

TECHNICAL SPECIFICATION OF MOTORS

GENERAL REQUIREMENTS

- 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.
- All equipment 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.
- Contractor shall provide fully compatible electrical system, equipment, accessories and services.
- 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.
- Paint shade shall be as per RAL 5012 (Blue) for indoor and outdoor equipment.
- The responsibility of coordination with electrical agencies and obtaining all necessary clearances for contractors equipment and systems shall be under the contractor scope.

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

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/IEC:60034
- 5) Energy Efficient motors : IS 12615, IEC: 60034-30

TYPE

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. HT motors shall have minimum design efficiency of 95 % Tolerance on efficiency value applicable as per IEC 60034.
- c) Crane duty motors shall be squirrel cage Induction motor as per the requirement.
- d) Motor operating through variable frequency drives shall be suitable for inverter duty with VPI insulation. Also these motors shall comply the requirements stipulated in IEC: 60034-18-41 and IEC: 60034-18-42 as applicable.
- e) Motors operating through variable frequency drives shall also meet the requirements mentioned in subsection for VFD.

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.

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. 41 deg.C over inlet cooling water maximum temperature of 39 deg.C for thermal class 90 (Y) wet wound Boiler circulation pump motor.

OPERATIONAL REQUIREMENTS

Starting Time

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 sec more than starting time.

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.

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.

Speed switches mounted on the motor shaft shall be provided in cases where above requirements are not met.

Torque Requirements

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

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

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

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

DESIGN AND CONSTRUCTIONAL FEATURES

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.

All motors shall be either Totally enclosed fan cooled (TEFC) or totally enclosed tube ventilated (TETV) or Closed air circuit air cooled (CACCA) 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)

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) 240VAC, 415V AC & 220V DC motors: Thermal Class (B) or better

Motors with heat exchangers shall have dial type thermometer with adjustable alarm contacts to indicate inlet and outlet primary air temperature.

Noise level for all the motors shall be limited to 85dB (A). Vibration shall be limited within the limits prescribed in IS/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.

Motor body shall have two earthing points on opposite sides.

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

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.

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.

The size and number of cables (for HT and LT motors) to be intimated to the successful bidder during detailed engineering and the contractor shall provide terminal box suitable for the same.

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

TYPE TEST

LT Motors supplied shall be of type tested design. During detailed engineering, the contractor shall submit for employer's approval the reports of all the type tests as listed in this specification 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 contractor 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 contractor 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/ employer's representative and submit the reports for approval.

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 100 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 to 85dB (A)).
10. Test for degree of protection and
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

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.

TABLE - I
DIMENSIONS OF TERMINAL BOXES FOR LV MOTORS

Motor MCR in KW

**Minimum distance between centre of
bottom terminal 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	385/203 (For Single core cables only)

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

LT MOTOR APPROVED VENDORS ARE GIVEN BELOW. HT MOTORS TO BE SOURCED FROM BHEL/ABB/SIEMENS

04	LT MOTORS	a) KEC	Bangalore/ Hubli (Up to 90KW)	Please refer remark column for Categorization	BAP/QR/ G501 & G502 /LTM:012 Rev NO: 00 dt 17 05 2018	Cat I <u>Above 50 KW and up to 200KW</u> NTPC inspn as per appd RQP/MQP
		c) CGL	Ahmednagar			
		b) SIEMENS	Mumbai	Please refer remark column for Categorization	** Acceptance of Motor rating between 30KW to 50 KW is based on NTPC Review of Routine Test Inspection report as per IS 325 Witnessed by BHEL/BHEL AIA ie Main contractor along with COC of the manufacturer and the contractor confirming as follows: "It is hereby confirmed that the above mentioned motor was /motors were manufactured taking care of NTPC specific requirements regarding ambient temperature, voltage and frequency variation, hot starts , pull out torque, starting KVA/KW, temperature rise, distance between centre of stud and gland plate, space heater and in accordance with approved drawing /data sheets"	Cat-II <u>**From 30KW to 50KW</u> BHEL Inspection
		c)ABB	Faridabad up to 55KW/ Bangalore above 55KW			
		a) BBL	Mumbai		##Acceptance of Motor less than 30KW is based on COC of the manufacturer and the contractor conforming as follows: "It is here by confirmed that the above mentioned motor/motor was / were manufactured taking care of NTPC specific requirements regarding ambient temperature, voltage and frequency variation, hot starts , pull out torque, starting KVA/KW, temperature rise ,distance between centre of stud and gland plate and tested in accordance with approved drawing /data sheet".	##Cat-III <u>Up to 30KW</u>
		b) NGEF	Hubli (up to15KW)			
		c) Marathon	Kolkata			
		d) Jyoti	Vadodara			
		e) LHP	Solapur			
		(For other PMD vendors except above NTPC approved vendors, pl refer Slno. 4 under important notes in page no:11)				

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