4817672/2026/O/o WM/Design/DMW/PTA

TECH. SPEC./ E-10/3/09 (MOTOR)
(3 Phase Drive Loco)

GOVERNMENT OF INDIA
MINISTRY OF RAILWAYS
(RAILWAY BOARD)

INDIAN RAILWAYS

TECHNICAL SPECIFICATION & TEST SCHEDULE

FOR

SINGLE PHASE/THREE PHASE INDUCTION MOTORS

FOR

DRIVING BLOWERS,COMPRESSORS AND PUMPS

FOR

THREE PHASE DRIVE ELECTRIC LOCOMOTIVES

Part - 2 (Motors)

AUGUST 1997

ISSUED BY
RESEARCH DESIGNS AND STANDARDS ORGANISATION
LUCKNOW

0.0 FOREWORD

0.1 This Specification deals with single phase and three phase induction motors for driving the various auxiliary machines of three phase drive electric locomotives. These auxiliary machines are mainly mixed flow centrifugal type blowers, reciprocating type compressors, centrifugal type pump, centrifugal type scavenge blowers and machine room blowers which are covered by separate technical specification. This specification shall be read in conjunction with specification of driven equipment. Performance requirements and tests on the combined units are dealt with in specification of driven equipment.

0.2 Any deviations from the requirements stipulated in the specification shall be clearly brought out by the tenderer while submitting the tenders. In the absence of such specific information regarding deviations, it will be presumed that the offer complies exactly with the stipulated requirements. As far as possible, the tenderer shall make only one offer to suit the exact requirements given in the specification. However, where, for technical reasons the tender proposes an offer which in his opinion is superior, he may do so, giving the relevant techno-economic details.

0.3 In preparing this specification, assistance has been taken from the following specifications :-

IS:325 - 1991	-	Specification for three phase induction motors. Rating and performance
IS:1231 - 1991	-	Dimension of three phase foot mounted induction motors.
IS:2223 - 1983	-	Dimensions of three phase flange mounted induction motors.
IS:4029 - 1991	-	Guide for testing three-phase induction motors.
IS:13730 (Pt.8)-1993	-	Specification for polyesterimide enamelled round copper winding wires with temperature class 180.
IS:13730 (Pt.13)-1993	-	Specification for dual coated enamelled round copper wires with temperature class 200.
IS:11101 - 1984	-	Enamelled and varnish bonded glass fibre covered round copper wires.
IEC-34-1/Part 1	-	Rating and performance of Rotating Electric Machines.
IEC-34-6/1991/Part 6	-	Method of cooling (IC-Code).

IEC-85/1984	-	Thermal evaluation and classification of electric insulation.
IEC-349 - 1991	-	Rules for rotating machines for Rail and Road Vehicles.
IEC 349-2/1993-3		Electric traction,Rotating machines for rail and road vehicles.
IS:4691 - 1985 & IEC-34-5-1981	-	Degree of protection provided by enclosures for rotating Electrical machinery.
IS:12075 - 1991	-	Mechanical vibration of rotating electrical machines.

0.4 Motor manufacturers before undertaking prototype production shall furnish detailed ;design data for scrutiny to RDSO. RDSO's approval will be only for the purpose of Standardisation and reliability assurance; notwithstanding RDSO's approval to the design/prototype, it shall be the motor manufacturer's responsibility for satisfactory performance of the motor and warranty obligation under the contract will not be affected.

0.5 For ensuring satisfactory design of the motor, it is necessary for the motor manufactuer to consult the manufacturer of the driven equipment. It shall be the responsibility of motor manufacturer to get necessary details directly from the firm supplying the dirven equipment.

1.0 SCOPE

1.1 This specification covers the performance requirement, type test, routine tests and brief description of reliability features to be incorporated in the auxiliary motors.

1.2 Each locomotive is equipped with three auxiliary converters each rated for 100kVA, these are directly connected to the auxiliary winding of the main transformer. One auxliliary converter is mounted in auxiliary converter box 1 called BUR1 and is a variable frequency converter which feeds the traction motor blower 1, scavenger blower 1 and the oil cooler blower 1. The other two auxiliary converters called BUR2 and BUR3 are housed in auxiliary converter box 2. The traction motor blower 2 scavenger blower 2 and the oil cooler blower 2 are fed off the converter BUR2 which is also a variable frequency converter. The frequency of the converters BUR 1 & 2 is changed in three steps (17 Hz, 33 Hz & 50 Hz) for achieving the required speed of the fan motor sensed by the temperature sensors in the traction motor and oil cooling circuit. The other auxiliary load viz. oil pumps 1 & 2 for transformer, oil pumps 1 & 2 for the main converter, main compressors 1 & 2 and the battery charger is fed from auxiliary converter BUR3 which is operated at a fixed frequency of 50 Hz.

It is possible to feed the load on BUR1 by BUR2 as also the load on BUR2 by BUR1 in case of exigencies. Similarly it is possible to feed the load on BUR2 by BUR3 and vice versa if the need arises.

1.3 The following motor driven auxiliaries are used in ac Electric locomotives.

1.3.1 Blowers:

- Traction motor cooling blower (VMT) - Mixed Flow Centrifugal type.
- Transformer oil cooling blower (VRH) - Mixed Flow Centrifugal type.
- Scavenge blower for traction motor Blower + Oil Cooler Blower. - Centrifugal type.
- Machine Room Blower - Mixed flow certrifugal type.
- Machine Room Scavenge blower . - Centrifugal type.

1.3.2 Pumps:

- Transformer Oil Pump - Centrifugal type for cooling transformer oil.
- Converter oil pump - Centrifugal type for cooling converter oil.

1.3.3 Compressor

- Air compressor (CP) - Reciprocating type for supplying compressed air to pneumatic equipments and loco brake system.
- Alternatively screw compressor may be provided.

2.0 TERMINOLOGY - SYMBOLS AND UNITES

2.1 For the purpose of this specification, the definitions given and or referred therein in the specification as shown under clause 0.3 shall apply wherever necessary.

3.0 CAPACITY AND RATINGS

3.1 The motor frame size and continuous rating currently in use are given in Appendix 'A'.

3.2 In order to achieve standardisation, adoption of frame

sizes/ratings as per Appendix A will be preferred.

4.0 SYSTEM CONDITIONS AND BASIC DESIGN FEATURES FROM CONSIDERATIONS OF PERFORMANCE:

4.1 The supply to the auxiliary motors is from PWM auxiliary converter is of quasi-square wave.

Nominal rated voltage and frequency for different Auxiliary motors are as under :

1. Traction Motor Blower Motor 2. Oil cooler blower motor. 3. Scavenge blower motor for traction motor blower + Oil cooler blower.	Rated voltage - 415V Voltage variation : 415V±10% Nature of supply : 3 Phase variable voltage and variable frequency. (Frequency varies in 3 steps, 17Hz, 33Hz & 50Hz).
4. Transformer Oil Pump Motor 5. Convertor Oil Pump Motor 6. Compressor Motor.	Rated Voltage - 415 V Voltage variation : 415V±10% Nature of supply: 3 Phase, constant voltage and frequency (415V, 50Hz).
7. Machine Room Blower Motor 8. Scavange Blower Motor for machine room blower.	Rated Voltage : 415V Voltage variation: 415V±10% Nature of supply: 1 phase 50 Hz. Both motors shall have the winding like 3-phase conventional motor. However with external connection of capacitors. These motor will work as single phase machines.

4.2 Normal duty -

Motors shall be rated for continuous operation at rated output over the full range of supply voltage variation without exceeding the limits of temperature rise subsequently. For compressors driving motors S4 duty (50% "ON" and 50% "OFF" period) shall be adopted.

"Compressor unit when supplied at the lowest voltage and lowest temperature (0 degree C) working against the back pressure of 10.5 kg/sq.cm. shall accelerate from rest to full speed in six seconds. The motor starting torque at lowest voltage shall meet this requirement".

Note: Considerable variation in starting torque of compressors under hot and cold conditions exists

The values of starting and full load torque as well as GD^2 value under cold and hot conditions shall be declared by the driven equipment manufacturers. The same shall be considered during design by motor manufacturers. Further a reserve of 10-15% should be available in motor than the requirements of the driven equipment.

4.3 The maximum starting current shall not exceed 6.5 times the normal full load current for 4 pole motors, 7.0 times for 2 pole motors and 7.5 times for 6/8 pole motors i.e. for MCP applications.

4.4 The slip at rated voltage shall be 2.75 %. Permissible value of slip at lowest voltage for motors greater than 4.7 KW rating shall be 6%. However, the slip at lowest voltage shall be between 5 to 8% for smaller motor having rating from 0.75 to 4.7 Kw .

4.5 Speed torque characteristics - The motor characteristics shall be carefully matched with the driven unit to obtain normal duty and starting performance as stipulated above. It may be ensured that the starting torque produced by motor shall be 10 to 15% more than the requirement of driven machine at lowest voltage.

4.6 The magenetic design of motors shall be such that the motors do not exhibit saturation behaviour up to 457V. The no load current versus voltages curve for the motors shall have linear characteristics upto 457V, i.e. with no abrupt slope changes in the no load characteristics. In general, the motors shall be designed from magnetic considerations for the highest voltage and from copper considerations for the lowest voltage.

4.7 The vibration levels on any part of the motor shall not exceed 15 microns peak to peak for TM blower motor and Oil cooler blower motor and 10 microns for other motors. The vibration measurements shall be made as per IS:4729/IS 12075.

5.0 SERVICE CONDITIONS:

5.1 Ambient temperature - The general ambient temperature of air at the inlet to the motors will be 0 to 65°C (Maximum) with relative humidity varying upto 100%.

5.2 Maximum altitude - 1000 metres above mean sea level.

5.3 The equipment and mounting arrangement shall be robust design for traction duty and shall withstand satisfactorily the vibrations and shocks normally encountered in service as indicated below:

a) Maximum vertical acceleration ... 1.0 g
b) Maximum longitudinal acceleration due to shock ... 3.0 g
c) Maximum transverse acceleration ... 1.0 g

5.3.1 The vibrations are of sine wave form and the frequency of vibration is between 1 Hz and 50 Hz. The amplitude a, expressed in millimetres is given as a function of f, by the equations -

$a = \frac{25}{f}$ for values of f from 1 Hz to 10 Hz.

$a = \frac{250}{f^2}$ for values of f exceeding 10 Hz and upto 50 Hz.

5.3.2 In the direction corresponding to the longitudinal movement of the vehicle, the equipment is subjected for 2 min. to 50 Hz vibrations of such a value that the maximum acceleration is equal to 3 g (amplitude a= 0.3 mm).

NOTE: Although no test to assess the suitability of motors under vibration levels as indicated in clauses 5.3, 5.3.1 and 5.3.2 has been proposed, the manufacturer shall take these factors into consideration while designing various components e.g. shaft, bearings mounting arrangements etc., and other necessary mechanical features.

6.0 TYPE OF ENCLOSURES

6.1 The degree of protection as per IS:4691/IEC 34-5 for the motors shall be as under :

MVMT, MVRH, MCP, MR Blower motor both scavange blower motors.	- IP55/IP54
Transformer oil pump motor Converter oil pump motor	- P100

7.0 FRAME CONSTRUCTION AND MOUNTING

7.1 Standard frames sizes as per IS: 1231/2223 shall be used.

7.2 The type of mounting shall be adopted as follows for different application:

MVMT, MVRH, MR Blower motor	: Vertically mounted with three point support at 120 degree apart.
Scavange blower motors and MCP.	: Foot mounted.
Transformer oil pump	: Horizontlly and foot mounted
conveter oil pump motor	: Vertically and flange mounted

4817672/2026/O/o WM/Design/DMW/PTA

8.0 TERMINAL BOX

8.1 Three terminals for line connecting shall be brought out in a terminal box on the side of the motor;

OR

the three terminal lead wires shall be brought from motor stator to the blower casing and suitably mounted with plug and socket arrangement as per the requirement of the loco supply system cables. The terminals shall be clearly marked UVW by embossing on the terminal block to obtain the correct direction of rotation with the supply phase sequence of UVW. Adequate creepage distance shall be provided between the terminals. Suitable compression cable type glands shall be provided to accommodate the supply cables. The terminal box should have a degree of protection IP-54, and the arrangement shall be subject to prior approval of RDSO.

8.2 Terminal block shall be made of epoxy reinforced glass or similar moulding conforming to BS-3815 and have the following additional characteristics:-

- It shall be anti-moisture obsorbent and free from porosity.
- It shall not deteriorate when working continuously at an ambient of 55°C and when tested at 120°C for 24 hours.
- The terminal block will have conducting part which should be made of cadmium plated steel as per IS:226 and IS:1572 and all the threaded portions should be mechanically strong, so that even with 100 operations of tightening and loosening, the threads should not wear out nor shall there be any loosening of the inserts. The terminal stud threads shall not worn out even after 100 operation of tightening and loosening at the specified torque. The terminal block design shall be as per RDSO sketch No. SKEL 2754A and SKEL 2784A (~~enclose~~d).
- Bakelite or Hylam terminal boards shall not be used for terminal box.

8.3 TERMINAL LEADS

8.3.1 Flexible insulated Fibre glass topper connecting lead wire with fire retardant silicon elostomer for temperatures -50 oC to +180 oC as per BSS 6195 /1969 type 8 'b' category C/D with B.D.V. of 6 KV minimum .(category 'C' for 4 & 6 mm^2 sizes and category 'D' for 10mm2 size of lead wire) Insulating varnish will be replaced by silicon elostomer.

The minimum sizes are given bellow

i) For 25 KW Motors : 80/0.4 (10 mm^2)

ii) For 10-15 KW Motors : 84/0.3 (6 mm^2)

iii) For 2.5 to 5 KW : 56/0.3 (4 mm^2).

iv) For below 2.5 KW : (3 mm^2)

The flexible leads shall be covered with suitable flexible insulated fiber glass sleeve with coating of fire retardant silicon elastomer applied by extrusion or multi-dip process having temperature index of 180 oC as per BS 2848 type 1/180 Tb having overall thickness of 0.9 mm and capable to withstand minimum B.D.V. of 5 Kv for one minute.

8.3.2 Silver brazed joints/fused for connecting terminal leads and winding wire shall only be used. Soldered joints are not acceptable. Winding wires shall in no case be brought to the terminal block directly.

8.3.3 The leads shall be tied securely on the stator overhang of the winding at their exit from motor stator overhang.

8.3.4 Flexible cable shall be well gripped by the insulated socket tube while doing crimping.

8.3.5 A compression type (rubber) gland shall be used for securing the flexible leads at the entry of terminal block and rubber grommet should also be used.

8.3.6 The crimped socket and joint shall comply with BS 4579, Part I.

8.3.7 The terminal sockets used shall be of annealed electrolytic copper. The minimum radius between palm and tube shall be 2 mm. Thickness of socket tube shall be at least 1 mm.

8.4 Alternatively plug in type socket and pins may be used along with PMA-protecting tubing for connecting the external connection of the motors as in the case of ABB loco except in the case of compressor motor.

9.0 Stator construction:

The stator winding shall be suitable strengthened mechanically and vacuum pressure impregnated with solventless insulating resin to resist vibration and the effects of lubrication oil/fumes, dust and moisture. Adequate clearances but not less than 10 mm between stator core outer diameter and frame shall be maintained to ensure proper cooling of core for SPDP-motors to ensure proper cooling of core. The overhang design should not obstruct passage of air in this region. The motors shall preferably be designed with maximum possible air gaps, but not less

than 0.8 mm for the TM blower motor oil cooler blower motor and 0.5 mm for other motors to ensure good performance under minor shaft deformation or vibrations. Dummy stampings shall be suitably tack welded at tooth portion on all teeth, after mounting on stator. This is to ensure that end laminations do not open out in service, which could lead to insulation failure on account of electro magnetic vibrations generated in them.

9.2 Rotor Construction:

Dynamically balanced, die cast aluminium alloy rotors shall be used.

9.3 Shaft :

Shaft material used shall be EN-24 suitably heat treated to achieve improve hardness to avoid wear and tear in service.

The various shaft dimensions such as surface finish, shoulder and fillet shall be as per recommendations of the bearing manufacturers.

9.4 Bearings:

The bearing sizes to be adopted shall be in general conformity with Appendix `B'. However, for designs meeting with the requirements of clause 3.2, the bearing designs shall cater for the severest requirements. The bearing design shall have following features:

i) In addition to provisions of required interference/ tolerances on bearing housings, the bearing covers shall grip the bearing faces to prevent outer race rotation in the housing for fixed bearings. Floating side of the bearings shall be suitably preloaded.

ii) The minimum L10 life of bearings shall be 1,00,000 hours. L10 life design shall be worked out based on parameters as per Clause 5.

iii) Only SKF/FAG (imported) bearings shall be used. However, indigenous SKF bearings upto 6310 and limited quantity of 6312/6313 may also be used.

iv) Semi-sealed bearings shall be used for all blower motors and conventional deep groove ball bearings for compressor and pump driven motors.

9.4.1 All bearings shall be inspected for boundary dimensions, radial clearance, free running surface finish etc. The bearings shall also be checked with shock pulse meter for noise/vibrations. All bearings shall have radial clearance of "C3".

9.4.2 Regreasing facilities with industrial type round head

nipple M-10 as per IS:.4009 shall be provided so as to ensure ease of regreasing and no dismentalling of any parts of motor or its driven unit are needed. Suitable outlet for escape of old grease shall also be provided. The motors in 200 frame size and above shall be provided with bearing covers of suitable design with a pocket for retnetion of discharged grease.

10.0 VENTILATING FANS:

10.1 Ventilating fans shall be either steel fabricated or cast steel/Alluminium alloy shall be used on scavange blower motor and if needed for compressor motor also.

11.0 WINDING WIRES:

11.1 The following types of winding wires may be used.

Dual coated enamelled winding wires as per IS:13730-Part 13/1993. Dual coat means that base coat with polyesterimide enamel MT 533.39A and Top Coat with Allotherm 602.35 of Dr. Beck and Co. only.

The enamel thickness shall comply with IS 13730 Pt.0 Section M (i) and (ii) mentioned above.

11.2 The test on enamelled winding wires shall be conducted as per IS 13778 Part-I to 6. Separate documentation for these tests shall be maintained by the manufacturers, indicating the winding wire supply particulars. The tests on these dual coat wire shall be conducted as per IS:13730 -13-1993.Kapton covered enamelled winding wire conforming to IS 11395-1985 may also be used.

12.0 IMPREGNATION:

12.1 Vacuum pressure impregnation (VPI) process shall preferably be adopted, with Dr. Beck & Co.'s Solventless unsaturated polyestermide (UP) impregnating resin Dobec-on FT 1052/2005/500 EK.

12.2 The winding shall be subjected to pressure impregnation as per recommended procedure of varnish manufacturer.

13.0 WINDING OF COIL OVERHANG:

13.1 The star point of the winding shall be formed inside the stator overhang. The star point shall be adequately brazed and insulated ensuring best workmanship. On the brazed joint apply General Electric RTV silicone sealent and overtape with two layers of half lap "Fusa Flex" 76593 tape (Supplier GE). Seal the joint with a heat gun.

13.2 Coil overhangs in the stator winding shall be adequately secured with glass cord and stagger taped and each coil emerging from the slot shall be covered with 1/2 lap impregnated glass tape of size 0.3 x 20 mm. Alternatively coil separator similar to the phase separators may be provided between adjacent coil emerging from the slot.

14.0 SLOT/INTERPHASE INSULATION:

14.1 Calendered Nomex/Kapton paper shall be used for slot liner and wedge separator. Uncalendered Nomex (Nomex 411) shall be used for inter layer and interphase insulation. Epoxy bonded glass fibre laminates shall be used for slot wedges. The tenderer shall state in his offer the brand names of the insulating materials proposed to be used. The materials used and insulation system as a whole shall be correspond to class 180.

14.2 Manufacturers may use any other insulation scheme for the motor provided with system has been proved during various tests including motorettes and meets the minimum stipulated temperature class. The use of such alternative schemes shall, however, require prior acceptance by RDSO.

15.0 TEMPERATURE-RISE:

15.1 The temperature-rise of stator windings above ambient of 65°C, during continuous duty at rated output at all voltages (i.e. 373 V to 457 V) shall not exceed in following limits:

80°C - if enamelled winding are used with `H' class insulating material.

15.2 attention is invited to Clause 19.6.7 regarding tempera-

ture rise tests to be carried out as Type Tests. Adequate margin in temperature rise shall be kept in the design so as to ensure that temperature rise under various conditions as specified does not exceed beyond the values laid down in clause 19.6.7.

15.3 The temperature rise limits specified in Clause 15.1 are absolute upper limits. The temperature rises on individual machines (when tested further be subjected to limits derived from the tests on the first 10 machines, in the following manner (please also see Clause 19.6.7 and Clause 19.7.5).

The first 10 motors shall be tested for temperature rise at 415V. During routine test, the temperature rise shall be carried out on every 15th motor as per Clause 19.7.5 and the temperature rise actually observed shall not exceed the average of first 10 motors by $5^{o}C$.

16.0 FINISH:

16.1 The motor shall be treated suitably for rust removal and coated with anti-rust Primer and finished with two coats of battleship grey paint.

17.0 INTERCHANGEABILITY:

The various components of the motor shall be manufactured with such a tolerance so as to enable completge interchangeability of components from one motor to another of the same design.

18.0 MARKINGS:

18.1 Name Plate - each motor shall have name plate, containing the following information:

a) Manufacturer's name,type and serial number.
b) Rated voltage and voltage range.
c) Winding connections.
d) Rated frequency.
e) Rated current.
f) Rated speed.
g) Rated output in kW and hp.
h) Class of insulation.
i) Weight.
j) Capacitor rating for MR blower motor and its scavange blower.

18.2 Direction of rotation - An arrow indicating the correct direction of rotation with the supply phases UVW or ABC connected to the corresponding terminals marked on the terminal box shall be permanently fixed on the motor body.

18.3 Lubrication - Plate giving lubricating instructions shall be affixed at a convenient location near the bearings indicating the type, quantity and the frequency of the lubrication.

19.0 TESTS:

19.1 This clause lays down the tests to be done on motors whether supplied as a spare motors or supplied to manufacturers of the driven machines to be eventually supplied to the Railways as combined units. In regard to the tests to be done on the combined unit, i.e., motor plus the driven auxiliary, specification of CLW/RDSO for the driven equipment may be referred to.

19.2 Tests are classified as Type and Routine Tests. Type tests are required to be conducted for prototypes of new designs not accepted or prove earlier as per this specification. Routine tests are required to be conducted on every motor, except where otherwise stated, of the supply.

Not withstanding the provisions of this Clause, the purchaser may require prototype tests to be repeated on any particular motor/motors, under certain circumstances such as changes in designs or materials, modifications for improvements and such other considrations. The carrying out of the repeat prototype tests will be subject to agreement between the purchaser and the supplier of the motors.

19.3 Unless otherwise specified, the tests and the method of measurement adopted shall comply with Indian Standards Specification IS:4029 - 1991. (Guide for testing 3 Phase induction motors) and IEC-34-1.

19.4 The instruments used for electrical measurements shall have 0.2 accuracy.

19.4.1 Slip at full load measurements and no load measurement shall be made with one of the following methods only:

a) Stroboscope
b) Slip Coil.
c) Magnetic needle
d) Tachometer (non-contact type)

19.5 The type tests will be conducted in the presence of Railways/RDSO representative. Any modifications in test conditions required by the supplier shall be subject to the prior approval of the Railways/RDSO. It is preferred to test the prototype motor with PWM converter supply with quasi square wave as per Clause 19.9.2.

19.6 Type Tests (To be conducted on Prototype Motors):

	Reference Clause Nos.
- Resistance measurement	(19.6.1)
- Direction of rotation	(19.6.2)
- No load test	(19.6.3)
- Locked rotor test	(19.6.4)
- Pull up and put out torque test	(19.6.5)
- Load test	(19.6.6)
- Temperature Rise Test	(19.6.7)
- Over speed test	(19.6.8)
- High voltage test	(19.6.9)
- Surge Test	(19.6.10)
- Vibration Test	(19.6.11)
- Starting test	(19.6.12)

* The test results and data sheets as per clause 19.8 and 21.1 shall be submitted in full by the manufacturer.

19.6.1 Measurement of resistance (cold) - The resistance of each phase winding of the stator, when cold, shall be measured either by bridge or by voltrage drop method in terms of IS:4029-1991. For this purpose, the motor shall be left in standstill condition for at least 12 hours before the resistance measurements. The winding temperature shall be determined with a mercury thermometer.

Method of test, voltage, current, resistance values and the winding temperature for each phase shall be recorded.

19.6.2 Direction of rotation - The direction of rotation shall be same as that marked on the motor when supply with phase sequence of RYB is connected to UVW/ABC terminals of the motor.

19.6.3 No load test - No load test as per IS: 4029 - 1991 at voltages varying from 150 to 457V in steps of 50V shall be conducted. However, at 373, 415 and 457V the readings may also be taken. Individual phase current, speed, total power input and frequency in each case shall be recorded. The variable copper losses and constant losses like iron losses, rotational losses shall be claculated. Record the test results including the calculated values.

19.6.4 Locked rotor test - Locked rotor test shall be conducted at 100, 200, 300, 373 and 415V balanced supply. This test shall be done at 373V with four position of rotors 90 degree apart.

19.6.5 Pull up and pull out torque - Determine the pull up torque and pull out torque of the motor at the lower voltage with and extrapolate it at 373 V.

19.6.6 Load Test - Immediately after the tests as specified in Clause 19.6.7, a test at an input voltage of 415V shall be con-

ducted to determine the characteristics of the motor under various load conditions. For this purpose the load torque shall be varied in steps of 25% from no load to 1.25 times the full load. The motor may conveniently be loaded by a coupled dc generator supplying a variable loading resistance. The output of the motor may preferably be measured directly by a torque meter. The full load torque shall be taken as the rated output torque of the motor on 415V. The total loss shall be restricted to guaranteed value + 10%.

Measure and record the following quantities :-

i) Input phase currents.
ii) Input power.
iii) Frequency
iv) Input power factor
v) Speed
vi) Output torque.

Calculate and record slip and efficiency:-

The efficiency shall not be less than 88% for 10 to 35 HP motors and 83% for smaller motors. Draw curves of speed, efficiency, power factor and mean current against motor output torque. Power factor shall be not less than 0.85 and 0.75 for 2/4 pole and 6 pole machine respectively.

19.6.7 TEMPERATURE RISE TEST (Resistance Method)

19.6.7.1 The motor being cold at the beginning of the test adjust the dynamometer set so as to obtain the rated output from the motor. The test during this test shall generally conform to IS:4029-1991. The following temperature rise test shall be carried out on the motor:-

i) Starting from cold condition, conduct temperature rise test at the lowest voltage 373 V for (a) one hour, (b) steady state final condition.

ii) Starting from cold conditions, conduct temperature rise test at 457 V for (a) one hour and (b) steady state conditions.

iii) Starting from cold conditions, conduct temperature rise test at 415V for (a) one hour and (b) continue this test for ascertaining maximum temperature rise under steady state conditions.

NOTE :

Maximum allowable temperature rise using dual coat enamelled copper conductors IS:13730-13/1993 will be 80 deg. C with class 'H' insulating material.

At the end of each of these tests, measure by resistance method and record the temperature rise of each winding and by thermometer or temperature detectors. The maximum temperatures of body, core, cooling air inlet and outlet shall also be recorded by thermometer for each of these tests. The maximum bearing temperature shall not be more than 95 deg. C.

(c) For accurate measurement of the temperature by the resistance method, the hot resistance of winding shall be measured immediately after switching off (in any case, not later than 30 Seconds) and subsequent measurements shall be carried out at intervals not exceeding 15 seconds for the first two minutes and 20 seconds for the following three minutes.

(d) Correction for cooling air temperature, when the temperature rise test is carried out with cooling air temperatures other than those specified in IS: 4029-1991, shall be applied as per Clause 14.1 of the above specification.

The temperature rise at the start of the cooling period is determined by means of a log scale graph by straight line extrapolation of the cooling curve plotted on a logarithmic scale for the temperature rise and linear scale for time. The points of abscisae exceeding 90 seconds shall be discregarded in the plotting of the curve. Only the part corresponding to the points of abscissae less than 90 seconds be used for the purpose of extrapolation.

(e) Record hot spot temperature at overhang, on core and on rotor.

(f) Repeat the test 19.6.7.1 with S4 duty when motor is coupled with compressor.

19.6.8 Overspeed Test- The motor shall be run at an over-speed of 1.25 times the synchronous speed for 2 minutes and there should not be any deformation. The bearing conditions shall be checked before and after the test by means of shock pulse tester and by screw driver separately for experience and confirmation only.

19.6.9 High Voltage Test:

On hot windings, perform a di-electric test at 3300V, 50 Hz applied for 1 minute between each insulated stator winding and the frame of the motor and record the insulation resistance before and after the high voltage test in terms of IS:325-1991. There should be no appreciable difference in insulation resistance values.

19.6.10 Vibration Test:

The vibration levels on the motors shall not exceed 15/10 microns (Refer Cluase 4.9) when tested as per IS: 4729-

1968. After all the above type tests, the motor shall be dismantled and inspected for any damage or abnormality and then the motor weighed with its components in working order.

19.6.11 Surge Test:

The stator winding shall be tested for inter turn shorts (without its rotor in position) at surge test voltage of 5 kV (peak to peak) when the rotor is dismantled as above.

19.6.12 Starting Test:

The motor shall withstand with 2 minutes interval between tests, five successive starts at the 373V and five successive starts at 457V while developing a torque corresponding to load which it is normally expected to meet in service preferably connect the machine to the auxiliary unit. The starting performance should be satisfactory and no abnormality shall be observed at the end of the tests.

19.7 ROUTINE TESTS (To be conducted on each motor)

	Reference Clause Nos.
- Resistance measurement	(19.7.1)
- Direction of rotation	(19.7.2)
- No load test	(19.7.3)
- Locked rotor test	(19.7.4)
- Temperture rise test	(19.7.5)
- High Voltage Test	(19.7.6)
- Vibration test	(19.7.7)
- Surge test	(19.7.8)

19.7.1 Measurement of resistance (cold) - As given in Clause 19.6.1 :-

The value of resistances recorded shall not differ from the corresponding test values by more than ±5%. The winding temperature differences may also be corrected as per IS:325-1991, if necessary.

19.7.2 Direction of Rotation:-

Test as per Clause 19.6.2.

19.7.3 No load Test:-

A single test at an input voltage of 415V balanced. The ratio of no load current at 457V to that of at 415V shall not exceed the values achieved during type tests.

19.7.4 Locked rotor tests:-

A single test at any reduced balanced input voltages as per IS: 4029-1991.

19.7.5 Temperature rise test:

On every fifteenth motor, conduct temperture rise test as per Clause 19.6.7, Item (iii) only.

19.7.6 High Voltage Test:

Test as per Clause 19.6.8 each motor at 80% of type test value i.e., on 2.64 kV.

19.7.7 Vibration Test:

Test as per Clause 19.6.10

19.7.8 Surge Test:

Test as per Clause 19.6.11. if needed otherwise ,internal stage tests results available in record shall be acceptable.

19.8 TEST RESULTS:

The test results should be submitted in full as per pro-forma included in Appendix `C'.

NOTE: Attention is invited to clause 3.7 of appendix `E" regarding acceptability of results obtained during routine test with respect to results obtained for type tests during prototype tests.

19.9 SPECIAL TESTS: (As agreed between manufacturers and CLW/RDSO).

19.9.1 Endurance Test :

The question of conducting certain special endurance tests on typical motors of different manufacturers is under the consideration of RDSO. The test will be destructive in nature and are intended to bring our long term reliability under service condition. The details of test programme are being worked out but it may briefly be stated that the tests will comprise :

i) Repeat starts and stops under at rated voltage. The duration `ON' and duration `OFF' will be predetermined.

ii) Application of a dielectric testing voltage between windings and the earth, a value about 2 to 3 times the rated voltage, during the period `OFF'.

iii) The cycles `ON' and `OFF' and the application of voltage during the `OFF' period will continue until the motors winding fails. The number of cycles to failure will be measured of relative reliability between machines.

iv) The test should be conducted preferably on a vibration table.

That such test as above are under consideration of RDSO is being conveyed tghrough this Specification only for the information of the manufacturers. It is not intended to treat this as Acceptance Tests for supplies of motors made against this specification.

19.9.2 Temperature rise test with PWM quasi square wave:

Temperature rise test at 415V, 457V and 373 V shall also be conducted with quasi square wave voltage suply in order to assess the suitability of these motors for 3 phase drive electric locomotives fitted with static invertor. At least one motor of each type of every motor manufacturer shall be tested with this supply.

19.9.3 Temperature rise test at Elevated Temperature:

Temperature rise test shall be carried out by artificially increasing environment temperature to 65 degree C on both motor and its driven unit like compressor and at 55 degree C for blower and pump motor.

19.9.4 Motorette Test:

Motor manufacturers shall submit the motorette test results of the insulation system adopted by them.

19.9.5 Compatability Test:

In case of any new type of enamelled winding wire or varnish proposed by the firm, compatibility test results shall be submitted to RDSO for assessing the suitability.

20.0 **GUIDE-LINES FOR INSPECTION:**

20.1 Certain important aspects to be checked by Inspecting Officials during tests (Type and routine) and during inspection of motors are given in Appendix (E). These may be noted by manufacturers.

21.0 **DATA SHEET AND DRAWING SHEET:**

21.1 The particulars of the motors shall be furnished in the data sheets as given in Appendix D1, D2, D3 and D4. This data shall be furnished in 4 stages i.e., (i) at the offer stage; (ii) design stage; (iii) prototype manufacture/inspection stage; and (iv) after successful testing of prototype.

22.0 **MAINTENANCE INSTRUCTIONS:**

22.1 The manufacturer shall supply detailed maintenance instructions and maintenance schedule based on monthly, bimonthly,

quarterly and annual overhauling.

23.0 **QUALITY ASSURANCE PLAN:**

23.1 The manufacturers shall supply the detailed Quality Assurance Plan as per ISO 9000/IS 14000 followed by them for their product.

APPENDIX-A

Frame sizes and outputs of motors currently in use

Application	size of frame	Speed syncro-nous	Continuous rating out output Kw/HP	Type of enclo-sures	Class of insula-tion
TM Blower Motor	200L	3000	25/34	TESC	H
Oil cooler blower motor	200L	3000	25/34	TESC	H
Scavenge Blower Motor for TM blower + Oil cooler.	100L	1500	2.2/3.0	TEFC	H
Machine room blower motor.	132M	3000	2.6/3.5	TESC	H
Scavange blower motor for machine room blower	90L	3000	0.75/1.0	TEFC	H
Transformer oil pump motor	112M	3000	4.7/6.4	TESC	H
Converters oil pump motor.	112M	3000	11/15	TESC	H
Main compressor motor	200L	750	15/20.4	TESC	H

TESC - Totally enclosed surface cooled

TEFC - Totally enclosed fan cooled

APPENDIX - B

BEARING DESIGN DETAILS OF AUXILIARY MOTORS

Sl. No.	Name of motor	Bearing type	
		Non-driving end	Drive end
1.	TM Blower motor	6312 ZR	6312ZR
2.	Oil cooler blower motor	6312 ZR	6312 ZR
3.	Machine room blower motor	6208 ZR	6208 ZR
4.	Scavange blower motor for TM blower + oil cooler.	6206 ZR	6206 ZR
5.	Scavange blower motor for machine room blower.	6205 ZR	6205 ZR
6.	Transformer oil pump motor	6306	6306 Double row ball bearing
7.	Converter oil pump motor	6306	6306 -Do-
8.	Main compressor motor	6312	6312

The complete bearing design including following shall be worked out by motor manufacturers in consultation with RDSO and bearing manufacturers, e.g. FAG/SKF.

i) Interference between shaft and inner race.
ii) Interference between housing and bearing outer.
iii) Radial clearance.
iv) Fillet dimensions and shoulder height.
v) Preload-design of bearing.

APPENDIX 'C'

TEST DATA FOR INDUCTION MOTOR

1. Motor particulars — Ratings

Make	V
Type	Hz
Machine No.	KW/HP
Order No.	A
Type of winding	PF
Class of Insulation	N
Type of Enclosure	
Type of winding	
Type of rotor	

2. Resistance - Measurements and Insulation Resistances:

Resistance with KELVIN Bridge:

3

Phase	T(amb)	Resistance	Resistance at 20 deg.C R 20	I.R.	AV. R/Phase
UV					
VW					
WU					

Resistance by V.I. Method:

Phase	T(amb)	V	I	R = V/I	R20 deg.C	I.R.	Av.	R/Phase
UV								
VW								
WU								

3. Direction of Rotation & Terminal marking:

As seen from drive end : Clockwise/Anti clockwise.

Stator terminal location : Left/right seen from drive end.

Terminal marking : Incoming terminal

U	V	W

Outgoing terminals A B C

4. No Load Test:

As per clause No. 19.6.3 on different V input record following :

V Input			I			Power Input			Power factor	Speed
UV	VW	WU	U	V	W	P1	P2	P	Cos 0	N

5. LOCKED ROTOR TEST : As per Clause 19.6.4 record for different V input.

In put			V Average	I			I Av.	P (Input)			Power factor	Torque in
UV	UW	WU		U	V	W		P1	P2	P	cos O	Kg.m

5.1 Pull up and pull out torque Test 19.6.5

6. Temperature Rise Test:

As per Clause 19.6.7 one hour and steady state rise of stator winding at 373V, 457V and 415V followed by temperature rise after 415V at steady state. The values as per following table shall be recorded.

Sl No.	Time	Voltage		I			Input watts			Rotor	Temp	Cooling Air
		UV	VW	UV	U	V	W	P1	P2	P	Speed Slip	T in T out

(Contd)

Temperature rise stator Winding by Resistance Method		
UV	VW	WU

NOTE: A calculation sheet indicating stator winding hot resistance values measures as per Clause 19.6.7 shall be submitted for all the conditions laid in this Clause. Log-scale graph shall be used for extrapolating zero time hot resistance.

Appendix `C' Contd.

7. Motor characteristics:

As per Clause 19.6.6 record following :

S No.	V			I			Power Input			Rotor Slip %	Out put KW	Power factor Cos O	Effi ciency n%	Torque Kgm
	UV	VW	WU	U	V	W	P1	P2	P					

8. Starting Test:

As per Clause 19.6.12

S No.	Voltage			V. Av.	%	UB	Current			Starting time
	UV	VW	WU				U	V	W	

9. Over speed test - as per clause 19.6.8

10. High Voltage Test : As per Clause 19.6.9

11. Insulation resistance : As per Clause 19.6.9

12. Vibration Test - As per clause 19.6.10

13. Weight of motor - As per Clause 19.6.10

Place: Date

Tested by -

(a) Railway's representative (Name & Designation)

Signature

1.

2.

3.

(b) Manufacturer's Representative (Name & Designation)

Signature

1.

2.

3.

APPENDIX - D1

DATA TO BE FURNISHED AT OFFER STAGE
(Refer Clause 0.2 and 21.1)

1. Application
2. Type
3. Rated voltage
4. Number of phases (Star/Delta)
5. Frequency
6. Speed
7. Continuous rating (HP/KW)
8. Rated current
   a) At rated voltage (415V)
   b) At lowest voltage (373 V)
9. Slip at full load in percentage at -
   a) Rated voltage (415V)
   b) Lowest Voltage (373 V)
10. Class of insulation
11. Type of enclosure.
12. Method of ventilation
13. Type of protection
14. Frame size.
15. Overall dimension
16. Type and make of bearing
17. Size of bearing and their estimated L10 life.
18. Weight of the motor
    - Weight or rotor.
19. Rotor construction
20. GD^2 value of the rotor.
    (Indicate the maximum variation)

21. Starting current and torque in Kgm.

    a) at 373 V
    b) at 457 V
    c) at 415 V

22. Any deviation from the specification indicating reasons thereof may please be explained.

23. Enamelled winding wire used:

    a) As per IS 13730 Pt. 13

APPENDIX D2

DATA TO BE FURNISHED AT DESIGN STAGE
(Refer Clause 0.4 and 21.1)

1. Material specification of core stamping.
2. Rating of stamping
3. Transformation ratio
4. Type of winding
5. Method of connection
6. No. of coils used
7. No. of turns per coil
8. No. of turns per phase in series
9. No. of coil group.
10. No. of coil group in parallel.
11. Coil pitch
12. Current density in the conductor in Amp/mm^2.
13. Conductor size (diameter and area)
14. No. of conductor/slot and No. of wire.
15. No. of slot, slot drawing slot area.
16. Slot insulation detail
17. Overhang insulation detail
18. Interlayer insulation detail

) Details to be furnished with drawing and literature on insulating material used).

19. Phase resistance at 20 deg. C.
20. Type of enamelled wire used -

    a) As per IS: 13730 - Part 13

    b) Double glass covered conductor as per IS 11184-8 on medium covcering of enamel as per IS:13730-I

21. Gross copper weight used on the winding.
22. Slot wedge specification and size.
23. Reactance/phase

24. Winding diagram with common notation.

25. Size of end ring (de x te) and current density.

26. No. of rotor slots.

27. Skew of slots on shaft and on outer surface of rotor.

28. Current density in rotor bare.

29. Size of bar

30. Material specification of -

    i) Rotor bar
    ii) End ring
    iii) Rotor stamping.

31. Class of tolerance followed:

    a) Between inner race and shaft.
    b) Between outer race and housing.

32. Class of clearance adopted for bearing.

33. Material specification for shaft.

APPENDIX - D3

PROTOTYPE MANUFACTURING/INSPECTION STAGE

(Refer Clause 21.1) Including data as per Appendix D1 & D2

1. Type of impregnation flood/vacuum

2. Class of insulation of varnish used.

3. Specification of lead wire.

4. Name the tests conducted on winding enamel wire as per IS: 13778 - Pt. 1 to 6.

5. Name the tests which are conducted for reliability of the winding etc.

6. Material specification of brazing in the brazed rotors.

7. Method of cable entry.

8. Method of bringing lead wire from winding wire to the terminal block.

9. Terminal Block material.

10. Name the tests which have been conducted for reliability etc.

    a) Shock pulse tester during manufacturing stage e.g.

    b) Surge tester

    c) High voltage test.

    d) Test on winding wires.

    e) Tests on insulating materials.

APPENDIX - D4

DATA TO BE FURNISHED AFTER SUCCESSFUL TESTING OF PROTOTYPE (Refer Clause 21.1)

(Include data as per Appendix D1, D2, D3)

1. Complete type test results as per Appendix 'C' with full calculation detail in Triplicate of the following -

   a) No load test curve.
   b) Load, efficienc, slip, curves.
   c) Speed torque characteristics.
   d) Starting torque and starting current.

2. Detailed drawings with dimensions of the motor in duplicate of the following :-

   a) Cross section of the motor
   b) Longitudinal Section of the motor
   c) Longitudinal and cross sectional drawing of the Rotors.
   d) Terminal Box including items 7,8,9 of Appendix D3

   e) Bearing mounting arrangement showing clearly method of gripping in the housing and class of tolerances adopted between shaft and inner race and between housing and outer race of the bearing.

   f) Shaft drawing showing dimensional tolerances at the various cross sections.

   g) Winding diagram showing all the winding details on the drawing itself.

   h) Slot cross sectional drawing with winding wires in position.

3. Bearing life calculation sheet and shaft strength calculation.

4. Detailed maintenance and overhaul instruction booklet.

APPENDIX 'E'

GUIDELINES FOR INSPECTORS

1. Three aspects are to be covered :

i) Inspecting and testing of motors offered for inspection.

ii) Inspection of rocords in regard to interval tests conducted by the manufacturers on the motors at various stages as well as tests on components and materials used on the motors such as winding wires, varnishes, bearings, etc. Spot check of some of the facilities and test data obtained.

iii) Random check of manufacturing process at various stages of any motors ordered to this specification in the process of manufacture. This may include shafts, housing, windings, etc. not necessarily related to the motors put up for inspection.

2. Results of tests should be on standard proforma Appendix (C) to this Specification is a typical proforma but this can be modified if required in consultation with manufacturers. The results recorded should be shown against the specified values and the Inspectors should clearly certify acceptability against each.

3. Apart from above tests, the succeeding clauses, from 1.0 onwards, of this annexure indicate the checks/ inspection to be done on the motors under assembly.

(Appendix 'E' contd...)

1.0 The following points shall be jointly checked/inspected by the motor manufacturers and the Railway Inspector during the prototype tests/routine inspections. Points marked in astrick (**) are for routine inspection.

** .1 Record the type of motor and its name plate rating particulars.

** .2 Check for identification plate for direction of rotation of the motor. Instruction plate regarding grease may be checked.

** .3 Provision of lifting hooks.

** .4 Dismantling and assembly procedure of the motor. (Report any difficulty likely to be encountered during routine test).

** .5 Report any deviations observed in the motor during routine test when compared to type tests results.

2.0 MECHANICAL ITEMS

2.1 Shaft

** .1 Material used supported by certificate from the manufacturers regarding chemical composition and physical properties.

.2 Surface finish at the bearing seats. This should be ground finish.

.3 Check for Fillet and shoulder heights. These should be as per SKF Bearing catelogue.

** .4 Tolerances on the bearing seats shall be within the specified limits indicated by motor manufacturer.

.5 Check the key/key way, shaft for the dimensions. The dimensional tolerance - these components shall, if not specified be within the IS:1231:1974 limits.

2.2 Bearing Housing

2.2.1 Check for dimensional tolerance. Ovality and taper shoud be recorded for both the bearing housings and this should be within the specified limits of SKF/FAG

2.2.2 Parallelism of motor base with respect to shaft axis

i) Complete motor should be placed on a surface plate. Ensure that the legs of the motor are in

the plane of surface plate. Check for correct machining of motor base by putting feeler gauge in between legs and surface plate.

ii) Check frame size of the motor. Frame size is the vertical height of the shaft axis from the base. The maximum deviation permissible in this dimension is + 0.25 mm.

2.3 Bearings -

** i) Check radial clearances on the bearing in assembled condition with the help of feeler gauge.

** ii) When the bearings are dismantled, check for initial radial clearanced. These shall be within the specified limits.

** iii) When the motor is working, check for any abnormal sound with shock pulse motor.

iv) Check bearing housings/shaft for required tolerances during manufacture stage.

2.4 Lubrication

i) Liberal size of lubrication pipe diameter shall be adopted. Accessibility of grease nipple for lubrication may be checked.

ii) Ensure that the grease outlet for old grease to come out has been provided.

iii) Check the bearing inner covers to ensure that number of groove for sealing lubricant are as per this specification. Measure clearance between the shaft and the inner bearing inner cover diameter. This shall be as per limits laid down by the motor manufacturers. The grease pipe arrangement shall be preferably on the bearing outer cover, with old grease outlet cover provided.

iv) Check for quality of grease and regreasing intervals.

2.5 TERMINAL BOX

These should be glass reinforced Epoxy moulded type as specified in the specification. On one per cent of terminal blocks conduct 100 operations of tightening and loosening and ensure that there is no loosening in inserts.

3.1 Earthing Terminal

Check for provision of earthing terminal.

3.2 Insulation

i) Epoxy glassa moulded slot linear shall be used for slot closure.

ii) Obtain internal test report from the manufacturer regarding quality of insulation materials.

iii) Obtain necessary test certificate of supplier of insulating materials.

3.3 Winding Wires

Conduct following checks -

** i) Cut through test, heat shock test, jerk test on some of the samples may be got conducted by the inspector (Railways) in his presence. Any defects etc. may be reported.

ii) Check for suitability of winding wires used based on manufacturer's internal test report.

3.4 Varnish and Varnishing Procedure

Record the following -

i) Type of varnish used.

ii) No. of impregnating cycles, curing temperature cycles during each stage.

iii) Viscosity check on varnish.

iv) Provision of epoxy Gel coating as per recommended procedure.

v) Compatibility test. (Pencil hardness test may be got done by Railways' Inspector in the Manufacturers works)

vi) Certificate from the manufacturers regarding use of specified type of enamel of the winding wire shall be obtained from motor manufacturer.

3.6 Routine Tests

The various performance parameters observed shall be statistically evaluated for first ten motors and limits of + 26 for satisfactory performance of motors for future lots shall be laid down jointly by RDSO and motor manufacturer.

4817672/2026/O/o WM/Design/DMW/PTA SN 802 A

GOVERNMENT OF INDIA
MINISTRY OF RAILWAYS
RESEARCH DESIGNS & STANDARDS ORGANISATION
Manak Nagar, Lucknow-226011
FAX (0522) - 450374

No.EL/3.2.176.1 Dated 30.6.2000

4-7

Chief Electrical Engineer,
- Central Rly., Mumbai CST-400 001
- Eastern Rly., Fairlie Place, Calcutta-700 001
- Northern Railway, Baroda House, New Delhi-110 001
- Southern Railway, Park Town, Chennai 600 003
- South Central Railway, Secunderabad 500 071
- South Eastern Railway, Garden Reach, Calcutta-700043
- Western Railway, Churchgate, Mumbai 400 020.
- Chittaranjan Locomotive Works, Cjittaranjan 713 331

AMENDMENT NO. 1

Sub: Amendment in the specification No. E-10/3/09 (note) of August 97 Issued vide RDSO's letter of even number dated 27.8.99 for 3-Phase Induction motors used for driving blowers compressors and pumps for 3 phase drive Electric Locomotives.

The following clauses of above mentioned specification are being amended and details are furnished in the Annexure.

Clause 4.1, 9.1,9.3, 9.4 (iii) & (iv) 9.4.1., 9.4.2, 10.1, 11.1, 12.1, 14.1, 15.1, 18.1, 19.6, 19.6.6,19.6.7.1 Appendix A&B, Appendix D1, Appendix E 1,2,2.2,2.3,3.2, 3.4.

Rajan Kumar
(R K Kulshrestha)
For Director General (Elec.)

Encl: As above.

Copy to:

Secretary (Electric Traction), Railway Board, Rail Bhawan, New Delhi 110 001 (Kind Attn: Sri Kul Bhushan, EDEE/Dev.) – for information please.

Rajan Kumar
(R K Kulshrestha)
For Director General (Elec.)

Copy to: Motors, Compressors, Blowers and Pumps manufacturers for information and necessary action please.

Rajan Kumar
(R K Kulshrestha)
For Director General (Elec.)

Encl: As above

4.7.2000

C/C

AMENDMENT TO FOLLOWING CLAUSES MAY BE INCORPORATED

4.1 Following changes shall be incorporated to the different types of blower motors.

4. Scavenge blower motor for Traction Motor Cooling Blower and Oil Cooler Blower :

(i) Rating of motor changed from 2.2kW to 3.0 kW, 2 Pole.
(ii) Other parameters unchanged.

7. Machine Room Blower Motor:

(i) Rating of motor changed from 2.6 kW to 3.0 kW.
(ii) Supply Voltage : Single phase at 415+10% from the auxiliary winding of -24%
the transformer directly.
(iii) Capacitor connection : Sleinmetz type 67 microfarad (900V) during start.
22 microfarad during run.
(iv) Other parameters unchanged.

7.2 Following changes shall be incorporated :

MVMT, Oil Cooler Blower (MVRH) : (i) Other parameters unchanged.
MR Blower motor : (ii) Oil cooler blower motor will be vertically foot mounted type on a stool.

8. Scavenge blower motor for machine room blower :

(i) rating of the motor unchanged, i.e, 0.75 kW, 3000RPM
(ii) Supply voltage – single phase at 415 +10% from the auxiliary winding of the -24%
transformer directly.
(iii) Capacitor connection steinmetz type : 22 microfarad during start.
22 microfarad during run.
(iv) Other parameters unchanged.

9.0 Stator construction

9.1 Following line may be added before start of the paragraph 9.1 existing:

'Cold rolled M45 grade, CRNGO low loss type both side insulated stamping should be used in the stator construction. The stator winding.... In them. (will remain the same i.e. no change).

9.2 Rotor Construction :

Cold rolled M45 grade, CRNGO, low loss type both side insulated steel stamping should be used in the rotor construction. Rotor should be pressure die cast and

dynamically balanced to the grade G2.5 of ISO 1940-1973 or IS 11723-1985. Rotor should also be balanced along with motor cooling fan and blower impellers to reduce vibration level. Rotor shall be pressure die cast of aluminium alloy and free from porosity, discontinuity and cracks at the junction of rotor bars and end rings.

9.4 Bearings:

The bearing size to be adopted shall be in general conformity with Appendix 'B'(Revised) – other details remain same..

Para (I) & (ii) no change.

(iii) Only imported SKF & FAG make bearings of European origin and NSK/Japan makes of bearings shall be used. However, indigenous SKF/FAG bearings may also be used for motors having rating from 0.75 Kw to 3.0 KW

(iv) Sealed or semi sealed bearing shall not be used for any motors. Only open type bearings shall be used with grease inlet and outlet arrangement.

9.4.1 Following additional line may be added in the end of para :

"Interference fit 'K5' between inner bore of bearing and shaft diameter and interference fit "J6" between outer racer of the bearing and end shield bearing housing bore".

9..4.2 Following additional line may be added in the end of para :

Only Servogem RR3 grease shall be used in all the bearings for all types of motors.

10.0 Ventilating Fans :

10.1 Ventilating fans shall be either steel fabricated or cast steel or Aluminium alloy. Fan should be balanced along with the rotor of the motor. Correct fit and tolerances should be followed while fitting motor fan on shaft to avoid looseness in service.

11.0 Winding Wires :

11.1 The following types of winding wires may be used:

Dual coated enamelled winding wires as per IS 13730-Part 13/1993. Dual coat means that base coat with polyesterimide enamel terebec MT 533.39A/Terebec TR 543.38 and top coat with Allotherm 602L-35S/602L-31S of M/s Schenectady Beck India Ltd.

The enamel thickness shall comply with IS 13730 Pt. 0 Section M (I) and (ii) Tan delta bending point value (deg. C) will be 180-195 and tan delta single point value will be 0.015 to 0.03 at 200 deg.C.

11.2 No change.

12 IMPREGNATION :

12.2 Vacuum pressure impregnation (VPI) process shall preferably be adopted with impregnating varnish Dobeckon FT 2015/2005/500 EK of Schenectady Beck India Ltd.

14.0 **SLOT/INTERPHASE INSULATION** :

14.1 Nomex 410 – Kapton – Nomex 410 (with calendered Nomex) or Nomex 418 shall be used for slot liner and wedge separator uncalandered Nomex 411-Kapton-Nomex 411 shall be used for inter layer and interphase insulation. Epoxy..... used. (Other details unchanged)

The materials used and insulation system as a whole shall correspond to class 180 degree, i.e. all motors used on Electric Locomotives will be class 'H'.

15.0 Temperature Rise :

15.1 Changed as follows:

Temperature rise of the stator winding above ambient of 65 deg. C during continuous duty at rated output at all voltages (i.e. 373V to 457V), shall not exceed 80 deg. C with the use of Class H insulating material.

18.1 Following additional parameter should be included:

"On the stator and rotor body at suitable place stator serial number, Rotor Serial Number. along with month and year of manufacture by engraving/embossing may be provided, which may last long.

(k) Servogem RR3 of M/s IOC, with quantity and greasing interval.

19.6 Measurement of "Noise Level" may be included in the list of type test.

19.6.6 Following changes may be incorporated :

Efficiency of the motors having rating of 0.75 Kw and 3 Kw shall not be less than 67% and 80% respectively.

Other parameters are unchanged.

APPENDIX – A

Frame sizes and outputs of motors currently in us

Application	Size of Frame	Speed syncro-Nous	Continuous rating out-put KW/HP	Type of enclos-ures.	Class of insulation
TM blower motor	200L	3000	25/34	TESC	H
Oil cooler blower motor	200 L	3000	25/34*	TESC	H
Scavenge Blower Motor For TM blower + Oil Cooler.	100 L	3000	3.0/4.0	TEFC	H
Machine room blower motor	132 M	3000	3.0/4.0	TESC	H
Scavange blower motor For machine room blower.	90L	3000	0.75/1.0	TEFC	H
Converter oil pump motor	112M	3000	11/15	TESC	H
Ttransformer oil pump motor	112M	3000	4.7/6.4	TESC	H
Main compressor motor	200L	750/1000	15/20.4	TESC	H

TESC – Totally enclosed surface cooled.

TEFC – Totally enclosed fan cooled.

* Can be uprated based on requirement of blower.

APPENDIX – B

BEARING DESIGN DETAILS OF AUXILIARY MOTORS

Sl. No.	Name of motor	Bearing type	
		Non-driving end	Drive end
1.	TM Blower motor	6312	6312
2.	Oil cooler blower motor	6312	6312
3.	Machine room blower motor	6208	6208
5.	Scavenge blower motor for TM blower + oil cooler.	6206	6206
5.	Scavenge blower motor for machine room blower.	6205	6205
6.	Transformer oil pump motor	6306	4306 A
7.	Converter oil pump motor	6306	-do-
8.	Main compressor motor	6312	6312

The complete bearing design including following shall be worked out by motor manufacturers in consultation with RDSO and bearing manufacturers, e.g., FAG/SKF.

i) Interference between shaft and inner race.
ii) Interference between housing and bearing outer race.
iii) Radial clearance.
iv) Fillet dimensions and shoulder height.
v) Preload-design of bearing.

AMENDMENT TO APPENDIX D1

Following additional points may be incorporated :

Further to point 23,

24. List of sources for major items used like winding wires, insulation and bearing etc. shall be furnished by the suppliers. It should be inline with RDSO SMI No. RDSO/ELRS/SMI/185 of Feb 97 and its amendment 1,2,3, 4,5&6.

25. Quality Assurance Plan being followed by manufacturers of these motors shall be furnished to RDSO for approval.

4817672/2026/O/o WM/Design/DMW/PTA

AMENDMENT TO APPENDIX – E

~~Guide lines for Inspectors~~

Para 1.2 and 3 – No change.
Pra 1.0, 1.1 to 1.5 – No change.

1.6 Check for rotor number, stator number and year of manufacture.

1.7 Rotor should be constructed from the cold rolled steel M45 grade, CRNGO type.

1.8 Rotor should by dynamically balanced to balancing quality grade of G2.5 to ISO 1940-1973 or IS 11723-1985.

1.9 Rotor should be pressure die cast and rotor bars should be free from porosity, blow holes discontinuity, cracks at the junction of the rotor and end rings. Out of 50 rotors, one rotor should go for X-ray test.

1.10 Motor manufacturers shall maintain the records for the points mentioned under Para 1.7, 1.8, 1.9. Railway Inspectors may check the record during routine inspection.

2.1 Shaft

2.1.1 Material ....properties – (No change). Shaft material should be of En 24 Steel. Ultra sound test should be conducted for checking the healthiness of shaft.

2.3 Bearings :

Following additional items may also be checked :

(v) Check the record of motor manufacturers for measuring boundary dimension, radial clearance, interference between rotor shaft and inner bore of bearing and between out racer diameter and bore of end ring. It should be preferably k5 and J6 respectively for all types of bearings.

(vi) Bearing should be used in line with para 9.4 of this specification. Check the record for the receipt of imported bearings.

(vii) Only 'Servogem RR3' should be filled in all the bearings of all types of motors.

(viii) Check that all motors are fitted with open type bearings with grease inlet and for the outlet facility and grease pocket.

(ix) Maintain the record of above parameters which should be shown to inspecting authority at the time of inspection.

3.2 Insulation :

i) Epoxy glass laminate shall be used for slot closure.

ii) Obtain internal test report from the manufacturers regarding the quality of insulating materials used in the motor viz., slot liner, interphase separator, dual coat enamelled winding wires, insulating sleeves and connecting lead wires.

iii) Obtain necessary test certificates of suppliers for the following insulating materials. The supplies should be RDSO approved and as per RDSO SMI No. ELRS/185 and its amendments.

(a) Slot Liner : Nomex 410-Kapton-Nomex 410 (NKN as per IEC 626-3).
(b) Inter phase separator – Nomex 411-Kapton-Nomex 411 (NKN)
(c) Sleeves type 1/180 Tb as per BS 2848-1973. Thickness of wall should be 0.9 mm and BDV should not be less than 5.0 KV for 1 minute.
(d) Connecting lead should be used as per RDSO approved suppliers. Check the record.
(e) All the input materials used for insulation shall be as per RDSO approved suppliers list. Purchase certificate and test certificate should be available with motor manufacturers.

3.3 Winding Wires :

(i)
& (ii) – No change.

Following new sub-para may be added :

(iii) Dual coat wires and double glass covered enamelled copper conductor should be procured from RDSO approved sources. Check the purchase records.

3.4 Varnish & Varnishing Procedure :

From (I) to (vi) – No change.

Following additional para may be included :

(vii) Varnish Debeckon FT2015 or 2005/500 EK of M/s Schenectady Beck India Ltd. should be used.
(viii) Level of vacuum followed during impregnation shall be recorded in the record register.
(ix) VPI plant should have facility of N2 gas for compressing the varnish on the return period . Similarly, plant should have chilling facility.

802 A/S

3.5 Terminal Leads :

(i)to (ii) – No change

(iv) May be modified as follows:

Insulation of terminal leads shall be as per specification (Clause 8.3.1) and should be procured from RDSO approved sources. Check the records for the procurement from approved sources.

(v) Check for terminal block conforms to RDSO SKEL 2754A and 2784A.

3.6 Routine Test :

Limit of ± 26 may be read as limit of ± 2 sigma.

Page 17 :

Note: Clause 3.7 should be replaced by Clause 3.6 and thus there will be no Clause 3.7 in Appendix 'E'.

4817672/2026/O/o WM/Design/DMW/PTA

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Government of India – Ministry of Railways
Research, Designs & Standards Organization, LUCKNOW - 226011

No. EL/3.2.176/1

Dated 16.6.2003

Distribution as per enclosed list.

Amendment No. 2

Sub: RDSO Specficiation No. **E-10/3/09 (motor) of Aug. 97** - Technical Specification and Test Schedule for Single Phase/Three Phase Induction Motors for driving blowers, compressors and pumps for 3-Phase Drive Electric Locomotives.

Ref: RDSO Specification No. E-10/3/09(motor) of Aug., 1997 issued to Railways vide RDSO letter of even number dated 27.8.97 and Amendment No. 1 dated 30.6.2000.

The following clauses of above Specification are being amended:

1. Clause No. 4.1
2. Clause No. 7.2
3. Clause No. 15.1
4. Clause No. 19.6.7.1
5. Appendix A
6. Appendix B

Replaced clauses are given below:

100724

1. Clause No. 4.1:

The supply to the auxiliary motors (except Sr. No. (g) and (h) below) is from VVVF PWM auxiliary converter. The details of the Auxiliary converter supply are as under:

i) Supply waveform	: Quasi-square wave
ii) Voltage	: 415 ± 10%, 3 Phase
iii) Harmonics in voltage	: 50%
iv) Harmonics in current	: 50%
v) dv/dt	: Less than 1000 V/micro sec.
vi) Frequency	: Varies in three steps 24 Hz, 37 Hz and 50 Hz.

Nominal rated voltage and frequency for different auxiliary motors are as under:

a) Traction Motor Blower Motor b) Oil Cooler Blower Motor c) Scavange Blower Motor for Traction Motor Blower + Oil Cooler Blower.	Rated voltage – 3 phase 415V ± 10% Frequency varies in three steps 24 Hz,37Hz and 50Hz with 50Hz corresponding to rated Voltage.
d) Transformer Oil Pump Motor e) Converter Oil Pump Motors f) Compressor Motor	Rated voltage – 3 Phase 415V ± 10% Frequency 50Hz.
g) Machine Room Blower Motor h) Scavenge Blower Motor for Machine Room Blower.	Rated voltage – Single Phase 415V from the aux. Winding of the transformer directly. Voltage variation : 415V +10%, -24% (Both motors shall have the winding like 3-Phase Induction motor.The motor will run as single phase motor capacitor connected in Steinmetz connection. Capacitor - 67 microfarad (900V) during start and 22 microfarad during run for Machine Room Blower Motor. 22 microfarad (900V) during start and during run for Scavenge Blower Motor for MR Blower.

2. **Clause 7.2 :**

The type of mounting shall be adopted as follows for different applications:

TM Blower Motor Oil Cooling Blower Motor MR Blower Motor	Vertically mounted with three supports at 120° apart.
Scavange blower motor for MR Scavange blower motor for TM+ Oil Cooler	Foot mounted horizontally.
Compressor Motor	Horizontally foot mounted (foot upward) (Compressor motor set is suspended at three point support).
Transformer oil pump	Horizontally foot mounted
Converter Oil Pump	Vertically flange mounted.

100725

3. **Clause 15.1 :**

The maximum allowable temperature rise of stator winding with dual coat wire and class H insulation shall not exceed the following limit when operating at continuous rated out put above ambient temperature of 65 ° C at all voltages (373V to 457V)

- With converter supply voltage: 80 °C
- With sinusoidal 50Hz supply voltage: 70 °C

4. **Clause 19.6.7.1:**

The following Note below Para (iii) to be deleted.

"Maximum allowable ..... insulating material."

5. **APPENDIX-A**

FRAME SIZES AND OUTPUTS OF MOTORS CURRENTLY IN USE

Application	Size of the frame	Speed synchronous	Continuous rating output kW/HP	Type of enclosures	Class of insulation
TM blower motor	200L	3000	25/34	TESC	H
Oil cooler blower motor	200L	3000	25/34*	TESC	H
Scavenge blower motor (TM+ Oil Cooler blower)	100L	3000	3/4	TEFC	H
Machine room blower motor	132M	3000	3/4	TESC	H
Scavenge blower motor for machine room blower	90L	3000	0.75/1.0	TEFC	H
Converter oil pump motor	112M	3000	11/15	TESC	H
Transformer oil pump motor	112M	3000	4.7/6.4	TESC	H
Main compressor motor	200L 200L 160L	750 1000 1500	15/20.4 15/20.4 15/20.4	TESC TESC TESC	H H H

TESC – Totally enclosed surface cooled.
TEFC - Totally enclosed fan cooled.
* Can be updated based on requirement of blower.

6. **APPENDIX-B**

BEARING DESIGN DETAILS OF AUXILIARY MOTORS

Sl. No.	Name of Motor	Bearing type	
		Non-Driving End	**Driving End**
1.	TM blower motor	6312	6312
2.	Oil cooler blower motor	6312	6312
3.	Scavenge blower motor (TM+ Oil Cooler blower)	6206	6206
4.	Machine room blower motor	6208	6208
5.	Scavenge blower motor for machine room blower	6205	6205
6.	Converter oil pump motor	6306	4306A
7.	Transformer oil pump motor	6306	4306A
8	Main compressor motor 200L 160L	 6312 6209	 6312 6209

The complete bearing design including following, shall be worked out by motor manufacturers in consultation with RDSO and bearing manufacturers, e.g. FAG/SKF.

i) Interference between shaft and inner race.
ii) Interference between housing and bearing outer.
iii) Radial clearance.
iv) Fillet dimensions and shoulder height.
v) Pre-load –design of bearing.

All other clauses of the Specification shall remain unaltered.

100727

16/6/2003

(M K Singhal)
for Director General (Elec)

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Government of India - Ministry of Railways
Research, Designs & Standards Organization, LUCKNOW - 226011

EL/3.2.176/1

Date: 28/01/2009

Chief Electrical Engineers,

1. Central Railway, CST Mumbai-400 001
2. Northern Railway, Baroda House, New Delhi-110 001
3. Eastern Railway, Fairlie Palace, Kolkata-700 001
4. Southern Railway, Park Town, Chennai-600 003
5. South Central Railway, Secunderabad-500 071
6. Western Railway, Church Gate, Mumbai-400 020
7. South Eastern Railway, Garden Reach, Kolkata-700 043
8. East coast Railway, Chandrashekharpur, Bhubneshwar-751 016
9. North Central Railway, Hastings Road, Allahabad – 211 001
10. East Central Railway, Hazipur – 844 101
11. West Central Railway, Jabalpur – 482 001
12. South East Central Railway, Bilaspur – 495 004
13. South Western Railway, Hubli
14. North Western Railway, Jaipur – 302 006
15. Chittaranjan Locomotive Works, Chittaranjan

Sub: Amendment No. 03 to RDSO's Specification No. E-10/3/09(Motor) of August'1997 for Single phase/three phase induction motors for Driving Blowers, Compressors and pumps for Three Phase Drive Electric Locomotives.

Clause number 11.0 of RDSO's Specification No: E-10/3/09(Motor) is amendment as under.

11.0 WINDING WIRES:

11.1 For Machine Room Blower Motor and Scavenge Blower Motor for Machine Room Blower following type of winding wire shall be used

i. Dual coated enameled copper winding wire as per IS 13730-Part 13 of 1993 of appropriate size shall be used. Dual coat means that the base coat with Polyesterimide enamel Terebec MT 533.39A/Terebec TR 543.38 and Top coat with Allotherm 602L-35S/602L-31S of M/s Schenectady Beck India Ltd now called Elantas Beck India Ltd.

ii. The enamel thickness shall comply with IS 13730 Pt 0 Section M (i) & (ii) Tan delta bending point value (deg C) will be 180-195 and Tan delta single point value will be 0.015 to 0.03 at 200 deg C.

iii. The test of enameled winding wires shall be conducted as per IS:13778 Pt 1 to 6. Separate documentation for these tests shall be maintained by the manufacturers, indicating the winding wire supply particulars.

iv. The winding wire shall be procured from the vendors approved by RDSO and appearing in latest RDSO's List of Approved suppliers' EL/M/0023.

v. Alternatively, Kapton covered enameled winding wire confirming to IS 11395-1985 may also be used.

11.2 **For converter fed motors** i.e. Oil Cooling Blower Motor, Traction Motor Blower Motor, Main Compressor Motor, Scavenge Blower Motor for TM Blower and Oil Cooling Blower, Transformer Oil Pump Motor and Convertor Oil Pump Motor following type of winding wire shall be used.

i. Corona resistant enameled copper winding wire of appropriate size shall be used. So far, the wire is available from M/s Pearl Insulation Pvt Ltd, Peenya Industrial Area, Bangalore-560 058 as per following description:-

"Thermax 200CR type round enameled winding wire"

ii. The wire shall meet all standards and testing requirements of IS 13730 Pt 13 (1993). In addition, Voltage Endurance Test as mentioned below shall be carried out on the prototype wire-

Voltage endurance Test

10 samples are to be prepared as per Clause 13.0 of IS 13730 (Pt 0/Sec 1) and IS 13778 Pt 5 and subjected to voltage of 2 KV at 50 Hz at room temperature and maintained till break down occurs. At least 8 samples shall withstand for 75 hours without break down. The Break down Voltage shall be measured as per Clause 4.0 of IS 13778 Pt 5:1993.

iii. Efforts are being made to develop detailed specification and further sources for this wire. Railways/manufacturers shall be advised regarding the development in due course. However, Railways/manufacturers are also advised to refer to latest Master list of approved vendors from time to time for approved sources for this wire.

Encl: Nil

(Ishaq Khan)
For Director General Stds (Electrical)

Copy to:

1. Secretary (Electrical), Railway Board, Rail Bhawan, New Delhi-01.
(Kind attention Sri Mohit Chandra, DEE/RS)-For information please.

2. Motor, compressors, Blowers and Pump manufacturers for information and necessary action please.

Encl: Nil

(Ishaq Khan)
For Director General Stds (Electrical)

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Government of India - Ministry of Railways
Research, Designs & Standards Organization, LUCKNOW - 226011

EL/3.2.176/1

Date: 20/10/2009

Chief Electrical Engineers,

1. Central Railway, Mumbai CST -400 001
2. East Central Railway, Hazipur – 844 101
3. East coast Railway, Chandrashekharpur, Bhubneshwar-751 016
4. Eastern Railway, Fairlie Palace, Kolkata-700 001
5. North Central Railway, Subedarganj, Allahabad – 211 033
6. Northern Railway, Baroda House, New Delhi-110 001
7. South Central Railway, Secunderabad-500 071
8. South East Central Railway, Bilaspur – 495 004
9. South Eastern Railway, Garden Reach, Kolkata-700 043
10. Southern Railway, Park Town, Chennai-600 003
11. West Central Railway, Jabalpur – 482 001
12. Western Railway, Church Gate, Mumbai-400 020

Sub: **Amendment No 04** to Specification no E-10/3/09(Motor)-August 1997 for auxiliary motors of 3 phase locomotives.

Railways have been reporting premature failures of bearing no 4306 provided on DE side of indigenously developed Oil pump for SR of three phase locomotives. RDSO has studied the problem in consultation with indigenous oil pump manufacturers and decided to change the bearing type. Accordingly following amendment to RDSO specification no E-10/3/09(Motor)-August 1997 for auxiliary motors for change of bearing is issued herewith.

"Appendix-B to specification:

For converter oil pump DE side bearing should be replaced with 3306A (metallic cage, SKF/FAG make only, imported) against existing 4306A mentioned."

This is for your information and necessary action accordingly please.

(Ishaq Khan)
For Director General Stds (Elect)

Copy to:

1. **Secretary (Electrical), Railway Board**, Rail Bhawan, New delhi-01: for kind information please.
2. **All motor and pump manufacturers**: for information and necessary action please. They should implement the amendment in new manufacture with immediate effect.

(Ishaq Khan)
For Director General Stds (Elect)

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EL/3.2.176/2

Date: 21/05/2010

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11. West Central Railway, Jabalpur – 482 001
12. Western Railway, Church Gate, Mumbai-400 020
13. Chittaranjan Locomotive Works, Chittaranjan -713331 (WB)

Sub: **Amendment No 05** to Specification no E-10/3/09(Motor)-August 1997 for auxiliary motors of 3 phase locomotives.

After detailed study, RDSO has decided to revise the rating of oil cooler blower motor of three phase locos from 25 KW to 30 KW. Accordingly following amendment to RDSO specification no E-10/3/09(Motor)-August 1997 for auxiliary motors of 3 phase locomotives is issued with immediate effect.

"Appendix-A to specification:

Continuous rating of oil cooler blower motor should be read as 30 KW."

This is for your information and necessary action accordingly please.

(Ishaq Khan)
For Director General Stds (Elect)

Copy to:

1. **Secretary (Electrical), Railway Board**, Rail Bhawan, New Delhi-01: for kind information please.
2. **All motor and blower manufacturers (as per list)**: for information and necessary action please.

(Ishaq Khan)
For Director General Stds (Elect)

4817672/2026/O/o WM/Design/DMW/PTA

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No. EL/3.2.176/1 **Dated**: 22/12/2021

Principal Chief Electrical Engineer,

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6. South East Central Railway, Bilaspur- 495 004
7. Eastern Railway, Fairlie Place, Kolkata-700 001
8. South Eastern Railway, Garden Reach, Kolkata-700 043
9. North Central Railway, Subedarganj, Allahabad-211 033
10. Southern Railway, Park Town, Chennai-600 003
11. Northern Railway, Baroda House, New Delhi-110 001
12. South Western Railway, Hubli-580 024
13. North Eastern Railway, Gorakhpur-273001
14. West Central Railway, Jabalpur-482 001
15. North East Frontier Railway, Maligaon, Guwahati-781 011
16. Western Railway, Churchgate, Mumbai-400 020
17. Banaras Locomotive Works, Varanasi-221 004
18. Chittaranjan Locomotive Works, Chittaranjan-713 331
19. Diesel Loco Modernisation Works, Patiala-147 003

Sub: Amendment No. 06 to Specification no. E-10/3/09/(Motor)-August 1997 for auxiliary motors of 3-phase locomotives.

As per Railway Board's decision on recommendation of 39th MSG (Electric Loco) meeting held at Ajni, Central Railway on 14th& 15th Oct'2019, it was decided that 3-phase motors rewound with corona wire shall be used for MRB & MRS and it will be fed from BUR-2. Accordingly, following amendment to RDSO Specification no. E-10/3/09/ (Motor) - August 1997 for auxiliary motors of 3- phase locomotives is issued.

(A) Amendment no. 02 to RDSO specification no.E-10/3/09/ (Motor)-August 1997;

Clause no. 4.1:

1. The text "(except Sr. No. (g) and (h) below)" is deleted.
2. Technical details of (g) & (h) is replaced with

(g) Machine Room Blower Motor: Rated voltage – 3 Phase, 415 V± 10%, Frequency 50Hz

(h) Scavenge Blower Motor for Machine Room Blower: Rated voltage - 3 Phase, 415 V± 10%, Frequency 50Hz

(B) Amendment no. 03 to RDSO specification no.E-10/3/09/ (Motor)-August 1997;

1. Clause no. 11.1 is deleted.
2. Clause no. 11.2: This clause shall be read as Clause 11.1.

4817672/2026/O/o WM/Design/DMW/PTA

The Para "For converter fed motors .....shall be used." is replaced with

"All converter fed motors i.e. Oil Cooling Blower Motor, Traction Motor Blower Motor, Main Compressor Motor, Scavenge Blower Motor for TM Blower and Oil Cooling Blower, Transformer Oil Pump Motor, Convertor Oil Pump Motor, **Machine Room Blower Motor** & **Scavenge Blower Motor for Machine Room Blower** following type of winding wire shall be used."

The sub clause (i) & (ii) remain unaltered.

The sub clause (iii) is deleted.

This is for information and necessary action please.

ARVIND PANDEY Digitally signed by ARVIND PANDEY Date: 2021.12.22 16:13:09 +05'30'

(Arvind Pandey)
for Director General Std. / Electrical

Encl: Nil

Copy to:

1. Secretary (Electrical), Railway Board, Rail Bhavan, New Delhi-110001: for kind information please.
2. Motor, Compressors, Blowers and Pump manufacturers: for information and necessary action please.

ARVIND PANDEY Digitally signed by ARVIND PANDEY Date: 2021.12.22 16:13:46 +05'30'

(Arvind Pandey)
for Director General Std. / Electrical

Encl: Nil

डी.एम.डब्ल्यु
D.M.W.