



**4X250 MW BRBCL NABINAGAR TPP
LIME FEEDING / DOSING SYSTEM
TECHNICAL SPECIFICATION**

(ELECTRICAL PORTION)

SPECIFICATION No: PE-TS-463-571-A102

SECTION : I

SUB-SECTION : C-3

REV. 00

SECTION: I

SUB-SECTION: C-3

TECHNICAL SPECIFICATION (ELECTRICAL PORTION)

908/2020/PS-PEM-MAX



TITLE :
ELECTRICAL EQUIPMENT SPECIFICATION
FOR
LIME DOSING/FEEDING SYSTEM
4X250 MW NABINAGAR STPP

SPECIFICATION NO.

VOLUME NO. : **II-B**

SECTION :

REV NO. **00** : DATE : 16.03.2020

SHEET : 1 OF 3

TECHNICAL SPECIFICATION

FOR

LIME DOSING/FEEDING SYSTEM
(ELECTRICAL PORTION)



TITLE :
ELECTRICAL EQUIPMENT SPECIFICATION
FOR
LIME DOSING/FEEDING SYSTEM
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SPECIFICATION NO.
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1.0 EQUIPMENT & SERVICES TO BE PROVIDED BY BIDDER:

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

- 3.1 The electrical specification without any deviation from the technical/quality assurance requirements stipulated shall be deemed to be complied by the bidder in case bidder furnishes the overall compliance of package technical specification in the form of



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compliance certificate/No deviation certificate.

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

4.0 List of enclosures :

- a) Electrical scope between BHEL & vendor
- b) Customer (NTPC) specification for Motors
- c) Customer (NTPC) cabling spec (to be referred by vendor for their scope of work (as per Electrical scope between BHEL & vendor)).
- d) Quality plan for motors & NTPC quality assurance
- e) Datasheet A for LT Motors (Annexure-I)
- f) Datasheet C for LT Motors (Annexure-X)
- g) List of Mandatory Spares (If applicable) (Annexure-II)
- h) Sub vendor List for Motors & other Electrical items (Annexure-III)
- i) Electrical Load data format (Annexure –IV)
- j) BHEL cable listing format (Annexure –V)

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ELECTRICAL SCOPE BETWEEN BHEL AND VENDOR

PACKAGES: LIME DOSING/FEEDING SYSTEM

SCOPE OF VENDOR: SUPPLY & SUPERVISION OF VENDOR'S EQUIPMENT

PROJECT: 4X250 MW NABINAGAR STPP

S.NO	DETAILS	SCOPE SUPPLY	SCOPE E&C	REMARKS
1	415 V Switchgear	BHEL	BHEL	For all LT motor & Auxiliary supply, 415 V AC (3 ph. 4 wire)/240 V AC (supply feeder) 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.
2	Local Push Button Station (for motors)	BHEL	BHEL	Located near the motor.
3	Power cables, control cables and screened control cables for a) both end equipment in BHEL's scope b) both end equipment in vendor's scope c) one end equipment in vendor's scope	BHEL BHEL BHEL	BHEL BHEL BHEL	1. For 3.b) & c): Sizes of cables required shall be informed by vendor at contract stage (based on inputs provided by BHEL) in the form of cable listing. Finalisation of cable sizes shall be done by BHEL. Vendor shall provide lugs & glands accordingly. 2. Termination at BHEL equipment terminals by BHEL. 3. Termination at Vendor equipment terminals by Vendor.
4	Junction box for control & instrumentation cable	Vendor	BHEL	Number of Junction Boxes shall be sufficient and positioned in the field to minimize local cabling (max 10-12 mtrs) and trunk cable.
5	Any special type of cable like compensating, co-axial, prefab, MICC etc.	Vendor	BHEL	
6	Cable trays, accessories & cable trays supporting system 100/ 50 mm cable trays/ Conduits/ Galvanised steel cable troughs for local cabling	BHEL Vendor	BHEL BHEL	Local cabling from nearby main route cable tray (BHEL scope) to equipment terminal (vendor's scope) shall be through 100/ 50 mm. cable trays/ conduits/ Galvanised steel cable troughs, as per approved layout drawing during contract stage.
7	a. Cable glands b. Lugs and bimetallic strip for equipment supplied by Vendor	Vendor Vendor	BHEL BHEL	a. Double compression Ni-Cr plated brass cable glands b. Solder less crimping type heavy duty tinned copper lugs for power and control cables.
8	Conduit and conduit accessories for cabling between equipment supplied by vendor	Vendor	BHEL	Conduits shall be medium duty, hot dip galvanised cold rolled mild steel rigid conduit as per IS: 9537.
9	Lighting	BHEL	BHEL	

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ELECTRICAL SCOPE BETWEEN BHEL AND VENDOR

PACKAGES: LIME DOSING/FEEDING SYSTEM

SCOPE OF VENDOR: SUPPLY & SUPERVISION OF VENDOR'S EQUIPMENT

PROJECT: 4X250 MW NABINAGAR STPP

10	Equipment grounding (including electronic earthing) & lightning protection	BHEL	BHEL	
11	Below grade grounding	BHEL	BHEL	
12	LT Motors with base plate and foundation hardware.	Vendor	BHEL	Makes shall be subject to customer/ BHEL approval at contract stage.
13	Mandatory spares	Vendor	-	Vendor to quote as per specification.
14	Recommended O & M spares	Vendor	-	As specified elsewhere in specification
15	Any other equipment/ material/ service required for completeness of system based on system offered by the vendor (to ensure trouble free and efficient operation of the system).	Vendor	BHEL	
16	a) Input cable schedules (Control & Screened Control Cables) b) Cable interconnection details for above c) Cable block diagram	Vendor Vendor Vendor	- - -	Cable listing for Control and Instrumentation Cable and electronic earthing cable in enclosed excel format shall be submitted by vendor during detailed engineering stage.
17	Electrical Equipment & cable tray layout drawings	-	-	Vendor to furnish drawing (both in print form as well as in AUTOCAD) of Lime Dosing/Feeding Building layout clearly indicating all motors, panels, JB's etc. which require cabling along with their terminal box/location/ Foundation etc.
18	Electrical Equipment GA drawing	Vendor	-	For necessary interface review.

NOTES:

1. Make of all electrical equipment/ items supplied shall be reputed make & shall be subject to approval of BHEL/customer after award of contract.
2. All QPs shall be subject to approval of BHEL/customer after award of contract without any commercial implication.
3. In case the requirement of Junction Box arises on account of Power Cable size mis-match due to vendor engineering at later stage, vendor shall supply the Junction Box for suitable termination.



SUB-SECTION-II-E2

MOTORS

**LOT-IA PROJECTS
FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE**

**TECHNICAL SPECIFICATION
SECTION-VI
BID DOCUMENT NO.: CS-0011-109(1A)-2**

PS-DEM-MAX CLASS No.		TECHNICAL REQUIREMENTS		एनटीपीसी NTPC	
MOTORS					
1.00.00	GENERAL REQUIREMENTS				
1.01.00	For the purpose of design of equipment/systems, an ambient temperature of 50 deg. Centigrade and relative humidity of 95% (at 40 deg C) shall be considered. The equipment shall operate in a highly polluted environment.				
1.02.00	All equipment's shall be suitable for rated frequency of 50 Hz with a variation of +3% & -5%, and 10% combined variation of voltage and frequency unless specifically brought out in the specification.				
1.03.00	Contactor shall provide fully compatible electrical system, equipment's, accessories and services.				
1.04.00	All the equipment, material and systems shall, in general, conform to the latest edition of relevant National and international Codes & Standards, especially the Indian Statutory Regulations.				
1.05.00	Paint shade shall be as per RAL 5012 (Blue) for indoor and outdoor equipment.				
1.06.00	The responsibility of coordination with electrical agencies and obtaining all necessary clearances for Contactors equipment and systems shall be under the Contactor scope.				
1.07.00	Degree of Protection				
	Degree of protection for various enclosures as per IEC60034-05 shall be as follows :-				
	i)	Indoor motors	-	IP 54	
	ii)	Outdoor motors	-	IP 55	
	iii)	Cable box-indoor area	-	IP 54	
	iv)	Cable box-Outdoor area	-	IP 55	
2.00.00	CODES AND STANDARDS				
	1)	Three phase induction motors	:	IS/IEC:60034	
	2)	Single phase AC motors	:	IS/ IEC:60034	
	3)	Crane duty motors	:	IS:3177, IS/IEC:60034	
	4)	DC motors/generators	:	IS:4722, IS/IEC:60034	
	5)	Energy Efficient motors	:	IS 12615, IEC:60034-30	
LOT-IA PROJECTS FLUE GAS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE		TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC NO : CS-0011-109(1)-2 221		SUB SECTION-II-E2 MOTORS	
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PS-DEM-MAX CLASS No.		TECHNICAL REQUIREMENTS		एनटीपीसी NTPC	
3.00.00	TYPE				
3.01.00	AC Motors:				
	a) Squirrel cage induction motor suitable for direct-on-line starting.				
	b) Continuous duty LT motors upto 200 KW Output rating (at 50 deg.C ambient temperature), shall be Premium Efficiency class-IE3 , conforming to IS 12615, or IEC:60034-30.				
	c) Crane duty motors shall be slip ring/ squirrel cage Induction motor as per the requirement.				
	d) Motor operating through variable frequency drives shall be suitable for inverter duty. Also these motors shall comply the requirements stipulated in IEC: 60034-18-41 and IEC: 60034-18-42 as applicable.				
3.02.00	DC Motors	Shunt wound.			
4.00.00	RATING				
	(a) Continuously rated (S1). However, crane motors shall be rated for S4 duty, 40% cyclic duration factor.				
	(b) Whenever the basis for motor or driven equipment ratings are not specified in the corresponding mechanical specification sub-sections, maximum continuous motor ratings shall be at least 10% above the maximum load demand of the driven equipment under entire operating range including voltage and frequency variations.				
5.00.00	TEMPERATURE RISE				
	Air cooled motors				
	70 deg. C by resistance method for both thermal class 130(B) & 155(F) insulation.				
	Water cooled				
	80 deg. C over inlet cooling water temperature mentioned elsewhere, by resistance method for both thermal class 130(B) & 155(F) insulation.				
6.00.00	OPERATIONAL REQUIREMENTS				
6.01.00	Starting Time				
6.01.01	For motors with starting time upto 20 secs. at minimum permissible voltage during starting, the locked rotor withstand time under hot condition at highest voltage limit shall be at least 2.5 secs. more than starting time.				
6.01.02	For motors with starting time more than 20 secs. and upto 45 secs. at minimum permissible voltage during starting, the locked rotor withstand time under hot condition at highest voltage limit shall be at least 5 secs. more than starting time.				
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CLASS No.	TECHNICAL REQUIREMENTS	एनटीपीसी NTPC		
6.01.03	For motors with starting time more than 45 secs. at minimum permissible voltage during starting, the locked rotor withstand time under hot condition at highest voltage limit shall be more than starting time by at least 10% of the starting time.			
6.01.04	Speed switches mounted on the motor shaft shall be provided in cases where above requirements are not met.			
6.02.00	Torque Requirements			
6.02.01	Accelerating torque at any speed with the lowest permissible starting voltage shall be at least 10% motor full load torque.			
6.02.02	Pull out torque at rated voltage shall not be less than 205% of full load torque. It shall be 275% for crane duty motors.			
6.03.00	Starting voltage requirement (a) Up to 85% of rated voltage for ratings below 110 KW (b) Up to 80% of rated voltage for ratings from 110 KW to 200 KW (c) Up to 85% of rated voltage for ratings from 201 KW to 1000 KW (d) Up to 80% of rated voltage for ratings from 1001 KW to 4000 KW (e) Up to 75 % of rated voltage for ratings above 4000KW			
7.00.00	DESIGN AND CONSTRUCTIONAL FEATURES			
7.01.00	Suitable single phase space heaters shall be provided on motors rated 30KW and above to maintain windings in dry condition when motor is standstill. Separate terminal box for space heaters & RTDs shall be provided. However for flame proof motors, space heater terminals inside the main terminal box may be acceptable.			
7.02.00	All motors shall be either Totally enclosed fan cooled (TEFC) or totally enclosed tube ventilated (TETV) or Closed air circuit air cooled (CACA) type. However, motors rated 3000KW or above can be Closed air circuit water cooled (CACW). The method of movement of primary and secondary coolant shall be self-circulated by fan or pump directly mounted on the rotor of the main motor as per IEC 60034-6. However VFD driven motors can be offered with forced cooling type with machine mounted fan or pump driven by separate electric motor. Motors and EPB located in hazardous areas shall have flame proof enclosures conforming to IS:2148 as detailed below (a) Fuel oil area : Group – IIB (b) Hydrogen generation : Group - IIC or (Group-I, Div-II as per plant area NEC) or (Class-1, Group-B, Div-II as per NEMA /IEC60034)			
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CLASS NO.	TECHNICAL REQUIREMENTS	
7.03.00	Winding and Insulation (a) Type : Non-hygroscopic, oil resistant, flame resistant (b) Starting duty : Two hot starts in succession, with motor initially at normal running temperature. (c) 11kV & 3.3 kV AC motors : Thermal class 155 (F) insulation. The winding insulation process shall be total Vacuum Pressure Impregnated i.e resin poor method. The lightning Impulse & interturn insulation surge withstand level shall be as per IEC-60034 part-15. (d) 240VAC, 415V AC & 220V DC motors : Thermal Class (B) or better	
7.04.00	Motors rated above 1000KW shall have insulated bearings to prevent flow of shaft currents.	
7.05.00	Motors with heat exchangers shall have dial type thermometer with adjustable alarm contacts to indicate inlet and outlet primary air temperature.	
7.06.00	Noise level for all the motors shall be limited to 85 dB(A) except for BFP motor for which the maximum limit shall be 90dB(A). Vibration shall be limited within the limits prescribed in IS:12075 / IEC 60034-14 . Motors shall withstand vibrations produced by driven equipment. HT motor bearing housings shall have flat surfaces, in both X and Y directions, suitable for mounting 80mmX80mm vibration pads.	
7.07.00	In HT motors, at least four numbers simplex / two numbers duplex platinum resistance type temperature detectors shall be provided in each phase stator winding. Each bearing of HT motor shall be provided with dial type thermometer with adjustable alarm contact and preferably 2 numbers duplex platinum resistance type temperature detectors.	
7.08.00	Motor body shall have two earthing points on opposite sides.	
7.09.00	11 KV motors shall be offered with Separable Insulated Connector (SIC) as per IEEE 386. The offered SIC terminations shall be provided with protective cover and trifurcating sleeves. SIC termination kit shall be suitable for fault level of 25 KA for 0.17 seconds.	
7.10.00	3.3 KV motors shall be offered with dust tight phase separated double walled (metallic as well as insulated barrier) Terminal box. Employer shall provide termination kit for the offered Terminal box. The offered Terminal Box shall be suitable for fault level of 250 MVA for 0.12 sec. Removable gland plates of thickness 3 mm (hot/cold rolled sheet steel) or 4 mm (non magnetic material for single core cables) shall be provided.	
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CLASS NO.	TECHNICAL REQUIREMENTS	
7.11.00	The spacing between gland plate & centre of terminal stud shall be as per Table-I.	
7.12.00	All motors shall be so designed that maximum inrush currents and locked rotor and pullout torque developed by them at extreme voltage and frequency variations do not endanger the motor and driven equipment.	
7.13.00	The motors shall be suitable for bus transfer schemes provided on the 11kV, 3.3 kV /415V systems without any injurious effect on its life.	
7.14.00	For motors rated 2000 KW & above, neutral current transformers of PS class shall be provided on each phase in a separate neutral terminal box.	
7.15.00	The size and number of cables (for HT motors) to be intimated to the successful Contactor during detailed engineering and the Contactor shall provide terminal box suitable for the same.	
8.00.00	The ratio of locked rotor KVA at rated voltage to rated KW shall not exceed the following (without any further tolerance): (a) From 50KW & upto 110KW : 11.0 (b) From 110 KW & upto 200 KW : 9.0 (c) Above 200 KW & upto 1000KW : 10.0 (d) From 1001KW & upto 4000KW : 9.0 (e) Above 4000KW : 6 to 6.5	
10.00.00	TYPE TEST	
10.01.00	HT MOTORS	
10.01.01	The Contactor shall carry out the type tests as listed in this specification on the equipment to be supplied under this contract. The Contactor shall indicate the charges for each of these type tests separately in the relevant schedule of Section - VII- (BPS) and the same shall be considered for the evaluation of the bids. The type tests charges shall be paid only for the test(s) actually conducted successfully under this contract and upon certification by the Employer's engineer.	
10.01.02	The type tests shall be carried out in presence of the Employer's representative, for which minimum 15 days notice shall be given by the Contactor. The Contactor shall obtain the Employer's approval for the type test procedure before conducting the type test. The type test procedure shall clearly specify the test set-up, instruments to be used, procedure, acceptance norms, recording of different parameters, interval of recording, precautions to be taken etc. for the type test(s) to be carried out.	
10.01.03	In case the Contactor has conducted such specified type test(s) within last ten years as on the date of bid opening, he may submit during detailed engineering	
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10.01.04		the type test reports to the Employer for waiver of conductance of such test(s). These reports should be for the tests conducted on the equipment similar to those proposed to be supplied under this contract and test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client. The Employer reserves the right to waive conducting of any or all the specified type test(s) under this contract. In case type tests are waived, the type test charges shall not be payable to the Contactor.			
10.01.05		Further the Contactor shall only submit the reports of the type tests as listed in "LIST OF TESTS FOR WHICH REPORTS HAVE TO BE SUBMITTED" and carried out within last ten years from the date of bid opening. These reports should be for the test conducted on the equipment similar to those proposed to be supplied under this contract and the test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client. However if the Contactor is not able to submit report of the type test(s) conducted within last ten years from the date of bid opening, or in the case of type test report(s) are not found to be meeting the specification requirements, the Contactor shall conduct all such tests under this contract at no additional cost to the Employer either at third party lab or in presence of client/Employers representative and submit the reports for approval.			
10.01.06		LIST OF TYPE TESTS TO BE CONDUCTED The following type tests shall be conducted on each type and rating of HT motor (a) No load saturation and loss curves upto approximately 115% of rated voltage (b) Measurement of noise at no load. (c) Momentary excess torque test (subject to test bed constraint). (d) Full load test(subject to test bed constraint) (e) Temperature rise test at rated conditions. During heat run test, bearing temp., winding temp.,coolant flow and its temp. shall also be measured. In case the temperature rise test is carried at load other than rated load, specific approval for the test method and procedure is required to be obtained. Wherever ETD's are provided, the temperature shall be measured by ETD's also for the record purpose. LIST OF TESTS FOR WHICH REPORTS HAVE TO BE SUBMITTED The following type test reports shall be submitted for each type and rating of HT motor (a) Degree of protection test for the enclosure followed by IR, HV and no load run test.			
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		(b) Terminal box-fault level withstand test for each type of terminal box of HT motors only. (c) Lightning Impulse withstand test on the sample coil shall be as per clause no. 4.3 IEC-60034, part-15 (d) Surge-withstand test on inter-turn insulation shall be as per clause no. 4.2 of IEC 60034, part-15			
10.02.00		LT Motors			
10.02.01		LT Motors supplied shall be of type tested design. During detailed engineering, the Contactor shall submit for Employer's approval the reports of all the type tests as listed in this specification and carried out within last <i>ten</i> years from the date of bid opening. These reports should be for the test conducted on the equipment similar to those proposed to be supplied under this contract and the test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client.			
10.02.02		However if the Contactor is not able to submit report of the type test(s) conducted within last ten years from the date of bid opening, or in the case of type test report(s) are not found to be meeting the specification requirements, the Contactor shall conduct all such tests under this contract at no additional cost to the Employer either at third party lab or in presence of client/Employers representative and submit the reports for approval.			
10.02.03		LIST OF TESTS FOR WHICH REPORTS HAVE TO BE SUBMITTED The following type test reports shall be submitted for each type and rating of LT motor of above 50 KW only 1. Measurement of resistance of windings of stator and wound rotor. 2. No load test at rated voltage to determine input current power and speed 3. Open circuit voltage ratio of wound rotor motors (in case of Slip ring motors) 4. Full load test to determine efficiency power factor and slip 5. Temperature rise test 6. Momentary excess torque test. 7. High voltage test 8. Test for vibration severity of motor. 9. Test for noise levels of motor(Shall be limited as per clause no 7.06.00 of this section)			
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CLASS NO.	TECHNICAL REQUIREMENTS	एनटीपीसी NTPC		
10.03.00 10.04.00	10. Test for degree of protection and 11. Overspeed test. 12. Type test reports for motors located in fuel oil area having flame proof enclosures as per IS 2148 / IEC 60079-1 All acceptance and routine tests as per the specification and relevant standards shall be carried out. Charges for these shall be deemed to be included in the equipment price. The type test reports once approved for any projects shall be treated as reference. For subsequent projects of NTPC, an endorsement sheet will be furnished by the manufacturer confirming similarity and "No design Change". Minor changes if any shall be highlighted on the endorsement sheet.			
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TECHNICAL REQUIREMENTS



TABLE - I

DIMENSIONS OF TERMINAL BOXES FOR LV MOTORS

Motor MCR in KW	Minimum distance between centre of
	stud and gland plate in mm
UP to 3 KW	As per manufacturer's practice.

Above 3 KW - upto 7 KW	85
Above 7 KW - upto 13 KW	115
Above 13 KW - upto 24 KW	167
Above 24 KW - upto 37 KW	196
Above 37 KW - upto 55 KW	249
Above 55 KW - upto 90 KW	277
Above 90 KW - upto 125 KW	331
Above 125 KW-upto 200 KW	203

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

PHASE TO PHASE/ PHASE TO EARTH AIR CLEARANCE:

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

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



SUB-SECTION-II-E6

~~CABLING, EARTHING & LIGHTNING PROTECTION~~

LOT-3 PROJECTS
FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE

TECHNICAL SPECIFICATION
SECTION-VI
BID DOCUMENT NO.: CS-0011-109(3)-9

PS-PEM-MAX CLAUSE NO.		TECHNICAL REQUIREMENTS		एन टी पी सी NTPC	
1.00.00		CODES AND STANDARDS			
1.01.00		All standards, specifications and codes of practice referred to herein shall be the latest editions including all applicable official amendments and revisions as on date of opening of bid. In case of conflict between this specification and those (IS codes, standards, etc.) referred to herein, the former shall prevail. All work shall be carried out as per the following standards/ codes as applicable .			
		IS:513	Cold rolled low carbon steel sheets and strips.		
		IS:802	Code of practice for the use of Structural Steel in Overhead Transmission Line Towers.		
		IS:1079	Hot Rolled carbon steel sheet & strips		
		IS:1239	Mild steel tubes, tubulars and other wrought steel fittings		
		IS:1255	Code of practice for installation and maintenance of power cables upto and including 33 KV rating		
		IS:1367 Part-13	Technical supply conditions for threaded Steel fasteners. (Hot dip galvanized coatings on threaded fasteners).		
		IS:2147	Degree of protection provided by enclosures for low voltage switchgear and control gear		
		IS:2309	Code of Practice for the protection of building and allied structures against lightning.		
		IS:2629	Recommended practice for hot dip galvanising of iron & steel		
		IS:2633	Method for testing uniformity of coating on zinc coated articles.		
		IS:3043	Code of practice for Earthing		
		IS:3063	Fasteners single coil rectangular section spring washers.		
		IS:6745	Methods for determination of mass of zinc coating on zinc coated iron & steel articles.		
		IS:8308	Compression type tubular in- line connectors for aluminium conductors of insulated cables		
		IS:8309	Compression type tubular terminal ends for aluminium conductors of insulated cables.		
		IS:9537	Conduits for electrical installation.		
		IS:9595	Metal - arc welding of carbon and carbon manganese steels - recommendations.		
		IS:13573	Joints and terminations for polymeric cables.		
		BS:476	Fire tests on building materials and structures		
		IEEE:80	IEEE guide for safety in AC substation grounding		
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		IEEE:142	Grounding of Industrial & commercial power systems			
		DIN 46267 (Part-II)	Non tension proof compression joints for Aluminium conductors.			
		DIN 46329	Cable lugs for compression connections, ring type ,for Aluminium conductors			
		BS:6121	Specification for mechanical Cable glands for elastomers and plastic insulated cables.			
			Indian Electricity Act.			
			Indian Electricity Rules.			
1.02.00		Equipment complying with other internationally accepted standards such as IEC, BS, DIN, USA, VDE, NEMA etc. will also be considered if they ensure performance and constructional features equivalent or superior to standards listed above. In such a case, the Bidder shall clearly indicate the standard(s) adopted, furnish a copy in English of the latest revision of the standards alongwith copies of all official amendments and revisions in force as on date of opening of bid and shall clearly bring out the salient features for comparison.				
2.00.00		DESIGN AND CONSTRUCTIONAL FEATURE				
2.01.00		Inter Plant Cabling				
2.01.01		Interplant cabling for main routes shall be laid along overhead trestles/duct banks. Cables from main plant to switchyard control room shall be laid in overhead trestles or duct bank. In case of Duct banks, pull-pits shall be filled with sand and provided with a PCC covering. Directly buried cables, if essential, shall not have concentration of more than 4 cables in one route. Cables crossing Railway line (if applicable) shall be laid underground through nearest culvert. Necessary statutory clearance if required shall be taken by Bidder. All HT,LT and control cable shall be armoured.				
2.01.02		Transformer yard				
		In transformer yard cables shall be laid in overhead trestle. The main cable routes coming out from Main plant building and crossing the Transformer yard shall be laid in overhead trestles. In transformer yard, trestle height for rail/road crossing shall be suitable for movement of Generator Transformer with bushing.				
2.01.03		Trenches				
		PCC flooring of built up trenches shall be sloped for effective drainage with sump pits and sump pumps.				
2.01.04		No sub zero level cable vault/trenches shall be provided below control building/switchgear rooms in main plant.				
2.01.05		Cable Vault				
		The cable vault/ / cable spreader room space below the HT / LT switchgear room, Control Rooms, unit control equipment room, Programmer room, UPS, Charger & Battery Rooms, shall have <u>800 mm wide</u> and 2.1 m high movement passage all around the cable trays in the cable vault/ cable spreader room for easy laying/maintenance of cables				
		Cable vaults shall be provided with adequate drainage facilities for drainage of fire water.				
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2.01.06	Each cable vault should have at least two doors.				
	Exit signs shall be provided near doors for personnel escape in case of emergency				
	Boiler Area				
	Cable trays in boiler & ESP area shall be supported from the boiler and ESP structures. The same shall be coordinated with SG/ESP contractor.				
	Cable trays in these areas shall be in vertical formation to avoid dust accumulation. No cable trenches shall be provided in boiler/ESP area.				
	2.01.07 Two separate cable routes shall be provided for cable routing of working and standby drives or different set/group (say 50% capacity) of auxiliaries.				
	2.01.08 OffSite Area				
	For feeder in bidder's scope for offsite areas, overhead cable tray arrangement shall be followed. However cable trenches/slit may also be acceptable, for some areas, if found to be required during detailed engineering.				
	Cable trenches provided shall be separated from fuel oil area to avoid oil accumulation.				
	2.01.09 The cable slits to be used for motor/equipment power/control supply shall be sand filled & covered with PCC after cabling.				
	2.01.10 Sizing criteria, derating factors for the cables shall be met as per respective chapters. However for the power cables, the minimum conductor size shall be 6 sq.mm. for aluminium conductor and 2.5 sq.mm. for copper conductor cable.				
2.01.11 Conscious exceptions to the above guidelines may be accepted under special conditions but suitable measures should be taken at such location to:					

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3.01.05		galvanised as per Clause No. 3.13.00 of this chapter. Troughs shall be standard width of 50 mm & 75 mm with depth of 25 mm.			
3.01.05		The tolerance for cable tray and accessories shall be as per IS 2102 (Part-1). Tolerance Class: - Coarse			
3.02.00		Support System for Cable Trays			
3.02.01		Cable tray support system shall be pre-fabricated out of single sheet as per enclosed tender drawings.			
3.02.02		Support system for cable trays shall essentially comprise of the two components i.e. main support channel and cantilever arms. The main support channel shall be of two types : (i) C1:- having provision of supporting cable trays on one side and (ii) C2:-having provision of supporting cable trays on both sides. The support system shall be the type described hereunder a. Cable supporting steel work for cable racks/cables shall comprise of various channel sections, cantilever arms, various brackets, clamps, floor plates, all hardwares such as lock washers, hexagon nuts, hexagon head bolt, support hooks, stud nuts, hexagon head screw, channel nut, channel nut with springs, fixing studs, etc. b. The system shall be designed such that it allows easy assembly at site by using bolting. All cable supporting steel work, hardwares fittings and accessories shall be prefabricated factory galvanised. c. The main support and cantilever arms shall be fixed at site using necessary brackets, clamps, fittings, bolts, nuts and other hardware etc. to form various arrangements required to support the cable trays. Welding of the components shall not be allowed. However, welding of the bracket (to which the main support channel is bolted) to the overhead beams, structural steel, insert plates or reinforcement bars will be permitted. Any cutting or welding of the galvanised surface shall be brushed and red lead primer, oil primer & aluminium paint shall be applied d. All steel components, accessories, fittings and hardware shall be hot dip galvanised after completing welding, cutting, drilling and other machining operation. e. The typical arrangement of flexible support system is shown in the enclosed drawings and described briefly below: The main support channel and cantilever arms shall be fabricated out of 2.5 thick rolled steel sheet conforming to IS 1079. f. Cantilever arms of 320 mm, 620mm and 750 mm in length are required, and shall be as shown in the enclosed drawing. The arm portion shall be suitable for assembling the complete arm assembly on to component constructed of standard channel section. The back plate shall allow sufficient clearance for fixing bolt to be tightened with tray in position. g. Support system shall be able to withstand - weight of the cable trays - weight of the cables (75 Kg/Metre run of each cable tray) - Concentrated load of 75 Kg between every support span. - Factor of safety of minimum 1.5 shall be considered.			
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3.02.03	The size of structural steel members or thickness of sheet steel of main support channel and cantilever arms and other accessories as indicated above or in the enclosed drawings are indicative only. Nevertheless, the support system shall be designed by the bidder to fully meet the requirements of type tests as specified. In case the system fails in the tests, the components design modification shall be done by the Bidder without any additional cost to the Employer. The bidder shall submit the detailed drawings of the system offered by him alongwith the bid.				
3.02.04	Four legged structure shall be provided wherever there is change in elevation and change in direction				
3.02.05	FOR COAL HANDLING PLANT/FGD PLANT AREA THE FOLLOWING SHALL ALSO BE APPLICABLE:				
	a) All overhead cable routes shall be along the route of the conveyor gallery on separate supporting structures and cables shall be laid in vertical trays. The bottom of the steel shall be such that the existing facilities, movement of trucks/human beings etc. does not get affected. The cable trestle shall have a minimum 600mm clear walk way and shall have maintenance platforms as required. The bottom of the steel supporting structure shall be generally at 3.0M above the grade level except for rail/road crossings where it shall be at 8.0M above grade level. Tap offs from the overhead cable trestle can be through shallow trenches with prior approval of the Employer. Directly buried cable, if essential, shall not have concentration of more than 4 cables on one route.				
	b) Cable trenches shall be provided only in Switchgear/MCC rooms.				
	c) Cables shall not be routed through the conveyor galleries except for the equipment located in the conveyor galleries for a particular conveyor i.e. protection switches, receptacles etc.				
	d) Cables for PCS and BSS shall be routed along the conveyors through GI conduits.				
3.03.00	Pipes, Fittings & Accessories				
3.03.01	Pipes offered shall be complete with fittings and accessories (like tees, elbows, bends, check nuts, bushings, reducers, enlargers, coupling caps, nipples etc.) The size of the pipe shall be selected on the basis of maximum 40% fill criteria				
3.03.02	GI Pipes shall be of medium duty as per IS: 1239				
3.03.03	Duct banks shall be High Density PE pipes encased in PCC (10% spare of each size, subject to minimum one) with suitable water-proof manholes.				
3.03.04	Hume pipes shall be NP3 type as per IS 458.				
3.03.05	TERNE Coated Flexible Steel Conduits shall be water proof and rust proof made of heat resistant lead coated steel. Conduit diameter shall be uniform throughout its length. Internal surface of the conduit shall be free from burrs and sharp edges. Conduits shall be complete with necessary accessories for proper termination of the conduit with junction boxes and lighting fixtures				
3.03.06	HDPE pipes and conduits shall be PE-80, PN-10 type as per IS 4984/IS 8008 part-I.				
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3.04.00	Junction Boxes				
3.04.01	Junction box shall be made of Fire retardant material. Material of JB shall be Thermoplastic or thermosetting or FRP type. The box shall be provided with the terminal blocks, mounting bracket and screws etc. The cable entry shall be through galvanized steel conduits of suitable diameter. The JB shall have suitable for installing glands of suitable size on the bottom of the box. The JB shall be suitable for surface mounting on ceiling/structures. The JB shall be of grey color RAL 7035. All the metal parts shall be corrosion protected. Junction box surface should be such that it is free from crazings, blisterings, wrinkling, colour blots/striations. There should not be any mending or repair of surface. JB's will be provided with captive screws so that screws don't fall off when cover is opened. JB's mounting brackets should be of powder coated MS. Type test reports for the following tests shall be furnished:- (a) Impact resistance for impact energy of 2 Joules (IK07) as per BS EN50102 (b) Thermal ageing at 70deg C for 96 hours as per IEC60068-2-2Bb. (c) Class of protection shall be IP 55. (d) HV test.				
3.04.02	Terminal blocks shall be 1100V grade, of suitable current rating, made up of unbreakable polyamide 6.6 grade. The terminals shall be screw type or screw-less (spring loaded) / cage clamp type with lugs. Marking on terminal strips shall correspond to the terminal numbering in wiring diagrams. All metal parts shall be of non-ferrous material. In case of screw type terminals the screw shall be captive, preferably with screw locking design. All terminal blocks shall be suitable for terminating on each side the required cables/wire size. All internal wiring shall be of cu. Conductor PVC wire.				
3.05.00	Terminations & Straight Through Joints				
3.05.01	Termination and jointing kits for 33kV, 11 kV, 6.6 KV and 3.3 kV grade XLPE insulated cables shall be of proven design and make which have already been extensively used and type tested. Termination kits and jointing kits shall be Pre-moulded type or heat shrinkable type. Further Cold shrinkable type termination and jointing kits are also acceptable. The Cold shrinkable type kits shall be type tested as per relevant standards. Calculation to withstand the required fault level shall also be furnished in case of cold shrinkable type kits. 33 kV, 11 kV, 6.6 KV and 3.3kV grade joints and terminations shall be type tested and Type test reports as per IS:13573 Part-II and IEC60502 shall be furnished. Also, heat shrink material shall comply with requirements of ESI 09-13 (external tests). Critical components used in cable accessories shall be of tested and proven quality as per relevant product specification/ESI specification. Cable joints and terminations should be with FRLS properties as per IEC 60754-1&2. Kit contents shall be supplied from the same source as were used for type testing. The kit shall be complete with the tinned copper solderless crimping type cable lugs & ferrule or mechanical connectors (wherein bolts are tightened that shear off at an appropriate torque) as per DIN standard suitable for aluminium compacted conductor cables. (Tender drg. no 0000-211-POE -A-51-RA of cable lug attached at the end of this chapter).				
3.05.02	Straight through joint and termination shall be capable of withstanding the fault level of 21 KA for 0.12 Sec. with dynamic peak of 52 KA for 33 KV system & of 40 kA for 0.12 sec with a dynamic peak of 100 kA for 11 kV, 6.6 KV & 3.3 KV system. Straight through joints shall have provisions for shield connection and earthing wherever required and complete with all accessories and consumables suitable for storage without deterioration at a temperature of 50 deg. C with shelf life of more than five years. 1.1 kV grade straight through joints shall also be of proven design				
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3.05.03		1.1 KV grade Straight Through Joint shall be of proven design.			
3.06.00		Cable glands			
3.06.01		Cable shall be terminated using double compression type cable glands. Testing requirements of Cable glands shall conform to BS:6121 and gland shall be of robust construction capable of clamping cable and cable armour (for armoured cables) firmly without injury to insulation. Cable glands shall be made of heavy duty brass machine finished and nickel chrome plated. Thickness of plating shall not be less than 10 micron. All washers and hardware shall also be made of brass with nickel chrome plating Rubber components shall be of neoprene or better synthetic material and of tested quality. Cable glands shall be suitable for the sizes of cable supplied/erected.			
3.07.00		Cable lugs/ferrules			
3.07.01		Cable lugs/ferrules for power cables shall be tinned copper solderless crimping type suitable for aluminium compacted conductor cables. Cable lugs and ferrules for control cables shall be tinned copper type. The cable lugs for control cables shall be provided with insulating sleeve and shall suit the type of terminals provided on the equipments. Cable lugs and ferrule shall conform to IS/DIN standards.			
3.08.00		Trefoil clamps			
3.08.01		Trefoil clamps for single core cables shall be pressure die cast aluminum or fibre glass or nylon and shall include necessary fixing accessories like G.I. nuts, bolts, washers, etc. Trefoil clamps shall have adequate mechanical strength, when installed at 1 mtr intervals, to withstand the forces generated by the peak value of maximum system short circuit current.			
3.09.00		Cable Clamps & Ties			
3.09.01		The cable clamps/ties required to clamp multicore cables shall be of SS-316 material, 12mm wide, polyster coated ladder lock type. The clamps/ties shall have self locking arrangement & shall have sufficient strength. The cable clamps/ties shall be supplied in finished individual pieces of suitable length to meet the site requirements.			
3.10.00		Receptacles			
3.10.01		Receptacles boxes shall be fabricated out of MS sheet of 2mm thickness and hot dipped gavanised or of die-cast aluminium alloy of thickness not less than 2.5 mm. The boxes shall be provided with two nos. earthing terminals, gasket to achieve IP55 degree of protection, terminal blocks for loop-in loop-out for cable of specified sizes, mounting brackets suitable for surface mounting on wall/column/structure, gland plate etc. The ON-OFF switch shall be rotary type heavy duty, double break,AC23 category, suitable for AC supply. Plug and Socket shall be shrouded Die-cast aluminium. Socket shall be provided with lid safety cover. Robust mechanical interlock shall be provided such that the switch can be put ON only when the plug is fully engaged and plug can be withdrawn only when the switch is in OFF position. Also cover can be opened only when the switch is in OFF position. Wiring shall be carried out with 1100 V grade PVC insulated stranded aluminium/copper wire of adequate size. The Terminal blocks shall be of 1100 V grade. The Terminal blocks shall be of 1100 V grade made up of unbreakable polyimide 6.6 grade with adequate current rating and size. The welding receptacles shall be provided with RCCB/RCD of 30mA sensitivity having facility for manual testing/checking of operation of RCCB/RCD.			
3.11.00		Cable Drum Lifting Jack			
		The jack for cable drum lifting shall be of screw type with 10 ton capacity. The cable drum jacks shall be manufactured from fabricated steel. The spindles supplied with the cable drum jack shall be manufactured using BSEN-24 grade steel bar with locking collars. Jack			
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		nests shall be of SG cast steel. Cable drum jack supplied shall have undergone load testing and reports for the same shall be submitted. At least Two Nos. of jacks shall be supplied for NTPC use. Contractor has to make arrangements for his own jacks for cable reeling/unreeling under his scope of installation.			
3.12.00		Galvanising			
3.12.01		Galvanising of steel components and accessories shall conform to IS:2629 , IS4759 & IS:2633. Additionally galvanising shall be uniform, clean smooth, continuous and free from acid spots.			
3.12.02		The amount of zinc deposit over threaded portion of bolts, nuts, screws and washers shall be as per IS:1367 . The removal of extra zinc on threaded portion of components shall be carefully done to ensure that the threads shall have the required zinc coating on them as specified			
3.13.00		Welding			
3.13.01		The welding shall be carried out in accordance with IS:9595. All welding procedures and welders qualification shall also be followed strictly in line with IS:9595			
4.00.00		INSTALLATION			
4.01.00		Cable tray and Support System Installation			
4.01.01		Cables shall run in cable trays mounted horizontally or vertically on cable tray support system which in turn shall be supported from floor, ceiling, overhead structures, trestles, pipe racks, trenches or other building structures.			
4.01.02		Horizontally running cable trays shall be clamped by bolting to cantilever arms and vertically running cable trays shall be bolted to main support channel by suitable bracket/clamps on both top and bottom side rails at an interval of 2000 mm in general. For vertical cable risers/shafts cable trays shall be supported at an interval of 1000mm in general. Fixing of cable trays to cantilever arms or main support channel by welding shall not be accepted. Cable tray installation shall generally be carried out as per the approved guidelines/ drawings. Vendor shall design the support system along with tray, spacing etc in line with tray loadings/drawings.			
4.01.03		The cantilever arms shall be positioned on the main support channel with a minimum vertical spacing of 300 mm unless otherwise indicated.			
4.01.04		The contractor shall fix the brackets/ clamps/ insert plates using anchor fasteners. Minimum size of anchor fasteners shall be M 8 X 50 and material shall be stainless steel grade 316 or better. Anchor fastener shall be fixed as recommended by manufacturer and as approved by site engineer. For brick wall suitable anchor fasteners shall be used as per the recommendations of manufacturer. Make of anchor fasteners subject to QA approval and the same shall be finalized at pre-award stage.			
4.01.05		All cable way sections shall have identification, designations as per cable way layout drawings and painted/stenciled at each end of cable way and where there is a branch connection to another cable way. Minimum height of letter shall be not less than 75 mm. For long lengths of trays, the identification shall be painted at every 10 meter. Risers shall additionally be painted/stenciled with identification numbers at every floor.			
4.01.06		In certain cases it may be necessary to site fabricate portions of trays, supports and other non standard bends where the normal prefabricated trays, supports and accessories may not be suitable. Fabricated sections of trays, supports and accessories to make the			
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4.02.00	Conduits/Pipes/Ducts Installation				
4.02.01	The Contractor shall ensure for properly embedding conduit pipe sleeves wherever necessary for cabling work. All openings in the floor/roof/wall / cable tunnel/cable trenches made for conduit installation shall be sealed and made water proof by the Contractor.				
4.02.02	GI pull wire of adequate size shall be laid in all conduits before installation. Metallic conduit runs at termination shall have two lock nuts wherever required for junction boxes etc.				
4.02.03	Conduit runs/sleeves shall be provided with PVC bushings having round edge at each end. All conduits/pipes shall have their ends closed by caps until cables are pulled. After cables are pulled, the ends of conduits/pipes shall be sealed with Glass wool/Cement Mortar/Putty to prevent entrance of moisture and foreign material				
4.02.04	Exposed conduit/pipe shall be adequately supported by racks, clamps, straps or by other approved means. Conduits /pipe support shall be installed square and true to line and grade with an average spacing between the supports as given below, unless specified otherwise				
	Conduit /pipe size (dia).		Spacing		
	Upto 40 mm		1 M		
	50 mm		2.0 M		
	65-85 mm		2.5 M		
	100 mm and above		3.0 M		
4.02.05	For bending of conduits, bending machine shall be arranged at site by the contractor to facilitate cold bending. The bends formed shall be smooth.				
4.03.00	Junction Boxes Installation				
4.03.01	Junction boxes shall be mounted at a height of 1200mm above floor level or as specified in the drawings and shall be adequately supported/mounted on masonry wall by means of anchor fasteners/ expandable bolts or shall be mounted on an angle, plate or other structural supports fixed to floor, wall, ceiling or equipment foundations.				
4.04.00	Cable Installation				
4.04.01	Cable installation shall be carried out as per IS:1255 and other applicable standards.				
4.04.02	For Cable unloading, pulling etc following guidelines shall be followed in general:				
	a) Cable drums shall be unloaded, handled and stored in an approved manner on hard and well drained surface so that they may not sink. In no case shall be drum be stored flat i.e. with flange horizontal. Rolling of drums shall be avoided as far as possible. For short distances, the drums may be rolled provided they are rolled slowly and in proper direction as marked on the drum. In absence of any indication, the drums may be rolled in the same direction as it was rolled during taking up the cables. For unreeling the cable, the drum shall be mounted on suitable jacks or on cable wheels and shall be rolled slowly so that cable comes out over the drum and not from below. All possible care shall be taken during unreeling and laying to avoid				
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		damage due to twist, kink or sharp bends. Cable ends shall be provided with sealed plastic caps to prevent damage and ingress of moisture. b) While laying cable, ground rollers shall be used at every 2 meter interval to avoid cable touching ground. The cables shall be pushed over the rollers by a gang of people positioned in between the rollers. Cables shall not be pulled from the end without having intermediate pushing arrangements. Pulling tension shall not exceed the values recommended by cable manufacturer. Selection of cable drums for each run shall be so planned so as to avoid using straight through joints. Care should be taken while laying the cables so as to avoid damage to cables. If any particular cable is damaged, the same shall be repaired or changed to the satisfaction of Project Manager.			
4.04.03		Cables shall be laid on cable trays strictly in line with cable schedule			
4.04.04		Power and control cables shall be laid on separate tiers inline with the approved guidelines/drawings. The laying of different voltage grade cables shall be on different tiers according to the voltage grade of the cables. In horizontal tray stacks, H.T. cables shall be laid on top most tier and cables of subsequent lower voltage grades on lower tiers of trays. Single core cable in trefoil formation shall be laid with a distance of four times the diameter of cable between trefoil center lines and clamped at every two metre. All multicore cables shall be laid in touching formation. Power and control cables shall be secured fixed to trays/support with cable clamps/ties with self locking arrangement. For horizontal trays arrangements, multicore power cables and control cables shall be secured at every five meter interval. For vertical tray arrangement, individual multicore power cables and control cables shall be secured at every one meter. After completion of cable laying work in the particular vertical tray, all the control cables shall be binded to trays/supports by cable clamps/ties with self locking arrangement at every five meter interval and at every bend. Fibre Optical cable shall be laid in trenches/trays or as decided by Employer.			
4.04.05		Bending radii for cables shall be as per manufacturer's recommendations and IS:1255.			
4.04.06		Where cables cross roads/rail tracks, the cables shall be laid in hume pipe/ HDPE pipe.			
4.04.07		No joints shall be allowed in trip circuits, protection circuits and CT/PT circuits. Also joints in critical equipment in main plant area shall not be permitted. Vendor shall identify and accordingly procure the cable drum length.			
4.04.08		In each cable run some extra length shall be kept at suitable point to enable one LT/two HT straight through joints to made, should the cable develop fault at a later stage. Control cable termination inside equipment enclosure shall have sufficient lengths so that shifting of termination in terminal blocks can be done without requiring any splicing.			
4.04.09		Wherever few cables are branching out from main trunk route troughs shall be used.			
4.04.10		Wind loading shall be considered for designing support as well Cable trays wherever required.			
4.04.11		Where there is a considerable risk of steam, hot oil or mechanical damage cable routes shall be protected by barriers or enclosures.			
4.04.12		The installation work shall be carried out in a neat workman like manner & areas of work shall be cleaned of all scraps, water, etc. after the completion of work in each area every day. Contractor shall replace RCC/Steel trench covers after the Installation work in that particular area is completed or when further work is not likely to be taken up for some time.			
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4.04.13	Separation At least 300mm clearance shall be provided between: - HT power & LT power cables, - LT power & LT control/instrumentation cables,														
4.04.14	Segregation 1) Segregation means physical isolation to prevent fire jumping. 2) All cables associated with the unit shall be segregated from cables of other units. 3) Interplant cables of station auxiliaries and unit critical drives shall be segregated in such a way that not more than half of the drives are lost in case of single incident of fire. Power and control cables for AC drives and corresponding emergency AC or DC drives shall be laid in segregated routes. Cable routes for one set of auxiliaries of same unit shall be segregated from the other set. 4) In switchyard, control cables of each bay shall be laid on separate racks/trays.														
4.04.15	Minimum number of spare cores required to be left for interconnection in control cables shall be as follows: Minimum number of spare cores required to be left for interconnection in control cables shall be as follows: <table><tr><td>No. of cores in cable</td><td>No. of spare cores</td></tr><tr><td>2C,3C</td><td>NIL</td></tr><tr><td>5C</td><td>1</td></tr><tr><td>7C-10C</td><td>2</td></tr><tr><td>14C and above</td><td>3</td></tr></table>	No. of cores in cable	No. of spare cores	2C,3C	NIL	5C	1	7C-10C	2	14C and above	3				
No. of cores in cable	No. of spare cores														
2C,3C	NIL														
5C	1														
7C-10C	2														
14C and above	3														
4.04.16	Directly Buried Cables a) Cable trenches shall be constructed for directly buried cables. Construction of cable trench for cables shall include excavation, preparation of sieved sand bedding, riddled soil cover, supply and installation of brick or concrete protective covers, back filling and compacting, supply and installation of route markers and joint markers. Laying of cables and providing protective covering shall be as per IS:1255 and the enclosed drawings showing cabling details. b) RCC cable route and RCC joint markers shall be provided wherever required. The voltage grade of the higher voltage cables in route shall be engraved on the marker. Location of underground cable joints shall be indicated with cable marker with an additional inscription "Cable Joint". The marker shall project 150 mm above ground and shall be spaced at an interval of 30 meters and at every change in direction. They shall be located on both sides of road crossings and drain crossings. Top of cable marker/joint marker shall be sloped to avoid accumulation of water/dust on marker.														
4.04.17	Cable tags shall be provided on all cables at each end (just before entering the equipment enclosure), on both sides of a wall or floor crossing, on each duct/conduit entry, and at														
LOT-3 PROJECTS FLUE GAS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE		TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC NO : CS-0011-109(3)-9		SUB SECTION-II-E6 CABLING, EARTHING & LIGHTNING PROTECTION											
				Page 11 of 23											

S-PEM-MAX CLAUSE NO.		TECHNICAL REQUIREMENTS		एन टी पी सी NTPC	
		every 20 meters in cable tray/trench runs. Cable tags shall also be provided inside the switchgear, motor control centers, control and relay panels etc. where a number of cables enter together through a gland plate. Cable tag shall be of rectangular shape for power cables and control cables. Cable tag shall be of 2 mm thick aluminum with number punched on it and securely attached to the cable by not less than two turns of 20 SWG GI wire conforming to IS:280. Alternatively, the Contractor may also provide cable tags made of nylon, cable marking ties with cable number heat stamped on the cable tags. The cable tag requirements mentioned above shall prevail over Tag requirements mentioned elsewhere in this document for HT power, LT power & control cables.			
4.04.18		While crossing the floors, unarmoured cables shall be protected in conduits upto a height of 500 mm from floor level if not laid in tray.			
4.05.00		Cable Terminations & Connections			
4.05.01		The termination and connection of cables shall be done strictly in accordance with cable termination kit manufacturer" instructions, drawings and/or as directed by Project Manager. Cable jointer shall be qualified to carryout satisfactory cable jointing/termination. Contractor shall furnish for review documentary evidence/experience reports of the jointers to be deployed at site.			
4.05.02		Work shall include all clamps, fittings etc. and clamping, fitting, fixing, plumbing, soldering, drilling, cutting, taping, preparation of cable end, crimping of lug, insulated sleeving over control cable lugs, heat shrinking (where applicable), connecting to cable terminal, shorting and grounding as required to complete the job to the satisfaction of the Project Manager.			
4.05.03		The equipment will be generally provided with undrilled gland plates for cables/conduit entry. The Contractor shall be responsible for punching of gland plates, painting and touching up. Holes shall not be made by gas cutting. The holes shall be true in shape. All cable entry points shall be sealed and made vermin and dust proof. Unused openings shall be effectively sealed by 2mm thick aluminium sheets.			
4.05.04		Control cable cores entering control panel/switchgear/MCC/miscellaneous panels shall be neatly bunched, clamped and tied with self locking type nylon cable ties with de interlocking facility to keep them in position.			
4.05.05		All the cores of the control cable to be terminated shall have identification by providing ferrules at either end of the core, each ferrule shall be indelible, printed single tube ferrule and shall include the complete wire number and TB number as per the drawings. The ferrule shall fit tightly on the core. Spare cores shall have similar ferrules with suffix sp1, sp2, ---etc along with cable numbers and coiled up after end sealing.			
4.05.06		All cable terminations shall be appropriately tightened to ensure secure and reliable connections.			
5.00.00		EARTHING SYSTEM			
5.01.00		Earthing system shall be in strict accordance with IS:3043 and Indian Electricity Rules/Acts The earthing system shall be designed for a life expectancy of at least forty (40) years, for a system fault current of 50 kA for 1.0 sec. The minimum rate of corrosion of steel for selection of earthing conductor shall be 0.12mm per year.			
LOT-3 PROJECTS FLUE GAS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE		TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC NO : CS-0011-109(3)-9		SUB SECTION-II-E6 CABLING, EARTHING & LIGHTNING PROTECTION	
				Page 12 of 23	

 MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS		STANDARD QUALITY PLAN		SPEC. NO. :	
		CUSTOMER :		QP NO. : PED-506-00-Q-006, REV-02	
		PROJECT :		PO NO. :	
		ITEM: AC ELECT. MOTORS UPTO 55KW (LV (415V))		SYSTEM:	
		SECTION: II		DATE: 27.02.2020	
				SHEET 1 OF 2	

Sl No.	Component & Operations	Characteristics	Class	Type of Check	Quantum Of check		Reference Document	Acceptance NORMS	FORMAT OF RECORD	AGENCY			
1	2	3	4	5	6		7	8	9	10			
					M	C/N				D	M	C	N
1.0	ASSEMBLY	1.WORKMANSHIP 2.DIMENSIONS 3.CORRECTNESS COMPLETENESS/ TERMINATIONS/ MARKING/COLOUR CODE	MA	VISUAL	100%	-	MFG. SPEC.	MFG. SPEC.	-DO-	P	-	-	
2.0	PAINTING	1.SHADE	MA	VISUAL	SAMPLE	-	MFG. SPEC./ APPROVED DATASHEET	SAME AS COL.7	LOG BOOK	P	-	-	
3.0	TESTS	1.ROUTINE TEST INCLUDING SPECIAL TEST	MA	-DO-	100%	100%	IS-325 / IS-12615/ APPROVED DATA SHEET	SAME AS COL.7	TEST/ INSPN. REPORT	P	W	W	NOTE -1 & NOTE-2
		2.OVERALL DIMENSIONS & ORIENTATION	MA	MEASUREMENT & VISUAL	100%	100%	APPROVED DRG/DATA SHEET	APPROVED DRG/DATA SHEET	TEST/ INSPN. REPORT	P	W	W	NOTE -1 & NOTE-2

ENGINEERING		QUALITY	
Sign & Date	Name	Sign & Date	Name
<i>[Signature]</i>	Heena K.	<i>[Signature]</i>	KUNAT
Prepared by:		Checked by:	
<i>[Signature]</i>	P. Dutta	<i>[Signature]</i>	KUNAT
Reviewed by:		Reviewed by:	
<i>[Signature]</i>		<i>[Signature]</i>	

BIDDER/ SUPPLIER	
Sign & Date	
Seal	

FOR CUSTOMER REVIEW & APPROVAL			
Doc No:	Sign & Date	Name	Seal
Reviewed by:			
Approved by:			

 MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS		STANDARD QUALITY PLAN		SPEC. NO.:	
		CUSTOMER:		Q.P. NO.: PED-506-00-Q-006, REV-02	
		PROJECT:		PO NO.:	
		ITEM: AC ELECT. MOTORS UPTO 55KW (LV (415V))		SYSTEM:	
		SECTION: II		DATE: 27.02.2020	
				SHEET 2 OF 2	

SI No.	Component & Operations	Characteristics	Class	Type of Check	Quantum Of check		Reference Document	Acceptance NORMS	FORMAT OF RECORD				AGENCY				
					6				9				..				
1	2	3	4	5	M	C/N	7	8	9	.			M	C	N		
					D												
		3.NAMEPLATE DETAILS	MA	VISUAL	100%	100%	IS-325 / IS-12615 / APPROVED DATA SHEET	SAME AS COL. 7	TEST/ INSPN. REPORT				P	W	W		
4.0	PACKING	SURFACE FINISH & COMPLETENESS	MA	VISUAL	100%	100%	AS PER MFG. STANDARD / APPROVED PACKING DRAWING. (#)	AS PER MFG. STANDARD / APPROVED PACKING DRAWING. (#).	INSPC. REPORT				P	W	-	(#) APPLICABLE FOR EXPORT JOBS	

NOTES:

- 1 ROUTINE TESTS ON 100% MOTORS SHALL BE DONE BY THE VENDOR. HOWEVER, BHEL/CUSTOMER SHALL WITNESS ROUTINE TESTS ON RANDOM SAMPLES. THE SAMPLING PLAN SHALL BE MUTUALLY AGREED UPON
- 2 FOR EXHAUSTVENTILATION FAN MOTORS OF RATING UPTO 1.5KW, ONLY ROUTINE TEST CERTIFICATES SHALL BE FURNISHED FOR SCRUTINY.
- 3 IN CASE TEST CERTIFICATES FOR THESE TESTS ON SIMILAR TYPE, SIZE AND DESIGN OF MOTOR FROM INDEPENDENT LABORATORY ARE AVAILABLE, THESE TEST MAY NOT BE REPEATED.
- 4 BHEL RESERVES THE RIGHT TO PERFORM REPEAT TEST, IF REQUIRED.
- 5 AFTER PACKING AND PRIOR TO ISSUE MDC, PHOTOGRAPHS OF ITEMS TO BE DESPATCHED SHALL BE SENT TO BHEL FOR REVIEW.
- 6 IN CASE, ANY CHANGES IN QP COMMENTED BY CUSTOMER AT CONTRACT STAGE SHALL BE CARRIED OUT BY BIDDER WITHOUT ANY IMPLICATION TO BHEL/CUSTOMER.

LEGENDS:

*RECORDS, IDENTIFIED WITH TICK(✓) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION,
 ** M: SUPPLIER/ MANUFACTURER/ SUB-SUPPLIER, B: MAIN SUPPLIER/ BHEL/ THIRD PARTY INSPECTION AGENCY, C: CUSTOMER,
 P: PERFORM, W: WITNESS, V: VERIFICATION, AS APPROPRIATE
 MA: MAJOR, MI: MINOR, CR: CRITICAL
 D: DOCUMENT

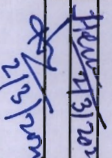
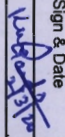
ENGINEERING			QUALITY		
Sign & Date	Name		Sign & Date	Name	
Prepared by: <i>[Signature]</i>	Hema K.		Checked by: <i>[Signature]</i>	Kunal	
Reviewed by: <i>[Signature]</i>	P. Dhara		Reviewed by: <i>[Signature]</i>	Ganesh	

BIDDER/ SUPPLIER	
Sign & Date	
Seal	

FOR CUSTOMER REVIEW & APPROVAL				
Doc No.:	Sign & Date	Name	Seal	
Reviewed by:				
Approved by:				

		MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	
STANDARD QUALITY PLAN		SPEC. NO. :	
CUSTOMER :		OP NO. : PED-506-00-Q-007, REV.04	
PROJECT :		DATE: 27.02.2020	
ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV (415V))		PO NO. :	
SYSTEM:		SECTION: II	
		SHEET 1 OF 9	

Sl No.	Component & Operations	Characteristics	Class	Type of Check	Quantum Of check		Reference Document	Acceptance NORMS	FORMAT OF RECORD	AGENCY				
					M	CN				D	M	C	N	
1	2	3	4	5			7	8	9					
1.0	RAW MATERIAL & BOUGHT OUT CONTROL													
1.1	SHEET STEEL, PLATES, SECTION, EYEBOLTS	1 SURFACE CONDITION	MA	VISUAL	100%		MANUFACTURERS DRG./SPEC	FREE FROM BLINKS, CRACKS, WAVINESS ETC	LOG BOOK		P	-	-	
1.2	HARDWARES	2 DIMENSIONS 3 PROOF LOAD TEST (EYE BOLT) 1 SURFACE CONDITION	MA	MECH TEST	SAMPLE -DO-		MANUFACTURERS DRG./SPEC	MANUFACTURERS DRG./SPEC	-DO- TEST REPORT		P	-	-	
1.3	CASTING	2 PROPERTY CLASS 1 SURFACE CONDITION	MA	VISUAL	100%		MANUFACTURERS DRG./SPEC	FREE FROM CRACKS, UN-EVENNESS ETC.	SUPPLIERS TC & LOG		PV	-	-	PROPERTY CLASS MARKING SHALL BE CHECKED BY THE VENDOR
1.4	PAINT & VARNISH	1 MAKE, SHADE, SHELF LIFE & TYPE	MA	VISUAL	100% CONTINUOUS		MANUFACTURERS DRG./SPEC	FREE FROM CRACKS, BLOW HOLES ETC.	LOG BOOK		PV	-	-	
		2 CHEM. & PHY. PROP.	MA	CHEM & MECH TEST	1 HEAT NO.		MANUFACTURERS DRG./SPEC	MANUFACTURERS DRG./SPEC	SUPPLIERS TC		PV	-	-	HEAT NO. SHALL BE VERIFIED
		3 DIMENSIONS	MA	MEASUREMENT	100%		MANUFACTURERS DRG./SPEC	MANUFACTURERS DRG./SPEC	LOG BOOK		PV	-	-	

ENGINEERING				QUALITY			
BHEL				BIDDER/ SUPPLIER			
Sign & Date	Name	Checked by:	Reviewed by:	Sign & Date	Name	Checked by:	Reviewed by:
	Hema K.	P. Dutta			Hema K.	P. Dutta	
Prepared by:		Reviewed by:		Seal			
Reviewed by:							

FOR CUSTOMER REVIEW & APPROVAL			
Doc No:	Sign & Date	Name	Seal
Reviewed by:			
Approved by:			

908/2020/PS-PEM-MAX

STANDARD QUALITY PLAN										SPEC. NO. :		
CUSTOMER :										DATE: 27.02.2020		
PROJECT :										PO NO. :		
ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV (415V))										SECTION: II		
SYSTEM:										SHEET 2 OF 9		
Sl No.	Component & Operations	Characteristics	Class	Type of Check	Quantum Of check		Reference Document	Acceptance NORMS	FORMAT OF RECORD	AGENCY		
1	2	3	4	5	6	7	8	9	10	11	12	
15	SHAFT (FORGED OR ROLLED)	1. SURFACE COND.	MA	VISUAL	M	C/N	-	FREE FROM VISUAL DEFECTS	-DO-	P	-	VENDOR'S APPROVAL IDENTIFICATION SHALL BE MAINTAINED
16	SPACE HEATERS, CONN- TORS, TERMINAL BLOCKS, CABLE LUGS, CARBON BRUSH TEMP DETECTORS, RTD, BTDS	1. MAKE & RATING	MA	VISUAL	-DO-	MANUFACTURERS DRG./STD.	MANUFACTURERS DRG./STD.	LOG BOOK	-DO-	PV	-	FOR D/A OF 55 MM & ABOVE
		2. CHEM. & PHYSICAL PROPERTIES	MA	CHEM. & PHYSICAL TESTS	-	MANUFACTURERS DRG/ SPEC.	MANUFACTURERS DRG/ STD.	SUPPLIERS TC	-DO-	PV	-	
		3. DIMENSIONS	MA	MEASUREMENT	100%	-DO-	MANUFACTURERS DRG.		-DO-	PV	-	
		4. INTERNAL FLAWS	CR	ULTRASONIC TEST	100%	ASTM-A388	MANUFACTURERS STD.		-DO-	PW	V	
		2. PHYSICAL COND.	MA	-DO-	-	MANUFACTURERS DRG./STD.	MANUFACTURERS DRG./STD.		-DO-	PV	-	
		3. DIMENSIONS (WHEREVER APPLICABLE)	MA	MEASUREMENT	SAMPLE	MANUFACTURERS DRG./STD.	MANUFACTURERS DRG./STD.		-DO-	PV	-	
		4. PERFORMANCE/ CALIBRATION	MA	TEST	100%	-DO-	MANUFACTURERS DRG./STD.		-DO-	PV	-	

ENGINEERING				QUALITY	
Sign & Date	Name	Checked by:	Sign & Date	Name	
<i>[Signature]</i>	Hema K.	<i>[Signature]</i>	<i>[Signature]</i>	K. Datta	
Prepared by:		Reviewed by:			
Reviewed by:					

BIDDER/SUPPLIER	
Sign & Date	Seal

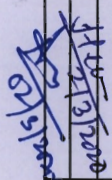
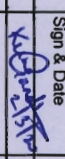
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Doc No:	Sign & Date	Name	Seal
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Approved by:			

908/2020/PS-PEM-MAX

 MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS		STANDARD QUALITY PLAN	
		CUSTOMER :	SPEC. NO. :
		PROJECT :	DATE: 27.02.2020
		ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV (415V))	SECTION: II
		SYSTEM:	SHEET 3 OF 9

Sl No.	Component & Operations	Characteristics	Class	Type of Check	Quantum Of check		Reference Document	Acceptance NORMS	FORMAT OF RECORD	AGENCY			
					M	CN				D	M	C	N
1													
1.7	OTHER INSULATING MATERIALS LIKE SLEEVES, BINDINGS CORDS, PAPERS, PRESS BOARDS ETC.	1. SURFACE COND. ETC. 2. OTHER CHARACTERISTICS	MA	VISUAL	100%	-	MANUFACTURERS STD.	NO VISUAL DEFECTS MANUFACTURERS STD.	TEST REPORT LOG BOOK AND OR SUPPLIERS TC		PV	-	-
1.8	SHEET STAMPING (PUNCHED)	1. SURFACE COND.	MA	VISUAL	100%	-	MANUFACTURERS DRG.	NO VISUAL DEFECTS (FREE FROM BURS) MANUFACTURERS DRG.	LOG BOOK		P	-	-
		2. DIMENSIONS INCLUDING BURS HEIGHT 3. ACCEPTANCE TESTS	MA	MEASUREMENT	SAMPLE	-	MANUFACTURERS DRG.	MANUFACTURERS DRG.	-DO- SUPPLIERS TC		PV	-	-
1.9	CONDUCTORS	1. SURFACE FINISH	MA	VISUAL	100%	-	MANUFACTURERS DRG/ STD.	FREE FROM VISUAL DEFECTS	LOG BOOK		-PV	-	-
		2. ELECT. PROP. & MECH. PROP.	MA	ELECT. & MECH. TEST	SAMPLES	-	MANUFACTURERS DRG/ SPEC.	MANUFACTURERS / SPEC.	SUPPLIERS TC & VENDORS TEST REPORTS		PV	-	-

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ENGINEERING				BHEL				QUALITY			
Prepared by:	Sign & Date	Name	Checked by:	Sign & Date	Name	Reviewed by:		Sign & Date		Seal	
		Hema K.			KUN						
Reviewed by:											

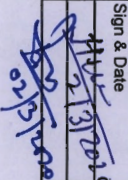
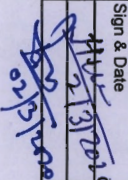
BIDDER/ SUPPLIER			
Sign & Date			

FOR CUSTOMER REVIEW & APPROVAL			
Doc No:	Sign & Date	Name	Seal
Reviewed by:			
Approved by:			

* MOTOR MANUFACTURER TO CONDUCT VISUAL CHECK FOR SURFACE FINISH ON RANDOM BASIS (10% SAMPLE) AT HIS WORKS AND MAINTAIN RECORD FOR VERIFICATION BY BHEL/CUSTOMER

 MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS		STANDARD QUALITY PLAN		SPEC. NO.:	DATE: 27.02.2020
		CUSTOMER:		OP NO.: PED-506-00-Q-007, REV.04	
		PROJECT:		PO NO.:	
		ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV (415V))		SYSTEM:	
SHEET 4 OF 9					

Sl No.	Component & Operations	Characteristics	Class	Type of Check	Quantum Of check		Reference Document	Acceptance NORMS	FORMAT OF RECORD	AGENCY			
					M	C/N				D	M	C	N
1													
1.10	BEARINGS	3 DIMENSIONS 1 MAKE & TYPE 2 DIMENSIONS	MA	MEASUREMENT VISUAL	-DO-	-	MANUFACTURERS DRG/ APPROVED DATASHEET	MANUFACTURERS DRG/ APPROVED DATASHEET	-DO-		PV	-	-
							APPROVED DATASHEET	APPROVED DATASHEET/ BEARING MANUFS CATALOGUES	-DO-		PV	-	-
								FREE FROM VISUAL DEFECTS	-DO-		PV	-	-
1.11	SUP RING (WHATEVER APPLICABLE)	1 SURFACE COND. 2 DIMENSIONS	MA	VISUAL	100%	-	-	-DO-	-DO-		P	-	-
							MANUFACTURERS DRG	MANUFACTURERS DRG	-DO-		P	-	-
							MANUFACTURERS STD/ APPROVED DATASHEET	MANUFACTURERS STD/ APPROVED DATASHEET	-DO-		PV	-	-
							-DO-	-DO-	-DO-		PV	-	-
1.12	OIL SEALS & GASKETS	1 MATERIAL OF GASKET 2 SURFACE COND. 3 DIMENSIONS	MA	VISUAL	100%	-	MANUFACTURERS DRG/SPECS	MANUFACTURERS DRG/ SPECS. FREE FROM VISUAL DEFECTS	-DO-		P	-	-
							MANUFACTURERS DRG	MANUFACTURERS DRG	-DO-		P	-	-

ENGINEERING		BHEL		QUALITY	
Sign & Date	Name	Checked by:	Sign & Date	Name	
Prepared by: 	HEERA K. P. DUTTA			KUNAL CHAKRABORTY	
Reviewed by: 		Reviewed by:			

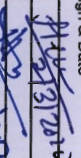
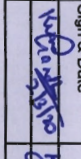
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FOR CUSTOMER REVIEW & APPROVAL			
Doc No.:	Sign & Date	Name	Seal
Reviewed by:			
Approved by:			

 MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS		STANDARD QUALITY PLAN		SPEC. NO.:	
		CUSTOMER:		QP NO.: PED-508-00-Q.007, REV/04	
		PROJECT:		PO NO.:	
		ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV (415V))		SYSTEM:	
				SECTION: II	
				SHEET 5 OF 9	

SI No.	Component & Operations	Characteristics	Class	Type of Check	Quantum Of check		Reference Document	Acceptance NORMS	FORMAT OF RECORD	AGENCY				
					6					**				
1	2	3	4	5	M	C/N	7	8	9	D	M	C	N	
2.0	IN PROCESS STATOR FRAME WELDING (IN CASE OF FABRICATED STATOR)	1.WORKMANSHIP & CLEANNESS	MA	VISUAL	100%	-	-DO-	GOOD FINISH	LOG BOOK		PW	-	-	
2.1					MEASUREMENT	-DO-	MANUFACTURERS DRG	MANUFACTURERS DRG	-DO-	P	-	-		
2.2	MACHINING	2.DIMENSIONS	MA	VISUAL	100%	-	-DO-	GOOD FINISH	LOG BOOK		P	-	-	
					MEASUREMENT	-DO-	MANUFACTURERS DRG	MANUFACTURERS DRG	-DO-	P	-	-		
2.3	PAINTING	3.SHAFT SURFACE FLOWS	MA	PT	100%	100%	MANUFACTURERS STD / ASTM-E165	MANUFACTURERS STD / APPROVED DATASHEET.	-DO-	✓	P	V	-	
					1.SURFACE PREPARATION	MA	VISUAL	100%	MANUFACTURERS STD/APPROVED DATASHEET	SAME AS COL 7	LOG BOOK		P	-
		2.PAINT THICKNESS (BOTH PRIMER & FINISH COAT)	MA	MEASUREMENT BY ELCOMETER	SAMPLE	-	-DO-	-DO-	-DO-		P	-	-	
					3.SHADE	MA	VISUAL	-DO-	-DO-	LOG BOOK		P	-	-
					4.ADHESION	MA	CROSS CUTTING & TAPE TEST	-DO-	-DO-	LOG BOOK		P	-	-
BH&L														
ENGINEERING				QUALITY										
Sign & Date	Name			Sign & Date	Name									
Prepared by: <i>[Signature]</i>	Hema K.			Checked by: <i>[Signature]</i>	KUNAL			Seal						
Reviewed by: <i>[Signature]</i>	P. Dutta			Reviewed by:	GANDHI									
BIDDER/SUPPLIER														
Sign & Date														
FOR CUSTOMER REVIEW & APPROVAL														
Doc No:														
Sign & Date				Seal										
Reviewed by:														
Approved by:														

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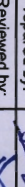
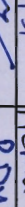
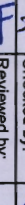
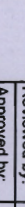
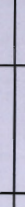
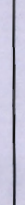
ENGINEERING		QUALITY	
Sign & Date	Name	Sign & Date	Name
 01/3/2020 P. Dutta	Hema K.	 01/3/2020 P. Dutta	Kunal Gandhi
Prepared by:	Checked by:	Reviewed by:	
Reviewed by:			

BIDDER/ SUPPLIER	
Sign & Date	Seal

FOR CUSTOMER REVIEW & APPROVAL			
Doc No.:	Sign & Date	Name	Seal
Reviewed by:			
Approved by:			

			
MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS			
STANDARD QUALITY PLAN		SPEC. NO.:	
CUSTOMER :		QIP NO.: PED-506-00-Q-007, REV-04	
PROJECT:		PO NO.:	
ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV (415V))	SYSTEM:	SECTION: II	
			DATE: 27.02.2020
SHEET 6 OF 9			

Sl No.	Component & Operations	Characteristics	Class	Type of Check	Quantum Of check		Reference Document	Acceptance NORMS	FORMAT OF RECORD		AGENCY				
1	2	3	4	5	6		7	8	9	•	••				
					M	CIN					D	M	C	N	
2.4	SHEET STACKING	1.COMPLETENESS 2.COMPRESSION & TIGHTENING	MA MA	MEASUREMENT MEASUREMENT	SAMPLE 100%	- -	MANUFACTURERS STD. -DO-	MANUFACTURERS STD. -DO-	LOG BOOK LOG BOOK			P P	- -	- -	
2.5	WINDING	1.COMPLETENESS	CR	VISUAL	100%	-	MANUFACTURERS STD./APPROVED DATASHEET	MANUFACTURERS STD./APPROVED DATASHEET	LOG BOOK			P	-	-	
		2.CLEANLINESS	CR	-DO-	-DO-	-	-DO-	-DO-	LOG BOOK			P	-	-	
		3.IR-HV-IR	CR	ELECT. TEST	100%	100%	IS-325/IS-12615/IEC-60034 PART-1	IS-325/IS-12615/IEC-60034 PART-1	LOG BOOK			✓	P	V	-
		4.RESISTANCE	CR	-DO-	100%	100%	IS-325/IS-12615/IEC-60034 PART-1	IS-325/IS-12615/IEC-60034 PART-1	LOG BOOK			✓	P	V	-
		5.INTERTURN INSULATION	CR	-DO-	-DO-	-	-DO-	-DO-	LOG BOOK				P	-	-
2.6	IMPREGNATION	1.VISCOSITY	MA	PHY. TEST	AT STARTING	-	MANUFACTURERS STANDARD	MANUF.RS STANDARD	LOG BOOK			P	-	-	
		2.TEMP. PRESSURE VACCUUM	MA	PROCESS CHECK	CONTINUOUS	-	MANUFACTURERS STANDARD	MANUFACTURERS STANDARD	LOG BOOK				P	-	-
		3.NO. OF DIPS	MA	-DO-	CONTINUOUS	CONTINUOUS	MANUFACTURERS STANDARD	MANUFACTURERS STANDARD	LOG BOOK			✓	P	V	-
															THREE DIPS TO BE GIVEN

				BIDDER/ SUPPLIER					
ENGINEERING		BHEL		QUALITY		FOR CUSTOMER REVIEW & APPROVAL			
Sign & Date		Name		Sign & Date		Name		Doc No:	
 Hemra K. P. Dutt				 K. P. Dutt				Sign & Date	
Prepared by:		Checked by:		Reviewed by:		Seal		Reviewed by:	
 Hemra K. P. Dutt		 K. P. Dutt		 K. P. Dutt		 K. P. Dutt		 K. P. Dutt	
Reviewed by:		Reviewed by:		Reviewed by:		Seal		Approved by:	
 K. P. Dutt		 K. P. Dutt		 K. P. Dutt		 K. P. Dutt		 K. P. Dutt	

 MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS		STANDARD QUALITY PLAN		SPEC. NO.:	
		CUSTOMER :		QP NO.: PED-506-00-Q-007, REV-04	
		PROJECT:		PO NO.:	
		ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV (415V))		SYSTEM:	
				SECTION: II	
				SHEET 7 OF 9	

Sl No.	Component & Operations	Characteristics	Class	Type of Check	Quantum Of check		Reference Document	Acceptance NORMS	FORMAT OF RECORD	AGENCY			
					M	CN				D	M	C	N
1													
2.7	COMPLETE STATOR ASSEMBLY	4 DURATION 1 COMPACTNESS & CLEANLINESS	MA MA	-DO- VISUAL	CONTINUOUS 100%	CONTINUOUS -	-DO- -DO-	-DO- -DO-	LOG BOOK LOG BOOK	✓ P	P P	V -	- -
2.8	BRAZING/COMPRESSION JOINT	1 COMPACTNESS 2 SOUNDNESS	CR CR	-DO- MALLETT TEST & UT	-DO- 100%	-DO- 100%	-DO- -DO-	-DO- -DO-	LOG BOOK LOG BOOK	✓ P	P P	V V	- -
2.9	COMPLETE ROTOR ASSEMBLY	3 HV 1 RESIDUAL UNBALANCE 2 SOUNDNESS	MA CR CR	ELECT. TEST DYN. BALANCE	100% -DO- 100%	100% -	-DO- MANUFACTURERS SPEC/ ISO 1940 MANUFACTURERS SPEC.	-DO- MANUFACTURERS DWG. MANUFACTURERS SPEC.	LOG BOOK LOG BOOK LOG BOOK	✓ P P	P P P	V - V	- - -
2.10	ASSEMBLY	1 ALIGNMENT 2 WORKMANSHIP 3 AXIAL PLAY 4 DIMENSIONS 5 CORRECTNESS, COMPLETENESS, TERMINATIONS/ MARKING/ COLOUR CODE 6 RTD, RTD & SPACE HEATER MOUNTING	MA MA MA MA MA MA	MEAS. VISUAL MEAS. -DO- VISUAL VISUAL	-DO- -DO- 100% -DO- 100%	-DO- -DO- 100% -	-DO- -DO- -DO- MANUFACTURERS SPEC. MANUFACTURERS SPEC.	-DO- -DO- -DO- MANUFACTURERS SPEC. MANUFACTURERS SPEC.	LOG BOOK LOG BOOK LOG BOOK LOG BOOK LOG BOOK	✓ P P P P	P P P P P	V - V - -	- - - - -

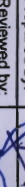
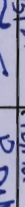
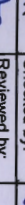
ENGINEERING				QUALITY			
Sign & Date	Name	Checked by:	Reviewed by:	Sign & Date	Name	Checked by:	Reviewed by:
	Hena K.	P. Dutta			K. K. K.		
Prepared by:							
Reviewed by:							

BIDDER/ SUPPLIER	
Sign & Date	Seal

FOR CUSTOMER REVIEW & APPROVAL			
Doc No:	Sign & Date	Name	Seal
Reviewed by:			
Approved by:			

			
MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS		STANDARD QUALITY PLAN	SPEC. NO.:
		CUSTOMER :	QP NO.: PED-506-00-Q-007, REV-04
		PROJECT:	PO NO.:
		ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV (415V))	SYSTEM:
		SECTION: II	DATE: 27.02.2020
			SHEET 8 OF 9

[illegible]

ENGINEERING				BHEL		QUALITY	
	Sign & Date	Name		Sign & Date	Name		
Prepared by:		Hema K.	Checked by:		Konart Chandrasekhar		
Reviewed by:		P. Datta	Reviewed by:				

BIDDER/SUPPLIER	
Sign & Date	
Seal	

FOR CUSTOMER REVIEW & APPROVAL			
Doc No:		Sign & Date	Seal
Reviewed by:			
Approved by:			

 MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS		STANDARD QUALITY PLAN		SPEC. NO.:		DATE: 27.02.2020 SHEET 9 OF 9
		CUSTOMER :		QP NO.: PED-506-00-Q-007, REV.04		
		PROJECT:		PO NO.:		
		ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV (415V))		SYSTEM:		
				SECTION: II		

Sl No.	Component & Operations	Characteristics	Class	Type of Check	Quantum Of check		Reference Document	Acceptance NORMS	FORMAT OF RECORD	AGENCY				IF APPLICABLE, REFER SEAWORTHY PACKING ALSO.
1	2	3	4	5	6		7	8	9	10	11	12	13	14
					M	C/N								
4.0	PACKING	SURFACE FINISH & COMPLETENESS	MA	VISUAL	100%	100%	AS PER MANUFACT. STANDARD / APPROVED CROSS SECTION DRAWING.	AS PER MANUFACT. STANDARD / APPROVED CROSS SECTION DRAWING.	INSPC REPORT	D	M	C	N	

NOTES:

1. DEPENDING UPON THE SIZE AND CRITICALLY, WITNESSING BY BHEL SHALL BE DECIDED.
2. ROUTINE TESTS ON 100% MOTORS SHALL BE DONE BY THE VENDOR. HOWEVER, BHEL/CUSTOMER SHALL WITNESS ROUTINE TESTS ON RANDOM SAMPLES. THE SAMPLING PLAN SHALL BE MUTUALLY AGREED UPON.
3. IN CASE TEST CERTIFICATES FOR THESE TESTS ON SIMILAR TYPE, SIZE AND DESIGN OF MOTOR FROM INDEPENDENT LABORATORY ARE AVAILABLE, THESE TEST MAY NOT BE REPEATED.
4. BHEL RESERVES THE RIGHT TO PERFORM REPEAT TEST, IF REQUIRED.
5. AFTER PACKING AND PRIOR TO ISSUE MDOC, PHOTOGRAPHS OF ITEMS TO BE DESPATCHED SHALL BE SENT TO BHEL PURCHASE GROUP FOR REVIEW.
6. IN CASE, ANY CHANGES IN QP COMMENTED BY CUSTOMER AT CONTRACT STAGE SHALL BE CARRIED OUT BY BIDDER WITHOUT ANY IMPLICATION TO BHEL/CUSTOMER.

LEGENDS:

- *RECORDS, IDENTIFIED WITH *TICK(*) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION.
 ** M: SUPPLIER/ MANUFACTURER/ SUB-SUPPLIER, B: MAIN SUPPLIER/ BHEL/ THIRD PARTY INSPECTION AGENCY, C: CUSTOMER, P: PERFORM, W: WITNESS, V: VERIFICATION, AS: APPROPRIATE
 MA: MAJOR, MI: MINOR, CR: CRITICAL
 D: DOCUMENT

ENGINEERING			BHEL			QUALITY		
Prepared by:	Sign & Date	Name	Checked by:	Sign & Date	Name	Reviewed by:	Sign & Date	Name
	<i>[Signature]</i>	Hema K.		<i>[Signature]</i>	Kunt		<i>[Signature]</i>	QANBH
Reviewed by:								

BIDDER/ SUPPLIER	
Sign & Date	
Seal	

FOR CUSTOMER REVIEW & APPROVAL				
Doc No:	Sign & Date	Name	Seal	
Reviewed by:				
Approved by:				

CLAUSE NO.		QUALITY ASSURANCE																		
MOTOR																				
TESTS/CHECKS TEMS/COMPONENTS		Visual	Dimensional	Make/Type/Rating Physical Inspection	Mech/Chem. Properties	NDT /DP/MP/UT	Metallography	Electrical Characteristics	Welding/Brazing(WPS/PQR)	Heat Treatment	Magnetic Characteristics	Hydraulic/Leak/Pressure Test	Thermal Characteristics	Run out	Dynamic Balancing	Routine & Acceptance tests as per IS-325/IS-4722 /IS- 9283/IS 2148/IEC60034/IEC 60079-I/ IS-12615	Vibration	Over speed	Tan delta, shaft voltage & polarization index test	Paint shade, thickness & adhesion
Plates for stator frame, end shield, spider etc.		Y	Y	Y	Y	Y				Y										
Shaft		Y	Y	Y	Y	Y	Y			Y										
Magnetic Material		Y	Y	Y	Y			Y			Y		Y							
Rotor Copper/Aluminium		Y	Y	Y	Y			Y		Y										
Stator copper		Y	Y	Y	Y			Y		Y			Y							
SC Ring		Y	Y	Y	Y	Y		Y	Y	Y										
Insulating Material		Y		Y	Y			Y					Y							
Tubes, for Cooler		Y	Y	Y	Y	Y				Y		Y								
Sleeve Bearing		Y	Y	Y	Y	Y				Y		Y								
Stator/Rotor, Exciter Coils		Y	Y	Y				Y	Y											
Castings, stator frame, terminal box and bearing housing etc.		Y	Y	Y	Y	Y			Y											
Fabrication & machining of stator, rotor, terminal box		Y	Y			Y			Y	Y										
LOT-IA PROJECTS FLUE GAS DESULPHURISATION SYSTEM PACKAGE						TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO CS-0011-109(1A)-2						SUB-SECTION-V-QE1 MOTORS				PAGE 1 OF 2				

CLAUSE NO.	QUALITY ASSURANCE																			
Wound stator	Y	Y					Y	Y												
Wound Exciter	Y	Y					Y	Y												
Rotor complete	Y	Y					Y						Y	Y						
Exciter, Stator, Rotor, Terminal Box assembly	Y	Y					Y													
Accessories, RTD, BTD,CT, Space heater, antifriction bearing, gaskets etc.	Y	Y	Y																	
Complete Motor	Y	Y	Y												Y	Y	Y	Y1 Y		
Note: 1. This is an indicative list of tests/checks. The manufacture is to furnish a detailed Quality Plan indicating the practices & Procedure followed along with relevant supporting documents during QP finalization. However, No QP for LT motor upto 50KW. 2. Additional routine tests for Flame proof motors shall be applicable as per relevant standard 3. Makes of major bought out items for HT motors will be subject to NTPC approval. 4. Y1 = for HT Motor / Machines only.																				
LOT-IA PROJECTS FLUE GAS DESULPHURISATION SYSTEM PACKAGE						TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO CS-0011-109(1A)-2						SUB-SECTION-V-QE1 MOTORS				PAGE 2 OF 2				

908/2020/PS-PEM-MAX

TITLE

LV MOTORS**DATA SHEET-A**

SPECIFICATION NO.

VOLUME II B

SECTION D

REV NO. 00 DATE 16.03.2020

SHEET 1 OF 1

- | | | | |
|------|--|---|--|
| 1.0 | Design ambient temperature | : | 50 °C |
| 2.0 | Maximum acceptable kW rating of LV motor | : | ≤200KW |
| 3.0 | Installation (Indoors/ Outdoors) | : | As required |
| 4.0 | Degree Of Protection (Indoor/Outdoor) | : | IP54/IP55 |
| 5.0 | Type of Cooling | : | TEFC/CACA/TETV |
| 6.0 | Details of supply system | | |
| | a) | Rated voltage (with variation) | : |
| | | 415V ± 10% | |
| | b) | Rated frequency (with variation) | : |
| | | 50 Hz (Variation: +3% TO –5%) | |
| | c) | Combined voltage & freq. variation | : |
| | | 10% | |
| | d) | System fault level at rated voltage | : |
| | | 50 kA for 1 sec | |
| | e) | Short time rating for terminal boxes | : |
| | | o 110kW & Above | : |
| | | (Breaker controlled) | |
| | | o Below 110kW (SFU+ Contactor controlled) | : |
| | | 50 KA for 0.20 sec. | |
| | f) | LV System grounding | : |
| | | Solidly | |
| 7.0 | Class of insulation | : | Refer clause 7.03.00 of Customer Motor Specification |
| 8.0 | Minimum voltage for starting
(As percentage of rated voltage) | : | Refer clause 6.03.00 of Customer Motor Specification |
| 9.0 | Power cables data | : | Shall be given during Detailed engg. |
| 10.0 | Earth Conductor Size & Material | : | Shall be given during Detailed engg. |
| 11.0 | Space heater supply | : | 240 V, 1Φ , 50 Hz |
| 12.0 | Rating up to which Single phase motor | : | Acceptable upto 0.20 kW |
| 13.0 | Tests | : | As per Customer motor spec. (enclosed) |
| 14.0 | Energy efficient/ Flame proof motor | : | As per Customer spec. requirement |

- **Also detail Customer spec. for Motors to be referred as enclosed with the specification.**

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CLAUSE NO.	Bidder's Name				
	DE-1B	LT MOTORS			
	A.	GENERAL			
	5.	Manufacturer & Country of origin. (Shall be as per approved QA make)			
	6.	Equipment driven by motor			
	7.	Motor type			
	8.	Quantity			
	B.	DESIGN AND PERFORMANCE DATA			
	18.	Frame size			
	19.	Type of duty			
	20.	Type of enclosure /Method of cooling/ Degree of			
	21.	Applicable standard to which motor generally			
	22.	Efficiency class as per IS 12615			
	23.	(a)Whether motor is flame proof	Yes/No		
		(b)If yes, the gas group to which it conforms as per IS:2148			
	24.	Type of mounting			
	25.	Direction of rotation as viewed from DE END			
	26.	Standard continuous rating at 40 deg.C. ambient temp. as per Indian Standard (KW)			
	27.	Derated rating for specified normal condition i.e. 50 deg. C ambient temperature (KW)			
	28.	Maximum continuous load demand of driven			
	29.	Rated Voltage (volts)			
	30.	Permissible variation of :			
		a. Voltage (Volts)			
		b. Frequency (Hz)			
		c. Combined voltage and frequency			
	31.	Rated speed at rated voltage and			
	32.	At rated Voltage and frequency:			
		a. Full load current			
	LOT 1A PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE		ATTACHMENT-12 TO SECTION-VII TECHNICAL DATA SHEETS BID DOC. NO. : CS-00111-109(1A)-2		PART-F CHAPTER-II MODULE-II SUB-SECTION:DE1 MOTORS
					PAGE 13 OF 17

CLAUSE NO.	Bidder's Name		
	b. No load current		
33.	Power Factor at		
	a. 100% load		
	b. NO load		
	c. Starting.		
34.	Efficiency at rated voltage and frequency,		
	a. 100% load		
	b. 75% load		
	c. 50% load		
35.	Starting current (amps) at		
	a. 100 % voltage		
	b. 85% voltage		
	c. 80% voltage		
36.	Minimum permissible starting Voltage (Volts)		
37.	Starting time with minimum permissible voltage		
	a. Without driven equipment coupled		
	b. With driven equipment coupled		
38.	Safe stall time with 100% and 110% of rated		
	a. From hot condition		
	b. From cold condition		
39.	Torques :		
	a. Starting torque at min. permissible voltage(kg-		
	b. Pull up torque at rated voltage.		
	c. Pull out torque		
	d. Min accelerating torque (kg.m) available		
	e. Rated torque (kg.m)		
40.	Stator winding resistance per phase (ohms at 20		
41.	GD ² value of motors		

LOT 1A PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE	ATTACHMENT-12 TO SECTION-VII TECHNICAL DATA SHEETS BID DOC. NO. : CS-00111-109(1A)-2	PART-F CHAPTER-II MODULE-II SUB-SECTION:DE1 MOTORS	PAGE 14 OF 17
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CLAUSE NO.	Bidder's Name			
	42.	No of permissible successive starts when motor is in hot condition		
	43.	Locked Rotor KVA Input		
	44.	Locked Rotor KVA/KW		
	45.	Vibration limit :Velocity (mm/s)		
	46.	Noise level limit (dBA)		
	C.	CONSTRUCTIONAL FEATURES		
	1.	Stator winding insulation		
		a. Class & Type		
		b. Winding Insulation Process		
		c. Tropicalised (Yes/No)		
		d. Temperature rise over specified maximum ambient temperature of 50 deg C		
		e. Method of temperature measurement		
		f. Stator winding connection		
	2.	Main Terminal Box		
		a. Type		
		b. Location(viewed from NDE side)		
		c. Entry of cables(bottom/side)		
		d. Recommended cable size(To be matched with cable size envisaged by owner)		
		e. Fault level (MVA),Fault level duration(sec)		
		f. Cable glands & lugs details (shall be suitable for		
	3.	Type of DE/NDE Bearing		
	4.	Motor Paint shade		
	5.	Weight of		
		a. Motor stator (KG)		
		b. Motor Rotor (KG)		
		c. Total weight (KG)		
	LOT 1A PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE		ATTACHMENT-12 TO SECTION-VII TECHNICAL DATA SHEETS BID DOC. NO. : CS-00111-109(1A)-2	PART-F CHAPTER-II MODULE-II SUB-SECTION:DE1 MOTORS
			PAGE 15 OF 17	

CLAUSE NO.	Bidder's Name				
	D.	List of accessories.			
	1.	Space Heaters (Applicable for 30 KW & above motor) (Nos./Power in watts/supply voltage)			
	2.	Terminal Box for Space Heater (Yes/No)			
	3.	Speed switch (Yes/No)			
	4.	Insulation of bearing (Yes/No)			
	5.	Noise reducer(Yes/No)			
	6.	Grounding pads			
		i) No and size on motor body			
		ii) Nos on terminal Box			
	7.	Vibration pads			
		i) Nos and size			
		ii) Location			
	8.	Any other fitments			
	E.	List of curves.			
	1.	Torque speed characteristic of the motor			
	2.	Thermal withstand characteristic			
	3.	Starting. current Vs. Time			
	4.	Starting. current Vs speed			
	5.	P.F. and Effi. Vs Load			
	F.	Additional Data to be filled for each rating of DC Motor			
	1.	Rated armature voltage (Volt)			
	2.	Rated field excitation (Amp)			
	3.	Permissible % variation in voltage			
	4.	Minimum Permissible Starting voltage (volt)			
	5.	At rated voltage			
		i)Full load Armature current.(Amp)			
	LOT 1A PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE		ATTACHMENT-12 TO SECTION-VII TECHNICAL DATA SHEETS BID DOC. NO. : CS-00111-109(1A)-2		PART-F CHAPTER-II MODULE-II SUB-SECTION:DE1 MOTORS
	PAGE 16 OF 17				

CLAUSE NO.	Bidder's Name		
	ii) Full load Field current (Amp)		
	iii) No load Armature current (Amp)		
6.	Full load Field current (Amp)		
7.	No load Armature current (Amp)		
8.	Minimum permissible field current (Amp) to avoid		
	i) Maximum permissible voltage		
	ii) Rated voltage		
	iii) Minimum Permissible Voltage		
9.	Resistance (indicative Values) in ohm		
	i) Armature winding (Arm + IP + Series) at 25		
	ii) Field Winding at 25 deg. C		
10.	Inductance (indicative values)		
	i) Armature winding		
	ii) Field winding		
11	Value of trimmer resistance (ohm) to be connected in series with the shunt field to		
	i) 220 V DC		
	ii) 250 V DC		
	iii) 187 V DC		
12	Value of the external resistance (ohm) required to be connected in series with armature during starting only		
13	Technical data sheet for external resistance box		
14	GA drawing of motor		
15	Starting time calculation		
16	Starter resistance design calculation		
17	Electrical connection diagram of motor		
LOT 1A PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE ATTACHMENT-12 TO SECTION-VII TECHNICAL DATA SHEETS BID DOC. NO. : CS-00111-109(1A)-2 PART-F CHAPTER-II MODULE-II SUB-SECTION: DE1 MOTORS PAGE 17 OF 17			