details of cable entry.
17. Bidder has to depute competent designer (s) of each machine at BHEL's office during detailed engineering stage to discuss drawings and other technical documents as and when required by BHEL. However, minimum 7 days notice shall be served for the same.



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18. Make of various bought items shall be as indicated in the NIT specification. Bidder will seek approval from BHEL during detailed engineering stage for those items which are not appearing in the list but required for the machine. However, Bidder shall not approach BHEL for approval of additional make of any item which is already appearing in the list.
19. Painting specification and schedule shall be provided by the bidder for each machine as indicated in the NIT specification. However, painting specification of those items / equipments which are not covered in the specification, bidder to prepare the painting specification (suitable for sea atmosphere) for each item / machine / equipment and will be submitted to BHEL / CUSTOMER for approval after placement of order and any changes required by BHEL / CUSTOMER for the same shall be incorporated and adhered by the bidder without any commercial implications. Bidder to include adequate quantity of loose touch up paint for each item / equipment / machine which is required to be supplied along with the item / equipment / machine to take care damage during transit and price for the same, if any, shall be taken care in the price bid.
20. Noise level for each machine at a horizontal distance of 1.0 metre from the edge of the machine and at a height of 1.5 metres from the ground shall be limited to 85 dba and the same shall be shown during the "PG" test.
21. Inspection checklist / MQP etc. shall be prepared by the bidder and will be submitted to BHEL / CUSTOMER for approval after placement of order and any changes required by BHEL / CUSTOMER for the same shall be incorporated and adhered by the bidder without any commercial implications. Necessary instruments / job material (steel plate / bar etc.) as required for the testing / inspection of machines shall be arranged by the bidder and shall also be included in bidder's scope of work.
22. All foundation nuts, bolts, lock nuts, washers etc. as required for fixing the machine with foundation shall be included in bidder's scope of work for each machine and the same shall be supplied along with the machine and **price for the same shall be taken care in the price bid, if any.**
23. All necessary guards, devices, tools & other means that will effectively protect all personnel from any accidental or injury that may occur while machine is in running condition shall be in bidder's scope of work and shall be provided and shown in the drawings to be submitted during detail engineering stage.
24. Offered machines shall be suitable for the electrical conditions like voltages, frequencies, variations etc. as indicated in project information of NIT specification.
25. BHEL, will provide one (1) no. feeder per machine. Bidder to note & confirm that they will distribute the power requirement of various motors at their end only for this feeder.
26. List of maintenance tools / hand tools & tackles in terms of numbers only indicating sizes / ratings etc. in annexure form for each machine shall be submitted during detail engineering stage and the same shall be included in bidder's scope of work. Maintenance tools and tackles shall be supplied along with the tool box(es) and **price for the same shall be taken care in the final price bid, if any.**
27. List of commissioning spares in terms of numbers only indicating sizes / ratings etc. in annexure form for each machine shall be indicated in the offer and shall be supplied along with the machine. **Price for the same shall be taken care in the final price bid, if any.**



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28. One (1) no. EOT Crane of capacity 10 Tonnes shall be provided by BHEL in the workshop building for maintenance of the machines. Bidder to check and confirm that the heaviest part of individual machine shall not exceed 10 Tonnes.
29. Necessary earthing studs / facilities for the machine and cables within the machine shall be provided by the bidder.
30. All machines shall be provided with DOL starter.
31. Bidder to furnish the Signed & stamped copy of quality plan for motors attached with the NIT specification during detail engineering stage.
32. Cable Glands shall be double compression tinned brass type and the cable glands shall be supplied as a part of each machine and **price for the same shall be taken care in the price bid, if any.**
33. All cable lugs shall be heavy-duty tin-plated crimping type the cable lugs shall be supplied as a part of each machine and **price for the same shall be taken care in the price bid, if any.**
34. All technical parameters of LV motors shall comply data sheet –A for LV motors.
35. Filled up motor data sheet of motor (for each motor) and filled up electrical load data format (enclosed with the NIT specification) for each machine shall be submitted during detail engineering stage.
36. All the hand wheels shall be polished / Nickel - Chrome plated.
37. List of standard accessories (which will be supplied free of cost along with the machine) in terms of numbers only for each machine shall be indicated in the offer and included in bidder's scope of work. **Price for the same shall be taken care in the price bid, if any.**
38. Bidder to indicate the material of construction of major parts of the machines indicating relevant IS / BS no.

7.0 **SPECIFIC REQUIREMENTS REGARDING ERECTION / TESTING & COMMISSIONING**

Field quality plan for all machines shall be prepared by the bidder during detailed engineering stage as per agreed schedule and the same shall be approved by BHEL to facilitate handling of equipment, erection & commissioning.

8.0 **BID EVALUATION CRITERIA**

The bid shall be evaluated based on the price quoted for main machine, commissioning spares, tools and tackles, manufacturer's standard accessories and special accessories as per specification and any technical loading due to non adherence to the technical specification. However, the price for recommended spares and other special / optional accessories which are not included in bidder's scope of work shall not be considered for evaluation purpose.

9.0 **CONDITION OF REJECTION**



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Bid may be rejected if the data which have asked in clause No. 5.0 above is not properly filled-up and submitted along with the bid with company seal.

10.0 **INSPECTION, TESTING AND CODES**

- 10.1 The machine offered shall conform to the latest relevant Indian / international Codes / Standards, their electrical drives shall conform to the latest Indian Electricity Rules and shall comply for the currently applicable statutory regulations and safety codes for the locality where the equipment shall be installed.
- 10.2 Each machine before despatch shall be shop assembled & tested for its performance in the presence of purchaser's representative. Vendor to ensure the proper quality checks during manufacturing & assembly of machine, including identification, co-relation & verification of material test certificates for critical components like gears, shafts, spindles, sleeves etc. and radiographic tests for welds and ultrasonic tests on forging/castings to ensure defects free components and furnish test procedure, reports & test certificates on shop tests.
- 11.0 Drawing / document distribution schedule is attached in the NIT specification. Bidder shall follow the same during detail engineering stage.



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ANNEXURE - I**MAKES OF SUB VENDORS ITEMS OF WORKSHOP EQUIPMENT**

S. NO.	ITEM	SUPPLIERS	PLACE	REMARKS
1.	BEARINGS	SKF	-	
		FAG	-	
		TATA	-	
		NBC	-	
2.	V- BELT	FENNER	-	
		DUNLOP	-	
3.	HYDRAULIC POWER PACK	VICKERS-PERRY	-	
		REXROTH	-	
4.	PVC POWER CABLES	APAR INDUSTRIES LTD.	MUMBAI	
		CORDS CABLE INDUSTRIES LTD.	NEW DELHI	
		DIAMOND POWER INFRASTRUCTURE LTD	VADODARA	
		GOYOLENE FIBRES (INDIA) PVT.LTD	MUMBAI	
		GOVIND CABLE INDUSTRIES	KOLKATA	
		GUPTA POWER INFRASTRUCTURE LIMITED	BHUBNESWAR	
		HAVELLS INDIA LIMITED	NOIDA	
		KEI INDUSTRIES LTD.	NEW DELHI	
		KRISHNA ELECTRICAL INDUSTRIES LTD	GWALIOR	
		KEC INTERNATIONAL LIMITED	MUMBAI	
		MANSFIELD CABLES COMPANY LTD.	NOIDA	
		NICCO CORPORATION LTD.	KOLKATA	
		PARAMOUNT COMMUNICATIONS LTD.	NEW DELHI	
		POLYCAB WIRES PVT. LTD.	MUMBAI	
		RADIANT CORPORATION PRIVATE LIMITED	HYDERABAD	
		RAVIN CABLES LIMITED	MUMBAI	
		SUYOG ELECTRICALS LTD.	VADODARA	
		SRIRAM CABLES PVT. LTD.	NEW DELHI	
		SCOT INNOVATION WIRES AND CABLES PVT. LTD.	SOLAN	
		SAM CABLES & CONDUCTORS (P) LTD	UDHAM SINGH NAGAR	
5.	PVC CONTROL CABLES	THERMO CABLES LTD	HYDERABAD	
		ADVANCE CABLE TECHNOLOGIES (P) LTD	BANGALORE	
		APAR INDUSTRIES LTD., CMI	MUMBAI	



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S. NO.	ITEM	SUPPLIERS	PLACE	REMARKS
		LTD		
		CMI LIMITED	FARIDABAD	
		CORDS CABLE INDUSTRIES LTD	NEW DELHI	
		CRYSTAL CABLE INDUSTRIES LTD	KOLKATA	
		DELTON CABLES LTD	NEW DELHI	
		DIAMOND POWER INFRASTRUCTURE LTD	VADODARA	
		ELKAY TELELINKS LTD	NEW DELHI	
		GEMSCAB INDUSTRIES LTD	NEW DELHI	
		GOVIND CABLE INDUSTRIES	KOLKATA	
		GUPTA POWER INFRASTRUCTURE LIMITED	BHUBNESWAR	
		HAVELLS INDIA LIMITED	NOIDA	
		INCOM CABLES (P) LTD	NEW DELHI	
		KEI INDUSTRIES LTD	NEW DELHI	
		KRISHNA ELECTRICAL INDUSTRIES LTD	GWALIOR	
		KEC INTERNATIONAL LIMITED	MUMBAI	
		MANSFIELD CABLES COMPANY LTD	NOIDA	
		NICCO CORPORATION LTD	KOLKATA	
		PARAMOUNT COMMUNICATIONS LTD	NEW DELHI	
		POLYCAB WIRES PVT. LTD	MUMBAI	
		RAVIN CABLES LIMITED	MUMBAI	
		SUYOG ELECTRICALS LTD	VADODARA	
		SPECIAL CABLES PVT. LTD	NEW DELHI	
		SCOT INNOVATION WIRES AND CABLES PVT. LTD	SOLAN	
		SAM CABLES & CONDUCTORS (P) LTD	UDHAM SINGH NAGAR	
		SPM POWER & TELECOM PVT. LTD	HYDERABAD	
		TORRENT CABLES LTD	AHMEDABAD	
		THERMO CABLES LTD	HYDERABAD	
		TIRUPATI PLASTOMATICS PVT. LTD	JAIPUR	
		UNIVERSAL CABLES LTD	SATNA	
6.	XLPE POWER CABLES	APAR INDUSTRIES LTD	MUMBAI	
		CORDS CABLE INDUSTRIES LTD	NEW DELHI	
		CRYSTAL CABLE INDUSTRIES LTD	KOLKATA	
		DIAMOND POWER INFRASTRUCTURE LTD	VADODARA	
		GEMSCAB INDUSTRIES LTD	NEW DELHI	



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S. NO.	ITEM	SUPPLIERS	PLACE	REMARKS
		GOVIND CABLE INDUSTRIES	KOLKATA	
		GUPTA POWER INFRASTRUCTURE LIMITED	BHUBNESWAR	
		HAVELLS INDIA LIMITED	NOIDA	
		KEI INDUSTRIES LTD	NEW DELHI	
		KRISHNA ELECTRICAL INDUSTRIES LTD	GWALIOR	
		KEC INTERNATIONAL LIMITED	MUMBAI	
		MANSFIELD CABLES COMPANY LTD	NOIDA	
		PARAMOUNT COMMUNICATIONS LTD	NEW DELHI	
		POLYCAB WIRES PVT. LTD	MUMBAI	
		RAVIN CABLES LIMITED	MUMBAI	
		SUYOG ELECTRICALS LTD	VADODARA	
		SPECIAL CABLES PVT. LTD	NEW DELHI	
		SCOT INNOVATION WIRES AND CABLES PVT. LTD	SOLAN	
		SRIRAM CABLES PVT. LTD	NEW DELHI	
		TORRENT CABLES LTD	AHMEDABAD	
		THERMO CABLES LTD	HYDERABAD	
		TIRUPATI PLASTOMATICS PVT. LTD	JAIPUR	
7.	XLPE CONTROL CABLES	APAR INDUSTRIES LTD	MUMBAI	
		CABLE CORPORATION OF INDIA LTD	MUMBAI	
		CRYSTAL CABLE INDUSTRIES LTD	KOLKATA	
		DIAMOND POWER INFRASTRUCTURE LTD	VADODARA	
		GEMSCAB INDUSTRIES LTD	NEW DELHI	
		HAVELLS INDIA LIMITED	NOIDA	
		KEI INDUSTRIES LTD	NEW DELHI	
		KRISHNA ELECTRICAL INDUSTRIES LTD	GWALIOR	
		KEC INTERNATIONAL LIMITED	MUMBAI	
		PARAMOUNT COMMUNICATIONS LTD	NEW DELHI	
		POLYCAB WIRES PVT. LTD	MUMBAI	
		RADIANT CORPORATION PRIVATE LIMITED	HYDERABAD	
		RAVIN CABLES LIMITED	MUMBAI	
		SUYOG ELECTRICALS LTD	VADODARA	
		SRIRAM CABLES PVT. LTD	NEW DELHI	
		TORRENT CABLES LTD	AHMEDABAD	
		UNIVERSAL CABLES LTD	SATNA	
8.	PUMP FOR COOLANT	PHULSONS		

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S. NO.	ITEM	SUPPLIERS	PLACE	REMARKS
		RAJPURA / RAJAMANE INDUSTRIES PVT. LTD.	BANGLORE	
9.	LT MOTORS	SIEMENS	-	
		NGEF (up to 15KW)	-	
		CROMPTON	-	
		KIRLOSKAR	-	
		BHARAT BIJLI	-	
		ALSTOM	-	
		ABB	-	
10.	PAINT	ASIAN PAINTS (I) LTD.	-	
		BERGER PAINTS INDIA LTD	-	
		GOODLASS NEROLAC	-	
		JENSON & NICHOLSON (I) LTD	-	
		CDC CARBOLINE (I) LTD.	-	
		SHALIMAR PAINTS LTD.	-	
		ADDISON PAINTS LTD	-	
		GRAND POLYCOAT	-	
		BOMBAY PAINTS	-	
		HEMPLE PAINTS (SINGAPORE)	-	
		JOTUN PAINTS	-	

NOTE:

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

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

2. DEALERS ARE NOT ACCEPTABLE FOR ANY ITEM OF THE PACKAGE. BIDDER SHALL PROCURE ALL ITEMS INCLUDING PLATES, STRUCTURAL, FLANGES; COUNTER FLANGES ETC. FROM APPROVED SUB VENDOR ONLY.
3. THE INSPECTION CATEGORY WILL BE INTIMATED AFTER AWARD OF CONTRACT BY BHEL/CUSTOMER. HOWEVER, THE SAME WILL BE ADHERED BY THE BIDDER WITHOUT ANY COMMERCIAL AND DELIVERY IMPLICATION TO BHEL/ CUSTOMER.



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ANNEXURE-II

DRAWINGS, DATA / DOCUMENTS TO BE FURNISHED BY THE SUCCESSFUL BIDDER

The successful bidder shall submit the following drawings / documents for each machine / equipment (as applicable), during detail engineering for approval /information:

LIST OF PRIMARY DRAWING / DOCUMENTS:

Sl. No.	BHEL DRG.NO	DRAWING TITLE	REMARKS	SUBMISSION SCHEDULE - WEEK NUMBER FROM DATE OF LOI
1.	PE-V0-435-568-A001	Inspection Check List / Manufacturing Quality Plan of machine/equipment	APPROVAL	3
2.	PE-V0-435-568-A002	GA, Foundation Detail (as required) and Data sheet of Machine / Equipment with detailed BOM	APPROVAL	3

List of Secondary dwg. /doc for each machine / equipment (as applicable) after approval of basic dwg. / doc:

Sl. No.	BHEL DRG.NO	DRAWING TITLE	REMARKS	SUBMISSION SCHEDULE - WEEK NUMBER FROM DATE OF LOI
3.	PE-V0-435-568-A003	O & M Manual for EQUIPMENT	INFORMATION	2 weeks after approval of primary dwg/doc.
4.	PE-V0-435-568-A004	Erection Procedure for WORKSHOP EQUIPMENT	INFORMATION	2 weeks after approval of primary dwg/doc.

- The above drawing list is tentative and shall be finalized with the successful bidder after placement of order. Every repeat submission within Ten (10) days. Response time by BHEL within 18 days after receiving of drawing. Supplier is required to submit hardcopies of O&M manual after 30 days of release of MDCC.
- Drawings shall be prepared in Auto-Cad latest edition. Required no. of hard and soft copies (editable) of the drawings shall be furnished as per requirement specified elsewhere in the specification.
- All the drawings and documents including general arrangement drawing, data sheet, calculation etc. to be furnished to the customer during detailed engineering stage shall include / indicate the following details for clarity w.r.t. Inspection, construction, erection and maintenance etc.: -
 - All drawings and documents shall indicate the list of all reference drawings including general arrangement.
 - All drawings shall include / show plan, elevation, side view, cross - section, skin section, blow - up view; all major self-manufactured and bought out items shall be labeled and included in BOQ / BOM in tabular form.

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- c) Painting schedule shall also be made as a part of general arrangement drawing of each equipment / items indicating at least 3 trade names.
- d) All the drawings required to be furnished to customer during detailed engineering stage shall include technical parameters, details of paints and lubrication, hardness and BOQ / BOM in tabular form indicating all major components including bought out items and their quantity, material of construction indicating its applicable code / standard, weight, make etc.



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ANNEXURE - III**Drawings / documents distribution schedule****Distribution of documents**

The source, distribution, no. of copies etc shall be as per the following document distribution schedule.

Document Distribution Schedule - After Placement of Order

Sl.No.	Document	Total Copies	Distribution		Consultant
			Owner		
			HQ	SITE	
1.	PERT Network, work schedules, Bar charts, Layout drawings in 2D & 3 D of all building, plant, pump house, control room etc	12	4	6	2
2.	Data, drawings, documents, write-ups, calculation				
	- Preliminary	12	5	5	2
	- Revised	12	4	6	2
3.	Approved drawings, documents etc.	12	4	6	2
4.	Instruction manuals for erection and O&M	12	5	6	1
5.	As built drawings including O &M manual				
	- Hard Copy	12	5	6	1
	- Soft Copy	5	2	2	1

Note: The above requirement is minimum. However, exact quantities of drawings / documents requirement shall be informed to the successful bidder during detailed engineering stage for which no commercial implication shall be entertained by BHEL.

All drawings & documents shall be prepared in Autocad and submitted for review / approval in soft copies also. Catalogues shall be scanned for soft copy.

Note:- Manually prepared drawings are not acceptable.

Soft copy in CD Rom and Reproducible Tracings of all drawings / documents shall be submitted along with Final / As-Built submission.

“Bidder to note that BHEL reserve the right for drg/doc submission through web based Document Management System. Bidder would be provided access to the DMS for drg/doc approval and adequate training for the same. Detailed



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methodology would be finalized during the kick-off meeting. Bidder to ensure following at their end.

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

DMS user manuals to be used by BHEL PEM vendors for uploading, viewing, revising, commenting and tracking documents on PEM's DMS have been uploaded on PEM internet website (www.bhelpem.com) under the Vendor session.

For quick access bidder may refer the link

<http://bhelpem.com/DMSManuals/DMSManuals.html>

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TECHNICAL SPECIFICATION

FOR

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Specific Technical Requirement (Electrical)

**TAMILNADU GENERATION &
DISTRIBUTION CORPORATION LTD.**

2 X 660 MW UDANGUDI STPP STAGE-I

WORKSHOP EQUIPMENT

**TECHNICAL SPECIFICATION
(ELECTRICAL PORTION)**

221660/2021/PS-PEM-MAX



TITLE:

**ELECTRICAL EQUIPMENT SPECIFICATION
FOR
WORKSHOP EQUIPMENT**

2 X 660 MW UDANGUDI STPP STAGE-I

SPECIFICATION NO.

VOLUME NO. : **II-B**SECTION: **C**REV NO. : **00** DATE: 24/12/2018

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D	STANDARD TECHNICAL SPECIFICATION – LV MOTORS	5
D	MOTOR DATA SHEET-C	2
D	QUALITY PLAN (FOR MOTORS BELOW 55 KW)	2
D	QUALITY PLAN (FOR MOTORS ABOVE & 55 KW)	9
D	SUB VENDOR LIST	1
D	ELECTRICAL LOAD DATA FORMAT (ANNEX-II)	1
D	MANDATORY SPARES	1

	ELECTRICAL EQUIPMENT SPECIFICATION FOR WORKSHOP EQUIPMENT 2 X 660 MW UDANGUDI STPP STAGE-I	SPECIFICATION NO.
		VOLUME NO. : II-B
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SPECIFIC TECHNICAL REQUIREMENTS:

1.0 EQUIPMENT & SERVICES TO BE PROVIDED BY BIDDER:

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

- a) Services and Equipment as per “Electrical Scope between BHEL and Vendor”.
- b) Any item/work either supply of equipment or erection material which have not been specifically mentioned but are necessary to complete the work for trouble free and efficient operation of the plant shall be deemed to be included within the scope of this specification. The bidder without any extra charge shall provide the same.
- c) Supply of mandatory spares as specified in the specifications of mechanical equipments.
- d) Electrical load requirement for Workshop equipment.
- e) All equipment shall be suitable for the power supply fault levels and other climatic conditions mentioned in the enclosed project information.
- f) Bidder to furnish list of makes for each equipment at contract stage, which shall be subject to customer / BHEL approval without any commercial and delivery implications to BHEL.
- g) Various drawings including GA drg, data sheet as per required format, quality plans, calculations, test reports, test certificates, operation and maintenance manuals, characteristic curves, wiring diagrams/schemes etc. shall be furnished as specified at contract stage. All documents shall be subject to customer / BHEL approval without any commercial implications to BHEL.
- h) The sub-vendor list for various electrical items is subject to BHEL/Customer approval without any commercial implications.
- i) Motors shall meet minimum requirement of Electric motor specification.
- j) Purchaser will furnish data sheets to the vendor after award of contract. Vendor shall furnish filled in data sheets meeting the specification requirements.
- k) Vendor to clearly indicate equipment locations and local routing lengths in their cable listing furnished to BHEL.
- l) Cable BOQ worked out based on routing of cable listing provided by the vendor for “both end equipment in vendor’s scope” shall be binding to the vendor with +10 % margin to take care of slight variation in routing length & wastages.

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

Refer “Electrical Scope between BHEL and Vendor”.

3.0 DOCUMENTS TO BE SUBMITTED ALONG WITH BID

	ELECTRICAL EQUIPMENT SPECIFICATION FOR WORKSHOP EQUIPMENT 2 X 660 MW UDANGUDI STPP STAGE-I	SPECIFICATION NO.
		VOLUME NO. : II-B
		SECTION: C
		REV NO. : 00 DATE: 24/12/2018
		SHEET: OF
3.1 Bidder shall confirm total compliance to the electrical specification without any deviation from the technical / quality assurance requirements stipulated. In line with this, the bidder as technical offer shall furnish two signed and stamped copies of the following: a) A copy of this sheet "Electrical Equipment Specification for Workshop Equipment and sheet "Electrical Scope between BHEL and Vendor" with bidder's signature and company stamp. b) Electrical load requirement. 3.2 No technical submittal such as copies of data sheets, drawings, write-up, quality plans, type test certificates, technical literature, etc, is required during tender stage. Any such submission even if made, shall not be considered as part of offer. 4.0 LIST OF ENCLOSURES 4.1 Electrical scope between BHEL & vendor 4.2 Technical specification – Specification for Electric Motors/Actuators 4.3 Standard Technical specification – LV Motors 4.4 Datasheets & quality plan for motors. 4.5 Load Data Format. (Annexure –II)		

ELECTRICAL SCOPE BETWEEN BHEL AND VENDOR (FOR EPC PROJECTS)**PACKAGES : WORKSHOP EQUIPMENT****SCOPE OF VENDOR: SUPPLY****PROJECT: 2 X 660 MW UDANGUDI STPP STAGE-I**

<u>S.NO</u>	<u>DETAILS</u>	<u>SCOPE SUPPLY</u>	<u>SCOPE E&C</u>	<u>REMARKS</u>
1	Power Supply	BHEL	BHEL	240 V AC (supply feeder)/415 V AC (3 PHASE 4 WIRE) supply shall be provided by BHEL based on load data provided by vendor at contract stage for all equipment supplied by vendor as part of contract. Any other voltage level (AC/DC) required will be derived by the vendor.
12	Motors	Vendor	Vendor	

NOTES:

1. Make of all electrical equipments/items supplied shall be reputed make & shall be subject to approval of BHEL/customer after award of contract without any commercial implication.
2. All QPs shall be subject to approval of BHEL/customer after award of contract without any commercial implication.



SECTION-3.16: MOTORS

1.0.0 INTENT OF SPECIFICATION

This section covers the technical requirements of HT motors, LT Motors and DC motors.

2.0.0 CODES AND STANDARDS

The equipment to be furnished under this specification shall be in accordance with the applicable section of the latest edition (including amendments) of the following Indian Standards (IS), IEC publications and other codes except where modified and /or supplemented by this specification.

- | | |
|-----------------|--|
| a) IS: 325 | Three phase induction motors |
| b) IS: 12615 | Energy efficient induction motors |
| c) IS: 900 | Code of practice for installation and maintenance of induction motors |
| d) IS: 996 | Single-phase AC induction motor for general purpose |
| e) IS: 1231 | Dimensions of three-phase foot-mounted induction motors |
| f) IS: 2223 | Dimensions of flange mounted AC induction motors |
| g) IS: 4029 | Guide for testing three-phase induction motors |
| h) IS: 8789 | Values of performance characteristics for three-phase induction motors |
| i) IS: 13555 | Guide for selection and application of 3-phase AC induction motors for different types of driven equipment |
| j) IS: 5571 | Guide for selection of electrical equipment for hazardous areas |
| k) IS: 12065 | Permissible limits of noise level for rotating electrical machines |
| l) IS: 12075 | Mechanical vibration of rotating electrical machines |
| m) IS 60034-5 | Degree of protection provided by Integral design of rotating electrical machines |
| n) IS 60034-8 | Terminal marking and direction of rotation |
| o) IS 60079-1 | Equipment protection by flame proof enclosure |
| p) IS 60034-1 | Rotating electrical machines. |
| q) IS 60079 | Explosive atmospheres |
| r) IS/IEC 60529 | Degrees of protection provided by enclosures (IP code) |
| s) IEC 60034 | Rotating electrical machines. |
| t) IS 3177 | Code of practice for Design, Manufacture, Erection and testing of Cranes and Hoists |

3.0.0 TECHNICAL REQUIREMENTS

3.1.0 Design ambient temperature

Motors shall be suitable for an ambient temperature of 50 degree C and relative humidity of 95% and shall deliver the rated output without exceeding its guaranteed temperature limits.

3.2.0 Supply voltage

Motors rated up to and including 415 V are termed as LT motors and the motors rated higher than 415 V are termed as HT motors.

Motors shall be capable of delivering the rated output under following voltage and frequency variations without exceeding its guaranteed temperature limits.



- Frequency variation : (+) 3% and (-) 5%
- Voltage variation for LT motors : ($\pm$) 10%
- Voltage variation for HT motors : ($\pm$) 6%
- Combined variation of voltage and frequency : 10% (absolute sum)

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

3.3.0 System Parameters

Sl. No.	Description	11 kV and 6.6 kV System	LT System
1.	Voltage level	6.6 kV : Above 200 kW and upto 2000 kW 11 kV: Above 2000 kW	240 V : up to 0.2 kW 415 V: >0.2 kW and up to 200 kW.
2.	System earthing	Earthed through resistance, limiting earth fault current to 300 Amps	415 V system solidly grounded.
3.	Fault withstand rating of motor terminal box (Breaker operated)	50 kA for 0.2 sec for 11 kV and 31.5 kA for 0.2 sec for 6.6 kV	415 V system : 50/65 kA for 0.2 second

3.4.0 Type

AC Motors shall be squirrel cage induction type unless otherwise it is specified.

3.5.0 Duty

- All AC motors shall be squirrel cage three phase/single phase induction motors. All the motor shall be designed for bi-directional rotation.
- All the motors shall be rated for S1 duty for continuous operation. Motors of crane and hoist application shall be intermittent duty.
- DC motor shall generally be of shunt wound type rated for 220 V DC.
- Motors shall be suitable for installation in hot, humid and tropical atmosphere and polluted at places with coal ash and or fly ash.
- The motors shall be suitable for bus transfer schemes provided on the 11 kV/6.6 kV/415 V systems without any injurious effect on its life.

3.6.0 Design margin

Whenever the basis for motor rating are not specified in the corresponding mechanical specification section maximum continuous motor rating shall be atleast 10% above the maximum load derived of the driven equipment under entire operating range including voltage & frequency variation.

The motor characteristics shall match the requirements of the driven equipment so that adequate starting, accelerating; pull up, breakdown and full load torques are available for the intended service.

Service shall be considered as 1.0 only.



3.7.0 Method of Starting

- All the motors shall be suitable for direct on-line starting on full load. Where variable voltage and variable frequency (VVFD) operation is envisaged through VVFD drives, motors shall be specially designed for such application.
- LT motors rated up to 125 kW shall be controlled through MPCB/MCCB and contactor. LT motors rated more than 125 kW shall be controlled through air circuit breaker.
- HT Motors shall be controlled through vacuum circuit breaker.

3.8.0 Efficiency

All the duty motors shall be energy efficient type. For HT and LT motors, it shall be IE3 class as per IS 12615. For VFD controlled HT and LT motors, it shall be IE2 class as per IS 12615.

3.9.0 Temperature rise

- Winding Insulation shall be Class F.
- Temperature rise of air cooled motors shall not exceed 70°C over air temperature of 50°C by resistance method, while delivering its maximum rated output.
- Temperature rise of water cooled motors shall not exceed 80°C over inlet cooling water temperature by resistance method, while delivering its maximum rated output.

3.10.0 Starting voltage

- Motors shall be capable of starting and accelerating the load at following starting voltage, with direct on-line starting, without exceeding specified winding temperatures.
 - HT Motors (up to 1000 kW) : 85% of rated voltage
 - HT Motors (> 1000 kW up to 4000 kW) : 80% of rated voltage
 - HT Motors (> 4000 kW) : 75% of rated voltage
 - LT motors : 80% of rated voltage
- During fast changeover of power supply source, vector difference between the motor residual voltage and the incoming supply voltage shall be about 150% of the rated voltage and the motors shall withstand voltage stress and torque stress developed during that time, which may last for a period of one (1) second.
- The motor shall be capable of operating at full load at a supply voltage of 75% of the rated voltage for 5 minutes.

3.11.0 No. of Starts

Continuous duty motors shall be suitable for the following starting requirements under the specified conditions of load, torque and inertia.

- No. of consecutive hot starts shall be 2 (with initial temperature of the motor at full load operating level).
- No. of consecutive cold starts shall be 3 (with initial temperature of the motor at ambient temperature).
- For conveyor motors, no. of consecutive hot starts shall be 3 (with initial temperature of the motor at full load operating level).



3.12.0 Starting current

- Locked rotor current of HT motors for applications other than listed below shall be limited to 600% of the full load current, and is subject to IS tolerance.
- For energy efficient LT motors, locked rotor current shall be as per IS: 12615.
- Locked rotor current of the VFD controlled AC motors shall be limited to 300% of the full load current, and is subject to IS tolerance.
- Locked rotor current of the BFP motors shall be limited to 450% of the full load current of the motor, and is subject to IS tolerance.

3.13.0 Locked rotor withstand time

- The locked rotor withstand time for HT motors under hot conditions at 110% rated voltage shall be more than the starting time at minimum permissible voltage specified above by atleast three seconds or 15% of the accelerating time whichever is greater. Provision of speed switch shall be avoided to the extent possible. In case the speed switch is required, it shall be indicated by the bidder in his offer
- For the LT motors having starting time up to 20 seconds at minimum permissible voltage, the locked rotor withstand time under hot condition at highest voltage limit shall be at least 2.5 seconds more than the starting time.
- For the motors having starting time more than 20 seconds and up to 45 seconds at minimum permissible voltage, the locked rotor withstand time under hot condition at highest voltage limit shall be at least 5 seconds more than the starting time.
- For motors having starting time more than 45 seconds at minimum permissible voltage, 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.
- Speed switches mounted on the motor shaft shall be provided in cases where above requirements are not met.
- When a speed switch is mounted on the motor shaft, the same shall remain closed for speeds lower than 20% and open for speeds above 20% of the rated speed. The speed switch shall be capable of withstanding 120% over speed in either direction of rotation.

3.14.0 Torque Requirements

- Accelerating torque at any speed with the lowest permissible starting voltage shall be at least 10% motor full load torque.
- Pull out torque at rated voltage shall not be less than 205% of full load torque.
- Motors subjected to reverse rotation shall be designed to withstand the stresses encountered when starting with non-energized shaft rotating at 125% of rated speed in reverse direction.

3.15.0 Enclosure

- a) Motors shall have IP 55 degree of protection.
- b) For hazardous location, the enclosure of motors shall following have flame proof construction conforming to applicable standard.
 - Fuel oil area Group – IIB
 - Hydrogen generation plant area : Group – IIC)



3.16.0 Cooling

- LT motors shall be totally enclosed fan cooled (TEFC), type IC411. The cooling shall be effected by self-driven bi-directional centrifugal fan protected by fan cover.
- HT motors can be totally enclosed fan cooled (TEFC) or totally enclosed tube ventilated (TETV) or closed air circuit air cooled (CACA-IC6A1A1) type.
- Motors rated >3000 kW can be closed air circuit water cooled (CACW).
- Motors with CACA/CACW heat exchangers shall have dial type thermometer with adjustable alarm contacts to indicate the following:
 - Hot and cold air temperatures of the closed air circuit for CACA motors.
 - Hot and cold, air and water temperatures for CACW motors.
- The Alarm switch contact rating shall be minimum 0.5 A at 220 V DC and 10 A at 230 V AC.

3.17.0 Winding

- Winding shall be class F insulation with temperature limited to class B. Insulation shall be Non-hygroscopic, oil resistant, and flame resistant. Winding, fittings and hardware shall be corrosion resistant. Winding shall be tropicalized and suitably varnished, baked and treated for operating satisfactorily in humid and corrosive atmosphere.
- For the VFD operated drives, insulation shall be designed to take care of stresses due to high DV/DT. Motors shall be wound with dual coated winding wires and impregnated with VPI process. Further for such application, insulated bearings shall be provided to avoid circulating current caused by shaft induced voltages.
- Space heaters rated for 240 V AC, 50 Hz supply shall be provided for motors rated 30 kW and above to maintain windings in dry condition when motor is standstill.
- For HT motors, insulation shall be Vacuum Impregnated (VPI).
- HT motors shall withstand one minute power frequency voltage test or 1.2/50 micro sec lightning impulse Voltage wave of $4U+5$ kV (U =Line voltage in kV) test on main insulation as per IEC 60034-15. The coil inter-turn insulation shall withstand steep front impulse withstand voltage as per IEC 60034-15.
- For HT motors, 12 nos. simplex or 6 nos. duplex RTDs (two per phase), each having D.C. resistance of 100 ohms at 0°C, embedded in the stator winding at locations where highest temperatures may be expected, shall be provided. The material of the ETD's shall be platinum.

3.18.0 Bearings

- Motor shall be provided with antifriction bearings, unless sleeve bearings are required by the motor application. Bearings shall be provided with seals to prevent leakage of lubricant or entrance of foreign matters like dirt, water etc. into the bearing area.
- Sleeve bearings shall be split type, ring oiled with permanently aligned, close running shaft sleeves. Grease lubricated bearings shall be pre-lubricated and shall have provisions for in-service positive lubrication with grease nipple and relief holes. For sleeve bearings, the bearing housing shall be preferably in end shield itself.
- Vertical shaft motors shall be provided with thrust and guide bearings. Thrust bearing of tilting pad type is preferred. However, if anti-friction bearings can take vertical thrust, thrust and guide bearings are not required.



- Lubricant shall not deteriorate under all service conditions. The lubricants shall be limited to normally available types. For motors rated 30 kW and above re-lubrication facility shall be provided.
- For motor with forced lubrication, a shaft driven oil pump shall be provided along with an electrical auxiliary pump. Alternatively, two motor driven pumps may be provided, one working and one standby. All necessary auxiliaries and accessories shall be provided to complete the system. A pressure gauge and pressure switch for low oil pressure warning and to start the standby oil pump automatically shall also be provided. A motor driven jacking oil pump may be provided, for heavy shaft loads.
- Flow switches shall be provided for monitoring oil flow of forced lubrication bearings, if used. Alarm switch contact rating shall be minimum 0.5 A at 220 V DC and 10 A at 230 V AC.
- For bearing temperature measurement, duplex RTDs shall be provided for each bearing and shall be wired up to the terminal box.
- Each bearing shall be provided with dial type thermometer.
- For all VFD operated motors shall have insulated bearings to prevent flow of shaft currents.
- For motors rated above 1000 KW having shaft length more than 1.5 M shall have insulated bearings to prevent flow of shaft currents.
- All the motors rated <15 kW shall be provided with sealed ZZ bearings.
- Lub oil pressure transmitters shall be provided to DCS for remote monitoring. Lub oil pressure very low trip to HT equipment shall be 2 out of 3 logic.

3.19.0 Terminal Boxes

- Separate terminal boxes of IP 55 degree of protection shall be provided for stator leads. For single core cables, gland plate shall be non-magnetic material. Terminal box of HT motors shall be capable of being turned 360° in steps of 180°. Terminal box of LT motors shall be capable of being turned 360° in steps of 90°. The terminal boxes shall be split type with removable cover with access to connections.
- Terminals for motors shall be stud type, thoroughly insulated from the frame. The terminals shall be clearly identified by phase markings, with corresponding direction of rotation marked on the non-driving end of the motor.
- The terminal box shall be capable of withstanding maximum system fault current for 0.2 sec for all breaker operated motors and shall be provided with explosion vent.
- For contactor operated LT motors, the terminal box shall be capable of withstanding the fault current for 0.2 sec minimum and operating time of MPCB/MCCB.
- Removable gland plates of thickness not less than 2.5 mm sheet steel or 3 mm aluminium (for single core cables) shall be provided for cable boxes.
- Cable spreader box shall be provided for larger cable sizes.
- Cable boxes of HT motors shall be phase segregated type. The terminals of three phases shall be segregated by barriers of metal or fiber glass. For HT motors, cable box design shall be suitable for accommodating cable termination kits.
- Separate terminal box for space heaters shall be provided.
- A separate terminal box of IP 55 degree of protection shall be provided for temperature detectors.
- Motors rated >1000 kW shall be provided with neutral current transformers of PS class on each phase for differential protection in neutral side terminal box. The three phases shall be connected to form the star point after passing through the CTs. The CT details shall be



finalized during detail engineering. Neutral terminal box shall have IP 55 degree of protection.

- The secondary leads of CT shall be wired to separate auxiliary terminal box of IP 55 degree of protection
- All the accessory terminal boxes shall be located on the same side of the main (power) terminal box.
- For LT motors, terminal box shall be located on top, unless otherwise specified.

3.20.0 Earthing Terminals

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

3.21.0 Noise and Vibration

- Motors shall be selected with low noise levels in accordance with IS 12065.
- The peak amplitude of the vibration shall also be within the specified limits of IS: 12075.
- All HT motors shall be provided with vibration pads for mounting vibration detectors.

3.22.0 Name Plates

Motor shall have stainless steel nameplate(s) showing diagram of connections, all particulars as per IS: 325 / IS: 12615 and shall also have 'BEE' marking.

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

- Temperature rise in °C under rated condition and method of measurement.
- Degree of protection.
- Bearing identification no. and recommended lubricant.
- Location of insulated bearings.

3.23.0 Canopy

Canopy shall be provided for all the motors located outdoor. For details, please refer Civil section.

4.0.0 DC MOTORS

DC motors shall be provided where specified/required. DC Motors shall be sized for operation with fixed resistance starting for reliability. DC motors shall be shunt wound type. Motors shall be capable of delivering the rated output at 220 V DC with (+) 10% and (-) 15% variations without exceeding its guaranteed temperature limits. 220 V DC system shall be unearthed. Starting current of the DC motors shall be limited to 200% of the full load current of the motor, and is subject to IS tolerance. DC Motors shall be similar to AC Motors with respect to other features like enclosure type, cooling and class of insulation.

5.0.0 INSTALLATION

Installation shall be carried out as per IS: 900.

6.0.0 PAINTING

Painting shall be carried out by an approved process. Pretreatment shall conform to applicable standard. The equipment shall be subject to a coat of red oxide primer paint. All inside and



outside surface shall be painted with epoxy based paint. The final thickness of paint film on steel shall not be less than 100 microns. Finish shade shall be 631 of IS: 5 (smoke grey).

7.0.0 TESTING AND INSPECTION

7.1.0 Equipment offered shall be of type tested and proven type. Type test certificates for test conducted earlier on similar rating shall be furnished for the motors rated 30 kW and above.

7.2.0 The following type tests shall be conducted on LT motors.

- Measurement of resistance of windings of stator and wound rotor.
- No load test at rated voltage to determine input current power and speed
- Full load test to determine efficiency power factor and slip.
- Temperature rise test.
- Momentary excess torque test.
- High voltage test.
- Test for vibration severity of motor.
- Test for noise levels of motor
- Test for degree of protection
- Over speed test.

7.3.0 The following additional type tests shall be conducted on HT motors.

- No load saturation and loss curves up to approximately 115% of rated voltage
- Measurement of noise at no load.
- Momentary excess torque test
- Full load test
- Temperature rise test at rated conditions.
- Lightning Impulse withstand test on the sample coil shall be as per IEC-60034, part-15
- Surge-withstand test on interturn insulation shall be as per clause no. 5.1.2 of IEC 60034, part-15
- Degree of protection test for the enclosure followed by IR, HV and no load run test.
- Terminal box-fault level withstand test for each type of terminal box.

7.4.0 The following routine tests shall be carried out for the motors as per applicable standards.

- IR of Winding before and after HV tests
- HV test on main winding space heater, RTD, BTD
- Resistance measurement
- No load run test Major Electrical
- Phase sequence and direction of rotation
- Vibration check Major Electrical
- Reduced voltage running test
- Locked rotor test at reduced voltage
- Record of RTD & BTD resistance at the end of no load test
- Test on space heater & RTD
- Visual Control of terminal box and verification of construction with respect to short tested terminal box

7.5.0 The following minimum tests/ checks shall be conducted at site. Any other tests/ checks as per the manufacturer's recommendation shall also be carried out

- Measurement of vibration.
- Measurement of insulation resistance and polarization index.
- Measurement of full load current.
- Test running of the motors, checking the temperature rise and identifying the hot spot etc.



8.0.0 DRAWINGS & DOCUMENTS

The following drawings and documents shall be submitted for approval during detail engineering stage.

- Motor sizing calculation
- Technical particulars
- General arrangement drawings
- Performance curves (Efficiency, power factor, starting current)
- Characteristic curves (Speed torque, Hot/cold with stand time, Negative sequence current)
- Terminal box details
- Test reports
- Sub-vendor list
- Manufacturing quality plan
- Field quality plan



SECTION-3.17: ELECTRICAL ACTUATORS

1.0.0 INTENT OF SPECIFICATION

This section covers the requirements of motor operated electrical actuators.

2.0.0 CODES AND STANDARDS

The equipment to be furnished under this specification shall be in accordance with the applicable section of the latest edition (including amendments) of the applicable Indian Standards (IS), IEC publications and other codes except where modified and /or supplemented by this specification.

3.0.0 TECHNICAL REQUIREMENTS

3.1.0 Electric actuators shall be provided as specified in Mechanical and C&I section. It shall be equipped with 3 phase induction motor, rated for S2-15 minutes duty for ON/OFF valve and intermittent duty for inching duty

3.2.0 Motor shall be class F insulated with temperature rise limited to class B. Motor shall be of class H insulation with temperature limited to class B used for high pressure and high temperature valves.

3.3.0 Motor shall be surface cooled designed for enclosure protection class of IP 67. Motor shall be suitable for starting direct on-line.

3.4.0 For installation in potentially hazardous areas, the actuators shall have suitable explosion proof / flame proof type enclosure.

3.5.0 Actuators shall be suitable for operation at an ambient temperature of 50 degree C and relative humidity of 95%.

3.6.0 Maximum continuous motor rating shall be atleast 10% above the maximum load derived of the driven equipment under entire operating range including voltage & frequency variation.

3.7.0 Motors shall be capable of operating under following supply variations without exceeding its guaranteed temperature limits.

- Frequency variation : (+) 3% and (-) 5% of 50 Hz
- Voltage variation for LT motors : (±) 10% of 415 V
- Combined variation of voltage and frequency: 10% (absolute sum)

3.8.0 All actuators shall be of integral type. Duty cycle of actuators shall suit the system requirement. The actuators shall be capable of giving the required torque at the output shaft. The actuators shall be designed to take the full thrust.

3.9.0 Electrical Actuators of Inching type position transmitters of non contact type shall be interfaced to DCS.

3.10.0 Actuators shall be of totally enclosed weather proof and dust proof construction with NEMA-6/IP 65 enclosure and shall be suitable for outdoor application without the necessity for a canopy. The actuator shall be suitable for mounting directly on the valve. The actuator shall be capable of giving the required torque, rpm and thrust without the help of any spur gear arrangement. The actuator shall be suitable for mounting in any position. Actuators shall be provided with integral starters.



- 3.11.0 The actuator shall be complete with motor, reduction gears, change gears, terminal compartment, switch compartment with limit switches and torque switches, local position indicator, position transmitter for remote position indicator, thermistor, space heaters, cable glands, mechanical position indicator, hand wheel for manual operation, valve attachment etc.
- 3.12.0 Each actuator shall have a hand wheel fitted on it for emergency operation. The hand wheel shall be designed such that it is declutched automatically when the power supply to the motor is restored. The material of the hand wheel shall be either malleable iron or steel. The hand wheel shall have adequate clearance from housing for each gripping and operation. Actuators offered shall be with self-locking worm.
- 3.13.0 Two number adjustable torque switches (one for open and one for close) each with 2 NO and 2 NC potential free contacts shall be provided. It is required to have calibration for the torque switches so that the switches can be easily set to any value desired.
- 3.14.0 Two numbers of position limit switches (one for open and one for close) each with 2 NO and 2 NC potential free contacts shall be provided. Two auxiliary limit switches (one for open and one for close) with 2 NO and 2 NC potential free contacts shall also be provided. The limit switches shall be of independently adjustable type. Limit switches and actuating mechanism shall be rust proof suitable for damp atmospheres. Limit switch compartment shall be weather proof and spacious enough for easy setting. The limit switches shall be suitable for the following ratings, both 240 Volts AC, 10 A and 220 V DC, 0.5 Amps.
- 3.15.0 Each actuator shall have a space heater in the limit switch compartment suitable for 240 V AC 50 Hz single phase supply.
- 3.16.0 The wiring from the limit switches, torque switches etc. shall be brought out in a separate terminal box of adequate size, so as to easily terminate the control cables.
- 3.17.0 Actuators shall be supplied with integral starter which shall have sophisticated electronic controls with field programming feature. It shall be designed for remote control from DCS/Respective control system. Required interposing relays for receiving open/close/stop command from DCS/Respective control system shall be provided. Potential free contacts and transducers shall be provided to provide status indication at remote DCS/Respective control system..
- 3.18.0 A three position selector switch (marked as LOCAL-OFF-REMOTE) and push buttons OPEN-STOP-CLOSE (for local operation) with indication lamps for running OPEN and running CLOSE shall be provided.
- 3.19.0 The Remote command signal (OPEN-STOP-CLOSE) from DCS/Respective control system/Control panel shall be isolated from control electronics through opto-isolator.
- 3.20.0 The following individual sStatus annunciation LED's and fault annunciation LED's shall be provided locally (Integral to actuator) to annunciate the following for easy local monitoring.
- Actuator in local mode
 - Actuator in remote mode
 - Actuator running in OPEN direction
 - Actuator running in CLOSE direction
 - Actuator in inching mode.
 - Actuator in self-retaining mode
 - Limit switch OPEN trip
 - Limit switch CLOSE trip
 - Control voltage availability
- 3.21.0 The following individual fault annunciation LED's (Colour-Red) shall be provided locally. (Integral to Actuator)



- Torque switch OPEN
- Torque switch CLOSE
- Thermo switch trip
- Electronic overload relay trip
- Motor single phasing
- Common fault (Inclusive of any one or combination of above fault)

3.22.0 View port shall be provided on integral starter unit to monitor the above status annunciation and fault annunciation.

3.23.0 Electronic Overload relay shall be provided to trip actuator in case of overload. Plug in connections/design shall be provided between:-

- Integral starter unit and basic actuator
- Between external customer connections and actuator.

3.24.0 OPEN-CLOSE indication /LED shall be provided for indication of full open/close position.

3.25.0 Automatic phase correction facility and potential free contact for annunciation of power failure shall be provided.

3.26.0 The following individual potential free relay contacts shall be provided in the actuator for remote annunciation to facilitate continuous monitoring of the actuator.

- Actuator (valve) running in OPEN direction.
- Actuator (valve) running in CLOSE direction.
- Actuator in remote mode.
- Actuator in local mode.
- Actuator power switched off /single phasing.
- Torque switch trip, thermo switch trip and overload relay trip

4.0.0 TESTING AND INSPECTION

Equipment offered shall be of type tested and proven type. Routine tests shall be carried out for all the equipment as per applicable standards. Copies of certified reports of all tests carried out at the works shall be furnished.

The following minimum tests/ checks shall be conducted at site. Any other tests/ checks as per the manufacturer's recommendation shall also be carried out.

- Measurement of insulation resistance.
- Measurement of full load current.
- Test running of the motors.

5.0.0 DRAWINGS & DOCUMENTS

The following drawings and documents shall be submitted for approval during detail engineering stage.

- Integral starter details
- Technical particulars of actuator
- Wiring diagram
- General arrangement drawings
- Test reports
- Manufacturing quality plan
- Field quality plan

DATA SHEET-A		
SL NO.	DESCRIPTION	2X660 MW UDANGUDI SUPERCRITICAL STPP
A	General	
1	Manufacturer & country of origin	
2	Motor type	Squirrel cage induction AC motors
3	Efficiency class	For all LT motors, it shall be IE3 class as per IS 12615 except for VFD controlled LT motors, it shall be IE2 class as per IS 12615
4	Type of starting	DOL
5	Maximum acceptable kW rating of LV motor	>0.2 kW and up to 200 kW. LT motors rated up to 125 kW shall be controlled through MPCB/MCCB and contactor. LT motors rated more than 125 kW shall be controlled through air circuit breaker.
6	Rating up to which Single phase motors permitted.	up to 0.2 Kw
7	Installation (Indoors/ Outdoors)	indoor/outdoor
8	Degree Of Protection	IP 55
9	Name of the equipment driven by motor & Quantity	
10	Maximum Power requirement of driven equipment	
11	Rated speed of Driven Equipment	As per system requirement
12	Design ambient temperature	50 deg C
B	Design and Performance Data	
1	Frame size & type designation	DURING DETAILED ENGINEERING
2	Type of duty	All the motors shall be rated for S1 duty for continuous operation. Motors of crane and hoist application shall be intermittent duty. The motors shall be suitable for bus transfer schemes provided on the 11 kV/6.6 kV/415 V systems without any injurious effect on its life.
3	Rated Voltage	240/415 V
4	Rated Frequency	50 Hz
5	System fault level at rated voltage	50 kA for 1 sec.
6	LV System grounding	solidly grounded
7	Permissible variation for	
a	Voltage	±10%
b	Frequency	+3% to -5%
c	Combined voltage & frequency	10%
8	Rated output at design ambient temp (by resistance method)	As per system requirement
9	Synchronous speed & Rated slip	As per system requirement
10	Minimum permissible starting voltage	80% of rated voltage During fast changeover of power supply source, vector difference between the motor residual voltage and the incoming supply voltage shall be about 150% of the rated voltage and the motors shall withstand voltage stress and torque stress developed during that time, which may last for a period of one (1) second. c) The motor shall be capable of operating at full load at a supply voltage of 75% of the rated voltage for 5 minutes.

11	TYPE OF STARTER PROVIDED IN MCC	DOL
12	Starting time in sec with mechanism coupled	
a	At rated voltage	As per manufacturers standard
b	At min starting voltage	
13	Locked rotor current as percentage of FLC (including IS tolerance)	For energy efficient LT motors, locked rotor current shall be as per IS: 12615. Locked rotor current of the VFD controlled AC motors shall be limited to 300% of the full load current, and is subject to IS tolerance
14	Torque	
a	Starting	Accelerating torque at any speed with the lowest permissible starting voltage shall be at least 10% motor full load torque. • Pull out torque at rated voltage shall not be less than 205% of full load torque. • Motors subjected to reverse rotation shall be designed to withstand the stresses encountered when starting with non-energized shaft rotating at 125% of rated speed in reverse direction.
b	Maximum	
15	Permissible temp rise at rated output over ambient temp & method	Winding shall be class F insulation with temperature limited to class B
16	Noise level at 1.0 m (dB)	Motors shall be selected with low noise levels in accordance with IS 12065.
17	Amplitude of vibration	The peak amplitude of the vibration shall also be within the specified limits of IS: 12075.
18	Efficiency & P.F. at rated voltage & frequency	
a	At 100% load	Premium efficiency (IE3) IS: 12615 .
b	At 75% load	
c	At starting	
C	Constructional Features	
1	Method of connection of motor driven equipment	As per system requirement
2	Applicable Standard	as per relevant standard
3	DOP of Enclosure	IP55
4	Method of cooling	LT motors shall be totally enclosed fan cooled (TEFC), type IC411. The cooling shall be effected by self-driven bi-directional centrifugal fan protected by fan cover. The Alarm switch contact rating shall be minimum 0.5 A at 220 V DC and 10 A at 230 V AC.
5	Class of insulation	All motors shall have class F insulation but limited to class B temperature rise
6	Main terminal box	

a	Type	Separate terminal boxes of IP 55 degree of protection shall be provided for stator leads. For single core cables, gland plate shall be non-magnetic material. Terminal box of LT motors shall be capable of being turned 360° in steps of 90°. The terminal boxes shall be split type with removable cover with access to connections.
b	Power Cable details (Conductor, size, armour/unarmour)	DURING DETAILED ENGINEERING
c	Cable Gland & lugs details (Size, type & material)	DURING DETAILED ENGINEERING The frame of each motor shall be provided with two separate and distinct grounding pads complete with tapped hole, GI bolts and washer. The terminal box shall have a separate grounding terminal.
d	Permissible Fault level (kArms & duration in sec)	Fault withstand rating of motor terminal box (Breaker operated): 415 V system : 50/65 kA for 0.2 second
7	Earth Conductor Size & Material	DURING DETAILED ENGINEERING
8	Space heater details (30KW & ABOVE) (Voltage & watts)	Space heaters rated for 240 V AC, 50 Hz supply shall be provided for motors rated 30 kW'and above to maintain windings in dry condition when motor is standstill.
9	Flame proof motor details (if applicable)	For hazardous location: the enclosure of motors shall following have flame proof construction conforming to applicable standard. • Fuel oil area Group – IIB • Hydrogen generation plant area : Group – IIC)
a	Enclosure	
b	suitability for hazardous area	
i	Zone O / I / II	
ii	Group IIA / IIB / IIC	
c	Degree of Protection	
9	No. of Stator winding	As per manufacturers standard
10	Winding connection	As per system requirement
11	Kind of rotor winding	As per manufacturers standard

12	Kind of bearings	Motor shall be provided with antifriction bearings, unless sleeve bearings are required by the motor application. Bearings shall be provided with seals to prevent leakage of lubricant or entrance of foreign matters like dirt, water etc. into the bearing area. • Sleeve bearings shall be split type, ring oiled with permanently aligned, close running shaft sleeves. Grease lubricated bearings shall be pre-lubricated and shall have provisions for inservice positive lubrication with grease nipple and relief holes. For sleeve bearings, the bearing housing shall be preferably in end shield itself. • Vertical shaft motors shall be provided with thrust and guide bearings. Thrust bearing of tilting pad type is preferred. However, if anti-friction bearings can take vertical thrust, thrust and guide bearings are not required. • Lubricant shall not deteriorate under all service conditions. The lubricants shall be limited to normally available types. For motors rated 30 kW and above re-lubrication facility shall be provided. For bearing temperature measurement, duplex RTDs shall be provided for each bearing and shall be wired up to the terminal box. • Each bearing shall be provided with dial type thermometer. • For all VFD operated motors shall have insulated bearings to prevent flow of shaft currents. Lub oil pressure transmitters shall be provided to DCS for remote monitoring. Lub oil pressure very low trip to HT equipment shall be 2 out of 3 logic.
13	Direction of rotation when viewed from NDE	motor shall be bi-directional
14	Paint Shade & type	Painting shall be carried out by an approved process. Pretreatment shall conform to applicable standard. The equipment shall be subject to a coat of red oxide primer paint. All inside and outside surface shall be painted with epoxy based paint. The final thickness of paint film on steel shall not be less than 100 microns. Finish shade shall be 631 of IS: 5 (smoke grey).
15	Net weight of motor	
16	Outline mounting drawing No (To be enclosed as annexure)	DURING DETAILED ENGINEERING
D	Characteristic curves/ drawings	
1	(To be enclosed for motors of rating >55KW)	
2	Torque speed characteristic	
3	Thermal withstand characteristic	
4	Current vs time	
5	Speed vs time	
E	Tests on motors	

NOTE:

- 1 Please write "As per manufacturers standard" where data is not defined in the project specification.
- 2 Please mention any project specific requirement if any in the datasheet (Add extra row).
- 3 For details which is not applicable please write "NA"

221660/2021/PS-PEM-MAX:



GENERAL TECHNICAL REQUIREMENTS

FOR

LV MOTORS

SPECIFICATION NO.
PE-SS-999-506-E101VOLUME NO. : **II-B**SECTION : **D**REV NO. : **00** DATE : 29/08/2005

SHEET : 1 OF 1

GENERAL TECHNICAL REQUIREMENTS

FOR

LV MOTORS

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

2021/PS-PEM-MAX : 07/05/21		SPECIFICATION NO. PE-SS-999-506-E101																															
	GENERAL TECHNICAL REQUIREMENTS FOR LV MOTORS	VOLUME NO. : II-B																															
		SECTION : D																															
		REV NO. : 00 DATE : 29/08/2005																															
		SHEET : 1 OF 4																															
1.0 INTENT OF SPECIFIATION																																	
The specification covers the design, materials, constructional features, manufacture, inspection and testing at manufacturer’s work, and packing of Low voltage (LV) squirrel cage induction motors along with all accessories for driving auxiliaries in thermal power station. Motors having a voltage rating of below 1000V are referred to as low voltage (LV) motors.																																	
2.0 CODES AND STANDARDS																																	
Motors shall fully comply with latest edition, including all amendments and revision, of following codes and standards: <table><tr><td>IS:325</td><td>Three phase Induction motors</td></tr><tr><td>IS : 900</td><td>Code of practice for installation and maintenance of induction motors</td></tr><tr><td>IS: 996</td><td>Single phase small AC and universal motors</td></tr><tr><td>IS: 4722</td><td>Rotating Electrical machines</td></tr><tr><td>IS: 4691</td><td>Degree of Protection provided by enclosures for rotating electrical machines</td></tr><tr><td>IS: 4728</td><td>Terminal marking and direction of rotation rotating electrical machines</td></tr><tr><td>IS: 1231</td><td>Dimensions of three phase foot mounted induction motors</td></tr><tr><td>IS: 8789</td><td>Values of performance characteristics for three phase induction motors</td></tr><tr><td>IS: 13555</td><td>Guide for selection and application of 3-phase A.C. induction motors for different types of driven equipment</td></tr><tr><td>IS: 2148</td><td>Flame proof enclosures for electrical appliance</td></tr><tr><td>IS: 5571</td><td>Guide for selection of electrical equipment for hazardous areas</td></tr><tr><td>IS: 12824</td><td>Type of duty and classes of rating assigned</td></tr><tr><td>IS: 12802</td><td>Temperature rise measurement for rotating electrical machines</td></tr><tr><td>IS: 12065</td><td>Permissible limits of noise level for rotating electrical machines</td></tr><tr><td>IS: 12075</td><td>Mechanical vibration of rotating electrical machines</td></tr></table> In case of imported motors, motors as per IEC-34 shall also be acceptable.				IS:325	Three phase Induction motors	IS : 900	Code of practice for installation and maintenance of induction motors	IS: 996	Single phase small AC and universal motors	IS: 4722	Rotating Electrical machines	IS: 4691	Degree of Protection provided by enclosures for rotating electrical machines	IS: 4728	Terminal marking and direction of rotation rotating electrical machines	IS: 1231	Dimensions of three phase foot mounted induction motors	IS: 8789	Values of performance characteristics for three phase induction motors	IS: 13555	Guide for selection and application of 3-phase A.C. induction motors for different types of driven equipment	IS: 2148	Flame proof enclosures for electrical appliance	IS: 5571	Guide for selection of electrical equipment for hazardous areas	IS: 12824	Type of duty and classes of rating assigned	IS: 12802	Temperature rise measurement for rotating electrical machines	IS: 12065	Permissible limits of noise level for rotating electrical machines	IS: 12075	Mechanical vibration of rotating electrical machines
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IS: 12065	Permissible limits of noise level for rotating electrical machines																																
IS: 12075	Mechanical vibration of rotating electrical machines																																
3.0 DESIGN REQUIREMENTS																																	
3.1 Motors and accessories shall be designed to operate satisfactorily under conditions specified in data sheet-A and Project Information, including voltage & frequency variation of supply system as defined in Data sheet-A																																	
3.2 Motors shall be continuously rated at the design ambient temperature specified in Data Sheet-A and other site conditions specified under Project Information Motor ratings shall have at least a 15% margin over the continuous maximum demand of the driven equipment, under entire operating range including voltage & frequency variation specified above.																																	
3.3 Starting Requirements																																	
3.3.1 Motor characteristics such as speed, starting torque, break away torque and starting time shall be properly co-ordinated with the requirements of driven equipment. The accelerating torque at any speed with the minimum starting voltage shall be at least 10% higher than that of the driven equipment.																																	
3.3.2 Motors shall be capable of starting and accelerating the load with direct on line starting without exceeding acceptable winding temperature.																																	

	GENERAL TECHNICAL REQUIREMENTS FOR LV MOTORS	SPECIFICATION NO. PE-SS-999-506-E101
		VOLUME NO. : II-B
		SECTION : D
		REV NO. : 00 DATE : 29/08/2005 SHEET : 2 OF 4
The limiting value of voltage at rated frequency under which a motor will successfully start and accelerate to rated speed with load shall be taken to be a constant value as per Data Sheet - A during the starting period of motors. 3.3.3 The following frequency of starts shall apply i) Two starts in succession with the motor being initially at a temperature not exceeding the rated load temperature. ii) Three equally spread starts in an hour the motor being initially at a temperature not exceeding the rated load operating temperature. (not to be repeated in the second successive hour) iii) Motors for coal conveyor and coal crusher application shall be suitable for three consecutive hot starts followed by one hour interval with maximum twenty starts per day and shall be suitable for minimum 20,000 starts during the life time of the motor 3.4 Running Requirements 3.4.1 Motors shall run satisfactorily at a supply voltage of 75% of rated voltage for 5 minutes with full load without injurious heating to the motor. 3.4.2 Motor shall not stall due to voltage dip in the system causing momentary drop in voltage upto 70% of the rated voltage for duration of 2 secs. 3.5 Stress During bus Transfer 3.5.1 Motors shall withstand the voltage, heavy inrush transient current, mechanical and torque stress developed due to the application of 150% of the rated voltage for at least 1 sec. caused due to vector difference between the motor residual voltage and the incoming supply voltage during occasional auto bus transfer. 3.5.2 Motor and driven equipment shafts shall be adequately sized to satisfactorily withstand transient torque under above condition. 3.6 Maximum noise level measured at distance of 1.0 metres from the outline of motor shall not exceed the values specified in IS 12065. 3.7 The max. vibration velocity or double amplitude of motors vibration as measured at motor bearings shall be within the limits specified in IS: 12075. 4.0 CONSTRUCTIONAL FEATURES 4.1 Indoor motors shall conform to degree of protection IP: 54 as per IS: 4691. Outdoor or semi-indoor motors shall conform to degree of protection IP: 55 as per IS: 4691 and shall be of weather-proof construction. Outdoor motors shall be installed under a suitable canopy 4.2 Motors upto 160KW shall have Totally Enclosed Fan Cooled (TEFC) enclosures, the method of cooling conforming to IC-0141 or IC-0151 of IS: 6362. Motors rated above 160 KW shall be Closed Air Circuit Air (CACA) cooled 4.3 Motors shall be designed with cooling fans suitable for both directions of rotation.		

	GENERAL TECHNICAL REQUIREMENTS FOR LV MOTORS	SPECIFICATION NO. PE-SS-999-506-E101
		VOLUME NO. : II-B
		SECTION : D
		REV NO. : 00 DATE : 29/08/2005 SHEET : 3 OF 4
4.4. Motors shall not be provided with any electric or pneumatic operated external fan for cooling the motors. 4.5. Frames shall be designed to avoid collection of moisture and all enclosures shall be provided with facility for drainage at the lowest point. 4.6. In case Class 'F' insulation is provided for LV motors, temperature rise shall be limited to the limits applicable to Class 'B' insulation. In case of continuous operation at extreme voltage limits the temperature limits specified in table-1 of IS:325 shall not exceed by more than 10°C. 4.7. Terminals and Terminal Boxes 4.7.1. Terminals, terminal leads, terminal boxes, windings tails and associated equipment shall be suitable for connection to a supply system having a short circuit level, specified in the Data Sheet-A. Unless otherwise stated in Data Sheet-A, motors of rating 110 kW and above will be controlled by circuit breaker and below 110 kW by switch fuse-contactor. The terminal box of motors shall be designed for the fault current mentioned in data sheet "A". 4.7.2. unless otherwise specified or approved, phase terminal boxes of horizontal motors shall be positioned on the left hand side of the motor when viewed from the non-driving end. 4.7.3. Connections shall be such that when the supply leads R, Y & B are connected to motor terminals A B & C or U, V & W respectively, motor shall rotate in an anticlockwise direction when viewed from the non-driving end. Where such motors require clockwise rotation, the supply leads R, Y, B will be connected to motor terminals A, C, B or U W & V respectively. 4.7.4. Permanently attached diagram and instruction plate made preferably of stainless steel shall be mounted inside terminal box cover giving the connection diagram for the desired direction of rotation and reverse rotation. 4.7.5. Motor terminals and terminal leads shall be fully insulated with no bar live parts. Adequate space shall be available inside the terminal box so that no difficulty is encountered for terminating the cable specified in Data Sheet-A. 4.7.6. Degree of protection for terminal boxes shall be IP 55 as per IS 4691. 4.7.7. Separate terminal boxes shall be provided for space heaters.. If this is not possible in case of LV motors, the space heater terminals shall be adequately segregated from the main terminals in the main terminal box. Detachable gland plates with double compression brass glands shall be provided in terminal boxes. 4.7.8. Phase terminal boxes shall be suitable for 360 degree of rotation in steps of 90 degree for LV motors. 4.7.9. Cable glands and cable lugs as per cable sizes specified in Data Sheet-A shall be included. Cable lugs shall be of tinned Copper, crimping type. 4.8. Two separate earthing terminals suitable for connecting G.I. or MS strip grounding conductor of size given in Data Sheet-A shall be provided on opposite sides of motor frame. Each terminal box shall have a grounding terminal. 4.9. General		

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		VOLUME NO. : II-B
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4.9.1 Motors provided for similar drives shall be interchangeable. 4.9.2 Suitable foundation bolts are to be supplied alongwith the motors. 4.9.3 Motors shall be provided with eye bolts, or other means to facilitate safe lifting if the weight is 20Kgs. and above. 4.9.4 Necessary fitments and accessories shall be provided on motors in accordance with the latest Indian Electricity rules 1956. 4.9.5 All motors rated above 30 kW shall be provided with space heaters to maintain the motor internal air temperature above the dew point. Unless otherwise specified, space heaters shall be suitable for a supply of 240V AC, single phase, 50 Hz. 4.9.6 Name plate with all particulars as per IS: 325 shall be provided 4.9.7 Unless otherwise specified, the colour of finish shall be grey to Shade No. 631 and 632 as per IS:5 for motors installed indoor and outdoor respectively. The paint shall be epoxy based and shall be suitable for withstanding specified site conditions. 5.0 INSPECTION AND TESTING 5.1 All materials, components and equipments covered under this specification shall be procured, manufactured, as per the BHEL standard quality plan No. PED-506-00-Q-006/0 and PED-506-00-Q-007/2 enclosed with this specification and which shall be complied. 5.2 LV motors of type-tested design shall be provided. Valid type test reports not more than 5 year shall be furnished. In the absence of these, type tests shall have to be conducted by manufacturer without any commercial implication to purchaser. 5.3 All motors shall be subjected to routine tests as per IS: 325 and as per BHEL standard quality plan. 5.4 Motors shall also be subjected to additional tests, if any, as mentioned in Data Sheet A. 6.0 DRAWINGS TO BE SUBMITTED AFTER AWARD OF CONTRACT a) OGA drawing showing the position of terminal boxes, earthing connections etc. b) Arrangement drawing of terminal boxes. c) Characteristic curves: (To be given for motor above 55 kW unless otherwise specified in Data Sheet). i) Current vs. time at rated voltage and minimum starting voltage. ii) Speed vs. time at rated voltage and minimum starting voltage. iii) Torque vs. speed at rated voltage and minimum voltage. For the motors with solid coupling the above curves i), ii), iii) to be furnished for the motors coupled with driven equipment. In case motor is coupled with mechanical equipment by fluid coupling, the above curves shall be furnished with and without coupling. iv) Thermal withstand curve under hot and cold conditions at rated voltage and max. permissible voltage.		

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	MOTORS DATA SHEET – C 2 x 660MW UDANGUDI STPP		SPECIFICATION NO.	
			VOLUME	II B
			SECTION	D
			REV NO. 00	DATE 21.05.18
			SHEET	1 OF 2

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

NAME OF VENDOR			SEAL	REV.	
NAME	SIGNATURE	DATE			

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	MOTORS DATA SHEET – C 2 x 660MW UDANGUDI STPP		SPECIFICATION NO.	
			VOLUME	II B
			SECTION	D
			REV NO. 00	DATE 21.05.18
			SHEET	2 OF 2

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

NAME OF VENDOR			SEAL	REV.	
NAME	SIGNATURE	DATE			

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

		QUALITY PLAN		CUSTOMER :			PROJECT			SPECIFICATION :		
				BIDDER/ :			TITLE			NUMBER :		
		SHEET 2 OF 2		VENDOR			QUALITY PLAN			SPECIFICATION :		
		SYSTEM			NUMBER PED-506-00-Q-006, REV-01			TITLE :				
					ITEM AC ELECT. MOTORS BELOW 55KW (LV)			SECTION		VOLUME III		
SL. NO.	COMPONENT/OPERATION	CHARACTERISTICS CHECK	CAT.	TYPE/METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS
									P	W	V	
1	2	3	4	5	6	7	8	9	10			11
		3.NAMEPLATE DETAILS	MA	VISUAL	100%	IS-325 & DATA SHEET	IS-325 & DATA SHEET	INSPN. REPORT	2	1	-	
NOTES: 1 ROUTINE TESTS ON 100% MOTORS SHALL BE DONE BY THE VENDOR. HOWEVER, BHEL SHALL WITNESS ROUTINE TESTS ON RANDOM SAMPLES. THE SAMPLING PLAN SHALL BE MUTUALLY AGREED UPON 2 WHERE EVER CUSTOMER IS INVOLVED IN INSPECTION, (1) SHALL MEAN BHEL AND CUSTOMERS BOTH TOGETHER. 3 FOR EXHAUST/VENTILATION FAN MOTORS OF RATING UPTO 1.5KW , ONLY ROUTINE TEST CERTIFICATES SHALL BE FURNISHED FOR SCRUTINY. <u>Legends for Inspection agency</u> 1. BHEL/CUSTOMER 2. VENDOR (MOTOR MANUFACTURER) 3. SUB-VENDOR (RAW MATERIAL/COMPONENTS SUPPLIER) P. PERFORM W. WITNESS V. VERIFY												
BHEL			PARTICULARS			BIDDER/VENDOR						
			NAME									
			SIGNATURE									
			DATE						BIDDER'S/VENDORS COMPANY SEAL			

SUB-VENDOR LIST FOR ELECTRICAL ITEMS

ITEM DESCRIPTION	SL NO.	VENDOR NAME
CABLE GLANDS	1	ALLIED TRADERS & EXPORTERS
	2	ARUP ENGG & FOUNDRY WORKS
	3	BALIGA LIGHTING EQPT.PVT.LTD.
	4	COMMET BRASS PRODUCTS
	5	DOWELLS
	6	ELECTROMAC INDUSTRIES
	7	INCAB
CABLE LUGS	1	DOWELLS
	2	UNIVERSAL MACHINES LTD.
LV MOTORS (NON FLAME PROOF)	1	ABB
	2	BHARAT BIJLEE LTD.
	3	CROMPTON GREAVES
	4	GE-POWER
	5	KIRLOSKAR ELECTRIC CO LTD.
	6	LAXMI HYDRAULICS PVT. LTD
	7	MARATHON
	8	NGEF
	9	RAJINDRA ELECT INDUSTRIES
	10	SIEMENS



VOLUME II

SUB-SECTION 2.22

~~WORKSHOP, ROAD WEIGH BRIDGE, CHEMICAL LABORATORY,
STORES AND DIESEL BUNK~~

1.0.0 GENERAL

This section is intended to provide the scope, design, constructional and technical requirements for workshop, chemical laboratory, stores, diesel bunk and road weigh bridge.

2.0.0 SCOPE OF SUPPLY**2.1.0 Workshop, Chemical laboratory and Stores**

The workshop, chemical laboratory and stores shall be complete in every respect & suitable for satisfactory operation of the power plant.

The list of minimum equipment to be supplied is furnished in this specification. The sizes of machines / equipment and their capacity shall be selected by the Contractor based on the requirement specific to the equipment and systems being proposed by them.

Maintenance tools and tackles as required for the various machines, commissioning spares for various machines as applicable, first fill lubricant / coolant for each equipment shall be provided.

2.2.0 Road Weigh Bridge

Two (2) no. of complete weigh bridge platform pit-less type with load cells, digital weight indicator and totaliser.

The weigh bridge shall be tested for full capacity and certified to be accurate before received at the site. After erection at site, contractor shall arrange for the inspection of the weigh bridge by the Inspector of weights and measures and get the weigh bridge stamped by him. The contractor shall pay the requisite fees for such first stamping. The requisite test loads for stamping shall also be arranged by the contractor.

All necessary cables from load cells up to digital weight indicator, totaliser and printer.

All other accessories and limits required to complete the weighing system.

3.0.0 DESIGN AND CONSTRUCTIONAL REQUIREMENTS**3.1.0 Workshop**

The various components of workshop machine shall be capable of easy installation and removal / replacement.

The noise and vibration from machinery shall be minimized and not be greater than that from high quality modern plant of comparable size.

Special attention shall be paid to the appropriate regulations for accident prevention. It must be assumed that in the operation of the machines even inexperienced personnel shall be satisfactorily protected. All equipment and machines with moving, hot or electrically energized



parts shall be provided with reliable protective equipment. Where necessary, erection openings / access shall be provided.

Suitable safety interlocks, limit switches for longitudinal travel and cross traverse of saddles and emergency brakes shall be provided as required. Emergency brake control shall be easily approachable to the operator.

The machines, tools and equipment will be in accordance with ISO standards as well as accident prevention regulations.

The dimensions of the workshop and stores shall be mainly based on the size of the equipment to be handled, the number of people working in the workshop and store and the quantity of spare parts to be stored.

Minimum 1500 mm clearance shall be maintained between the individual machines / equipments.

The various machinery, plant and equipment shall be so designed and arranged as to present a functional and pleasing appearance.

3.1.1 Equipment - Workshop

Sl. No.	Equipment	Specification	Accessories	Qty
1.	Heavy duty lathe	900 mm SOB, 2000 mm DBC. other parameters of the machine shall be as per manufacturer's standard	Square tool post, two (2) nos. dead centers, rotating center, quick change tool post with set of tool holder, 3 jaw self centering chuck, complete coolant system, oil gun & oil can, rear splash guard, steady rest and follow rest, one set (10 nos.) of carbide turning tools (standard), work light without bulb, chip tray, longitudinal stop.	1
2.	General Duty Lathe	600 mm SOB, 1500 mm DBC. other parameters of the machine shall be as per manufacturer's standard		1
3.	Shaper	Stroke-610 mm, other parameters of the machine shall be as per manufacturer's standard	Crank handle, tool holder attachment, Ram length adjustment control, one (1) no. high speed steel (HSS) cutting tool, machine vice, pulleys & v-belts as required, electric motor, starter, automotive lubricating pump, machine lamp without bulb.	1
4.	Slotting machine	Stroke - 300 mm, other parameters of the machine shall be as per manufacturer's standard	Complete coolant system / equipment, lighting equipment, 3 jaw self centering chuck of diameter 300 mm with back plate (steel body).	1
5.	Universal milling machine	Table - 1600 mm X 300 mm, other parameters of	Complete coolant equip. work light without bulb,	1



Sl. No.	Equipment	Specification	Accessories	Qty
		the machine shall be as per manufacturer's standard	indexing head. One(1) no. high speed steel milling cutter.	
6.	Radial drilling machine	Capacity drilling in steel 50 mm diameter, Radius of drilling arm : 1500 mm, other parameters of the machine shall be as per manufacturer's standard	Box table (500 mm X 500 mm X 500 mm), complete coolant equipment with pump, motor, piping etc., work light without bulb	1
7.	Pedestal drill	16 mm diameter in steel, size of table – 600 mm x 600 mm	-	1
8.	Grinder	600 mm wheel diameter. Double wheel pedestal grinder	Eye protection shield, tool rest bracket, adjustable tool rest, One coarse grinding wheel and one fine grinding wheel, machine lamp.	1
9.	Tube bending machine	1/2" to 4" NB, other parameters of the machine shall be as per manufacturer's standard	Formers of different sizes suiting machine capacity.	1
10.	Power hacksaw	Job diameter - 225 mm, other parameters of the machine shall be as per manufacturer's standard	One (1) no. hacksaw blade, machine lamp without bulb.	1
11.	A/C welding machine	Current range - 60 to 400 Amps, AC Welding Transformer, other parameters of the machine shall be as per manufacturer's standard	Welding cable with electrode holder (5 metres length), Earthing cable assembly (5 metres), Protective helmet with glass, pair of hand gloves, chisel, wire brush, Ammeter - voltmeter attachment	2
12.	D/C welding machine	MG set, current range : 35 – 320 Amps, Rectifier welding sets other parameters of the machine shall be as per manufacturer's standard	Welding cable with electrode holder (5 metres length), Earthing cable assembly (5 metres), Protective helmet with glass, pair of hand gloves, chisel, wire brush.	1
13.	Argon Arc welding set	Max continuous welding current @ 60% duty cycle 170 amps, welding current range: 5 to 220 Amps.	-	2
14.	Soldering iron	25 Watts, 250 Volts	-	4
15.	Welding tables	Size - 750 mm (length) X 500 mm (width) X 1000 mm (Height)	-	3
16.	Pneumatic hammer	As per manufacturer standard.	-	1
17.	Work benches	Carpenter type work bench, size – 750 mm x 500 mm x 1000 mm height	-	6



Sl. No.	Equipment	Specification	Accessories	Qty
18.	Fitter vice	Size – 150 mm.	-	6
19.	Marking-off table	Size – 2000mm x 2000 mm, material of construction – cast iron.	-	1
20.	Portable screens	Fabricated screen, size 6 ft high and 8 ft length	-	
21.	Corrugating rollers	Size 900mm	-	1
22.	Industrial Vacuum cleaner.	As per manufacturer standard.	-	
23.	Set of Measuring tools			1 set for each measuring tool
a)	Vernier Calliper	Size 0 to 300mm, least count 0.02mm.	-	
b)	Vernier depth guage	Size 0 to 300mm, least count 0.02mm.	-	
c)	Inside calliper	0 to 150mm.	-	
d)	Outside calliper	0 to 150mm.	-	
e)	Inside Micrometer	Size 0 to 25mm, least count 0.01mm.	-	
f)	Outside Micrometer	Size 0 to 150mm, 0.01mm accuracy.	-	
g)	Dial guage with magnetic stand.	Size 0 to 10mm, least count 0.01mm	-	
h)	V block	100 mm x 45 mm x 60 mm	-	
i)	Snap Gauges	As per manufacturer standard.	-	
j)	Feeler Gauges	As per manufacturer standard.	-	
k)	Thread Pitch Gauges	NPT, Metric- As per manufacturer standard.	-	
l)	Slip Gauge Block set	As per manufacturer standard.	-	
m)	Precision Level	As per manufacturer standard.	-	
n)	Steel measuring tape	5m long.	-	
o)	Steel Rule	150 mm , 300 mm, 600 mm, 1000mm	-	
24.	General Tool			
a)	Screw drivers	Dimension & Blade length (mm)- 3.2x0.5x200; 4.3x0.6x200; 5x0.6x125; 5x0.8x200.	-	1
b)	Double ended spanners (mm x mm)	10x11; 12x13; 14x15; 16x17; 18x19; 20x22; 21x23; 24x26; 24x27; 25x28; 30x32.	-	1



Sl. No.	Equipment	Specification	Accessories	Qty
c)	Hammer Set	Ball Peen Hammer in 1 lb, 2 Lbs, Mallet Hammer 1 Lbs, Wooden Hammer	-	1
		Sledge Hammer		1
		10 Lbs Sledge Hammer		1
d)	Hack Saw frame with blades	As per manufacturer standard.	-	1
e)	Socket set	1/2" Sq Drive socket in size mm (10, 12, 14, 16, 18, 20, 22, 24, 26, 28 30,32)	-	1
f)	Precision Level	As per manufacturer standard.	-	1
g)	File set	Flat- 100,150,200,250 mm Round file - 150 mm Half Round file - 200 mm, 250 mm	-	10
h)	Pipe Cutter	1/2" – 2"	-	1
i)	Long nose plier	170 mm(L)	-	1
j)	Round nose plier	25 mm(L)	-	1
k)	Universal Plier & Cutter Plier	As per manufacturer standard.	-	1
l)	Cir Clip Plier (Inside / Outside)	As per manufacturer standard.	-	1
m)	Pipe wrench	Each - 0-3/4", 1 1/2", 0-2 1/2	-	1
n)	Right angle	12" Size	-	1
o)	Chisel Set	Flat Chisel of 1/2", 3/4", 1" tip size	-	1
p)	Bearing Puller set	Universal Puller Twin Grip of 6" opening size - 1	-	1
		Puller triple grip of 8" opening size -1 No.	-	1
q)	Centre Punch	As per manufacturer standard.	-	1
r)	Gasket Punch set	Punches of various sizes 6, 8, 10, 12, 16, 20, 22, 24 mm in a case.	-	1
s)	Hand Lamps, without Bulbs , Sockets , Plugs &Cables	As per manufacturer standard.	-	1
t)	Box for above tools	As per manufacturer standard.	-	1



TITLE 2X660 MW UDANGUDI STPP
TECHNICAL SPECIFICATION
FOR
WORKSHOP EQUIPMENT

SPECIFICATION NO. PE – TS - 435 - 568 – A001

VOLUME III

SECTION III

REV 0

SHEET OF

SECTION-III

DOCUMENTS TO BE SUBMITTED ALONG WITH BID

SUB-SECTION IIIA – Documents Furnished along with offer

SUB-SECTION IIIB – Compliance cum confirmation certificate

SUB-SECTION IIIC – Electrical Load Data

SUB-SECTION IIID – Pre Bid Clarification



TITLE 2X660 MW UDANGUDI STPP
TECHNICAL SPECIFICATION
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VOLUME III

SECTION IIIA

REV 0

SHEET OF

DOCUMENTS TO BE FURNISHED WITH OFFER FOR TECHNICAL EVALUATION

- 1) SCHEDULE OF TECHNICAL DEVIATION (IF ANY)
 OR

‘NO DEVIATION CERTIFICATE’ – Clearly mentioning that bidder has considered ‘No - Deviation’ from the technical specification provided by BHEL.

- 2) SIGNED AND STAMPED COPY OF COMPLIANCE CUM CONFIRMATION CERTIFICATE.
 3) Copy of Electrical Scope between BHEL & Vendor duly signed and stamped
 4) Electrical Equipment Specification for Workshop Equipment duly signed and stamped
 5) Compliance to Electrical load list, duly signed and stamped
 6) Un priced copy of price format indicating quoted/ not applicable against each row/column

NOTE:

i) NO OTHER DOCUMENTS OTHER THAN THOSE LISTED ABOVE ARE REQUIRED TO BE SUBMITTED FOR TECHNICAL EVALUATION. IN CASE ANY OTHER DOCUMENT IS FURNISHED, THE SAME WILL NOT BE TAKEN INTO CONSIDERATION FOR TECHNICAL EVALUATION.

	TECHNICAL SPECIFICATION FOR WORKSHOP EQUIPMENT 2X660 MW UDANGUDI STPP COMPLIANCE CUM CONFIRMATION CERTIFICATE	SPEC. NO.: PE-TS-435-568-A001
		VOLUME: III
		SECTION: IIIB
		REV. NO. 0
		Date:

COMPLIANCE CUM CONFIRMATION CERTIFICATE

The bidder shall confirm compliance with following by signing/ stamping this compliance certificate (every sheet) and furnish same with the offer.

- a) The scope of supply, technical details, construction features, design parameters etc. shall be as per technical specification & there are no exclusions other than those mentioned under "exclusion" in section C and those resolved as per 'Schedule of Deviations', if applicable, with regard to same.
- b) There are no other deviations w.r.t. specifications other than those furnished in the 'Schedule of Deviations'. Any other deviation, stated or implied, taken elsewhere in the offer stands withdrawn unless specifically brought out in the 'Schedule of Deviations'.
- c) Bidder shall submit QP in the event of order based on the guidelines given in the specification & QP enclosed therein. QP will be subject to BHEL/ CUSTOMER approval & customer hold points for inspection/ testing shall be marked in the QP at the contract stage. Inspection/ testing shall be witnessed as per same apart from review of various test certificates/ Inspection records etc. This shall be within the contracted price with no extra implications to BHEL after award of the contract.
- d) All drawings/ data-sheets/ calculations etc. submitted along with the offer shall be considered for reference only, same shall be subject to BHEL/ CUSTOMER approval in the event of order.
- e) The offered materials shall be either equivalent or superior to those specified in the specification & shall meet the specified/ intended duty requirements. In case the material specified in the specifications is not compatible for intended duty requirements then same shall be resolved by the bidder with BHEL during the pre - bid discussions, otherwise BHEL/ Customer's decision shall be binding on the bidder whenever the deficiency is pointed out.

For components where materials are not specified, same shall be suitable for intended duty, all materials shall be subject to approval in the event of order.

- f) The commissioning spares shall be supplied on 'As Required Basis' & prices for same included in the base price itself.
- g) All sub vendors shall be subject to BHEL/ CUSTOMER approval in the event of order.
- h) Guarantee for plant /equipment shall be as per relevant clause of GCC /SCC /Other Commercial Terms & Conditions.
- i) In the event of order, all the material required for completing the job at site shall be supplied by the bidder within the ordered price and within purview of the tender specification even if the same are additional to approved billing break up, approved drawing or approved Bill of quantities.
- j) Schedule of drawings submissions, comment incorporations & approval shall be as stipulated in the specifications. The successful bidder shall depute his design personnel to BHEL's/ Customer's/ Consultant's office for across the table resolution of issues and to get documents approved in the stipulated time.



**TECHNICAL SPECIFICATION FOR
WORKSHOP EQUIPMENT
2X660 MW UDANGUDI STPP
COMPLIANCE CUM CONFIRMATION
CERTIFICATE**

SPEC. NO.: PE-TS-435-568-A001

VOLUME: III

SECTION: IIIB

REV. NO.	0
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Date:

- k) As built drawings shall be submitted as and when required during the project execution.
- l) The bidder has not tempered with this compliance cum confirmation certificate and if at any stage any tempering in the signed copy of this document is noticed then same shall be treated as breach of contract and suitable actions shall be taken against the bidder.

221660/2021/PS-PEM-MAX

LOAD TITLE	RATING (KW / A)		UNIT (U)/STN (S)	Nos.		VOLTAGE CODE*	FEEDER CODE**	EMER. LOAD (Y)	CONT.(C)/ INTT.(I)	STARTING TIME >5 SEC (Y)	LOCATION	BOARD NO.	CABLE		BLOCK CABLE DRG. No.	CONT ROL CODE	REMA RKS	LOAD No.	VERIFICATI ON FROM MOTOR DATASHEE T (Y/N)	KKS NO
	NAME PLATE (Range of Load)	MAX. CONT. DEMAND (MCR)		RUNNING	STANDBY								SIZE CODE	NOS						
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Heavy Duty Lathe	6 KW- 9 KW		S	1		D	S													
Heavy Duty Lathe M/c-1	3 KW- 5 KW		S	1		D	S													
Shaper	2 KW- 4 KW		S	1		D	S													
Slotting Machine	1.5 KW- 2.5 KW		S	1		D	S													
Universal Milling Machine	6 KW- 10 KW		S	1		D	S													
Radial Drilling Machine	4 KW – 7.5 KW		S	3		D	S													
Pedestal Drill	1 KW- 1.5 KW		S	1		D	S													
Grinder	3 KW- 6 KW		S	1		D	S													
Power Hacksaw Machine	1 KW - 3 KW		S	1		D	S													
A/C Welding Machine	15 KVA – 20 KVA		S	1		D	S													
D/C Welding Machine	12 KVA – 15 KVA		S	1		D	S													
NOTES: 1. COLUMN 1 TO 12 & 18 SHALL BE FILLED BY THE REQUISITIONER (ORIGINATING AGENCY); REMAINING COLUMNS ARE TO BE FILLED UP BY PEM (ELECTRICAL)/ CUSTOMER 2. ABBREVIATIONS : * VOLTAGE CODE (7):- (ac) A=11 KV, B=6.6 KV, C=3.3 KV, D=415 V, E=240 V (1 PH), F=110 V (cc): G=220 V, H=110 V, J=48 V, K=+24V, L=-24 V : ** FEEDER CODE (8):- U=UNIDIRECTIONAL STARTER, B=BI-DIRECTIONAL STARTER, S=SUPPLY FEEDER, D=SUPPLY FEEDER (CONTACTER CONTROLLED)																				
	LOAD DATA (ELECTRICAL)	JOB NO.		435				ORIGINATING AGENCY				PEM (ELECTRICAL)								
		PROJECT TITLE		2X660 MW UDANGUDI STPP				NAME					DATA FILLED UP ON							
		SYSTEM						SIGN.					DATA ENTERED ON							
		DEPTT. / SECTION		MAX				SHEET 1 OF 2		REV. 00		DE'S SIGN. & DATE								

221660/2021/PS-PEM-MAX73

LOAD TITLE	RATING (KW / A)		UNIT (U)/STN (S)	Nos.		VOLTAGE CODE*	FEEDER CODE**	EMER. LOAD (Y)	CONT.(C)/ INTT.(I)	STARTING TIME >5 SEC (Y)	LOCATION	BOARD NO.	CABLE		BLOCK CABLE DRG. No.	CONT ROL CODE	REMA RKS	LOAD No.	VERIFICATI ON FROM MOTOR DATASHEE T (Y/N)	KKS NO
	NAME PLATE (Range of Load)	MAX. CONT. DEMAND (MCR)		SIZE CODE	NOS															
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Argon Arc Welding Machine	4 KVA- 10 KVA		S	1		D	S													
Soldering Iron	220 V		S	1		E	S													
Industrial Vacuum cleaner	1 KW – 5 KW		S	1		E	S													
NOTES: 1. COLUMN 1 TO 12 & 18 SHALL BE FILLED BY THE REQUISITIONER (ORIGINATING AGENCY); REMAINING COLUMNS ARE TO BE FILLED UP BY PEM (ELECTRICAL)/ CUSTOMER 2. ABBREVIATIONS : * VOLTAGE CODE (7):- (ac) A=11 KV, B=6.6 KV, C=3.3 KV, D=415 V, E=240 V (1 PH), F=110 V (cc): G=220 V, H=110 V, J=48 V, K=+24V, L=-24 V : ** FEEDER CODE (8):- U=UNIDIRECTIONAL STARTER, B=BI-DIRECTIONAL STARTER, S=SUPPLY FEEDER, D=SUPPLY FEEDER (CONTACTER CONTROLLED)																				
LOAD DATA (ELECTRICAL)	JOB NO.		435				ORIGINATING AGENCY				PEM (ELECTRICAL)									
	PROJECT TITLE		2X660 MW UDANGUDI STPP				NAME								DATA FILLED UP ON					
	SYSTEM						SIGN.								DATA ENTERED ON					
	DEPTT. / SECTION		MAX				SHEET 2 OF 2		REV. 00		DE'S SIGN. & DATE									

TITLE **2X660 MW UDANGUDI STPP**
TECHNICAL SPECIFICATION FOR
WORKSHOP EQUIPMENT

SPECIFICATION NO. PE-TS-435-568-A101

VOLUME III

SECTION III D

REV	00	DATE
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SHEET 1 OF 1

PRE-BID CLARIFICATION SCHEDULE

[illegible]

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

SIGNATURE: _____

NAME: _____

DESIGNATION: _____

COMPANY:

DATE: _____

COMPANY SEAL