BHARAT HEAVY ELECTRICALS LIMITED

HIGH PRESSURE BOILER PLANT, TIRUCHIRAPALLI-620 014

CONTROLS & INSTRUMENTATION/FB

TECHNICAL SPECIFICATION OF

FLAME PROOF LT AC MOTORS

SPECIFICATION REFERENCE – TCI : 141, Rev. 12

Revision History

Rev. No.	Date	Description	Prepared	Reviewed		Approved
			Engineering	Engineering	Quality	Engineering
01 to 11		Earlier Revisions	-Sd-	-Sd-	-Sd-	-Sd-
12	28-08-18	Energy efficiency, Type test requirements included				

Sl. No.	Description	Requirement
1	Site Conditions :-	
	Altitude above MSL	50 metres
	Ambient temperature	50° C
	Relative Humidity	100 %
	Atmosphere	Tropical, dusty, salty, corrosive and highly polluted
2	Motor type	Squirrel cage type induction motor suitable for direct on line starting through any type of breaker.
3	Applicable Standards	IS-325, IS-1231, IS-6362, IS-2253, IS-5572, IS-12065, IS-12075, IS/IEC-60079, IS-12615, IS/IEC-60529 & IEC-60034. (Latest version of relevant standards shall be referred).
4	Application	Light Fuel Oil (LFO), Heavy Fuel Oil (HFO), Drain Oil & Sump Oil - Pump motor.
5	Type of Enclosure and degree of protection	Totally Enclosed Fan Cooled (TEFC), IP-55 as per IEC- 60529
6	Flame proof enclosures	Flame proof, Ex - 'd' enclosures as per IS 2148/IEC-60079 shall be provided for the following applications, Light Fuel Oil (LFO), Heavy Fuel Oil (HFO), Drain Oil & Sump Oil - Pump motor – Flame proof motor. Area of Classification: Gas Group – II B with temperature class T4, Zone 2 as per IEC 60079.
7	Duty Cycle	Continuous, S1
8	Energy Efficiency Class	IE-2/IE-3 as per IS-12615/IEC 60034-30. Refer project specific transmittal for applicable energy efficiency class.
9	Rated Voltage & Tolerance	415 V, AC, 3 Phase, ± 10 %.
10	Rated Frequency & Tolerance	50 Hz, ± 5 %
11	Combined voltage & frequency tolerance	10 % (absolute sum)

Sl. No.	Description	Requirement
12	General Requirements	a. All motors shall be so designed that maximum inrush currents, locked rotor and pull out torque developed at extreme voltage and frequency variations do not endanger the motor and driven equipment. b. Motor shall be designed to keep torsional and rotational natural frequencies of vibration at least 25 percent above the motor rated speed ranges to avoid resonant vibration over the operating speed range of the motor and driven equipment. c. Maximum continuous rating (MCR) of the motor shall have at least 15 % margin over the maximum load demand of the driven equipment including voltage and frequency variation. (Applicable only if vendor supplies motor along with the driven equipment or load).
13	Torque requirements	Accelerating torque at any speed with the lowest permissible starting voltage shall be at least 10% of motor full load torque. Pull Out torque at rated voltage shall not be less than 205 % of full load torque.
14	Requirements during Starting & Running	• Motor shall start with rated load and accelerate to full speed with 80 % rated voltage at motor terminals • The motor shall be capable of withstanding the stresses imposed if started at 110 % rated voltage. • The motor shall be capable of operating satisfactorily at full load for 5 minutes without injurious heating with 75 % rated voltage at motor terminals. • The motor shall be designed to withstand momentary over-load of 60% of full load torque for 15 seconds without any damage. • The motor shall be designed to withstand 120 % of rated speed for 2 minutes without any mechanical damage.

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15	Class of Insulation	Class-F insulation with temperature rise limited to Class-B. Temperature rise of the motor shall be limited to 70° C (by resistance method) over an ambient temperature of 50° C.
16	Stress withstanding capability during Bus Transfer	The motor may be subjected to sudden application of 150 % rated voltage during bus transfer, due to the phase difference between the incoming voltage and motor residual voltage.
17	Capacity to restart for rated voltage	a. Two successive starts from cold condition b. Three equally spread starts per hour c. Two hot starts in succession, with motor initially running at normal temperature.
18	Starting Current	The starting current (% of FLC) shall be limited as per the standard IS-12615.
19	Locked Rotor Condition	The ratio of Locked Rotor KVA at rated voltage to rated KW shall not exceed as indicated below (without any further tolerance) For Motor rating from 50 KW ≤ 110KW : 11
20	Locked Rotor with-stand time	For motor with starting time up to 20 seconds at minimum permissible voltage during starting, the locked rotor withstand time under hot condition at highest voltage limit shall be at least 2.5 seconds more than starting time.
		For motor with starting time more than 20 seconds but not exceeding 45 seconds at minimum permissible voltage during starting, the locked rotor withstand time under hot condition at highest voltage limit shall be at least 5 seconds more than the starting time.
		For motor with starting time more than 45 seconds at minimum permissible voltage during starting, the locked rotor withstand time under hot condition at highest voltage limit shall be 10% more than the starting time
		Vendor to provide Speed switches mounted on the motor shaft in case the above requirement is not met with.

Sl. No.	Description	Requirement
21	Type of balancing of rotor	Dynamic balancing
22	Method of cooling	IC-0411 as per IS-6362
23	Direction of cooling air flow	NDE side to DE Side
24	Winding wire	Enameled Copper Wire, Grade-2, as per IS-13730, Part-3. Windings shall be non-hygroscopic, oil resistant and flame resistant.
25	Treatment on Winding Insulation	Winding Insulation shall be given tropical and fungicidal treatment for operation of motor in hot, humid & tropical climate.
26	Noise level	Noise level shall be limited to 85 dB at 1 metre distance.
27	Vibration level	The peak amplitude of vibration shall be as per IS-12075 (Limits of Severity-Normal grade shall be followed).
28	Shaft extension	Motor shall be provided with key slotted bare shaft extension, with key at the drive end.
29	Terminal box	The flame proof terminal box shall be provided as per IS/IEC-60079. The terminal box shall be capable of being turned through 360° in steps of 180° or 90°. Shall meet IP 55 protection class requirements as per IEC 60034-5. 1 No. Earth terminal shall be provided inside the terminal box. Minimum Distance between centre of the terminal stud & the gland plate and Minimum inter-phase/phase-earth air clearance shall be provided as per IEC standards. Terminal box shall have adequate space to terminate the Power cable applicable to the motor by using suitable lugs. Connection diagram shall be marked inside the terminal box.

Sl. No.	Description	Requirement
30	Cable Entries, Cable Glands & Lugs	Cable entries, Cable glands and Lugs shall be provided suitable for the power cable size as indicated in the annexure (project specific transmittal). Double Compression type, brass with nickel plated flame proof cable glands shall be provided – Quantity to be matched with the number of entries. 3 Nos. of Tinned Copper Lugs shall be provided.
31	Terminals	Separate Terminals for Space heaters and Windings with suitable connecting links shall be supplied.
32	Body Earth	Shall have 2 Nos. of earth points (Threaded hole with suitable GI Bolt) at appropriate location (in motor base frame).
33	Space heater for motors rated 30 KW and above	Separate space heater suitable for 240 V AC, Single Phase supply shall be provided.
34	Lifting device	Eye bolt.
35	Project specific requirements	Vendor to take care of the project specific requirements indicated in the annexure - "Project specific transmittal".
36	Name Plates	Motor shall have name plate as per relevant IS and in addition, Manufacture's name, frame size, Energy Efficiency class, Insulation class designation shall also be indicated.
37	Quality assurance, Inspection & Testing	Motors up to 30 KW, Inspection by Vendor meeting IEC standard requirements, as applicable. Routine & type test reports shall be submitted for review and acceptance by BHEL. For Motors >30 KW, Inspection by BHEL/Third party Inspection TPI agency as per BHEL approved VQP/RQP. Routine tests will be witnessed by BHEL/TPI. Type test reports shall be submitted for review and acceptance by BHEL. In case the vendor is not able to submit report of the type test(s) conducted within last 5 years from the date of bid opening, or in case the type test report(s) are not found to be meeting the specification requirements, the vendor shall conduct all such

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		tests either in an independent laboratory or at manufacturer's works in presence of Owner's representative under this contract, free of cost to the Owner and submit the reports for approval.
38	Type test reports	Type test reports shall be produced for the following tests as per the requirements spelt in the standards, 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. 10. Test for degree of protection. 11. Over speed test. 12. Type test reports for motors located in fuel oil area having flame proof enclosures as per IS 2148 / IEC 60079-1 13. Energy Efficiency test.
39	Confirmation and Documents to be submitted by the vendor, during Purchase Enquiry.	a. Vendor to indicate the references of technical specification and project specific annexure and indicate "No Deviation" in the Sub-delivery Enquiry deviation form. Any deviation shall only be indicated in the Sub-delivery Enquiry deviation form. Deviations indicated elsewhere in the offer shall not considered. b. Motor GA drawing indicating foundation, shaft details and terminal box arrangement with complete dimensions.

Sl. No.	Description	Requirement
40	Documents to be submitted by the vendor for approval by BHEL/Customer, after placement of purchase order.	3 Sets of the following :- a. Final technical Data sheet as per the format submitted by BHEL. b. Motor GA drawing indicating foundation, shaft details and terminal box arrangement with complete dimensions. c. Motor Characteristic curves (Torque Vs. Speed, Current Vs. Speed, Speed Vs. time, Current Vs. time, Efficiency and PF Vs. load, Thermal withstand characteristic) d. O & M manuals.
41	Packing	The packing shall be suitable for safe transport, safe delivery at site and shall avoid damages due to environmental conditions during storage at site.
42	Painting	Paint shade shall be as per the purchase enquiry. The finish shall be corrosion resistant, epoxy based paint.