

TENDER SPECIFICATION NO: CLW/ES/B-14

Alt.	A	B	C						
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This specification supersedes earlier specification no. CLW/ES/B-3 Alt. R

Enclosed drawings/sketches:

1. CLW/ES/SK-1/B-14
2. CLW/ES/SK-2/B-14
3. CLW/ES/SK-3/B-14
4. CLW/ES/SK-4/B-14
5. CLW/ES/SK-5/B-14
6. CLW/ES/SK-6/B-14
7. CLW/ES/SK-7/B-14

SPECIFICATION FOR MOTOR DRIVEN BLOWER
(MVM, MVRH, MVSL, MVSI)
FOR

25 KV A.C. Electric Locomotive
CLASS WAG-7/ WAP-4

Total no. of sheets in this specification:

Alt.	-	A	B	C					
Sheets	6	9	4	6	5	8	5		

ISSUED BY:
Dy. Chief Electrical Engineer / D-I
Chittaranjan Locomotive Works
P.O. Chittaranjan
Distt. Burdwan
West Bengal

Specification for
Motor driven blower.

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DY. CEE. (D)

चिह्नित रूप में प्रेषित कारखाना
चिह्नित संस्था, भारत
CHITTARANJAN LOCOMOTIVE WORKS
WEST BENGAL, INDIA

क्रमांक/NO. CLW/ES/B-14 Alt. A B C
दिनांक/DATE: 06-07-2000

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DETAILS OF ALTERATION

ALT. NO.	DATE	DESCRIPTION	SIGNATURE	REMARKS
A	23-4-2001	<p>i) PROVISION OF DFG WIRE FOR MWM AND MWM MOTOR DELETED</p> <p>ii) T BOX COVER MATERIAL CHANGED TO EPOXY MOULDING</p> <p>iii) SOURCE OF SUPPLIERS FOR WINDING WIRES, INSULATING MATERIALS ETC. REVISED</p> <p>iv) DRG. NO. SK-1 & SK-2 REVISED</p> <p>v) DRG. NO. CLW/ES/SK-7/B-14 FOR CABLE ENTRY ARRANGEMENT ADDED</p> <p>vi) EFFICIENCY FOR MVSU/MVSL MOTORS CONNECTED TO 83%</p> <p>vii) Programme for checks during Routine inspection of motor.</p> <p>viii) Terminal Leads specification changed</p>	<p><i>[Signature]</i> DY.CEE/D-1</p>	<p>VIDE RDSO LETTER NO. EL/227001/28.12.99</p> <p>EL/2248307.9/12.2000</p> <p>EL/227001/23.2000</p> <p>EL/2-2-70</p> <p>BY-10/12-4-2001</p>
B	07/01/2002	<p>i) MINIMUM ESSENTIAL TEST FACILITIES</p> <p>ii) QUALITY ASSURANCE PLAN FOR MANUFACTURING BLOWERS FOR ELECTRIC LOCOMOTIVES.</p> <p>iii) GUIDELINES FOR INSPECTORS DURING ROUTINE TEST OF BLOWER MOTOR SETS.</p>	<p><i>[Signature]</i> DY.CEE/D-1</p>	<p>VIDE RDSO L/NO. TL/73256 DT.28.6.99</p> <p>RDSO GUIDELINE NO. ELAS/PR/0101 OF JUNE 2001.</p>
C	08/07/02	<p>Make of hardware specified.</p> <p>cl. No 3.3.3 and in G.A. dry.</p>	<p><i>[Signature]</i> 8/7/2002</p>	<p>VIDE L/NO. NO. CEE/EL/NO dated 04/07/02</p>

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SPECIFICATION FOR MOTOR
DRIVEN BLOWER

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दिनांक/DATE: 23-4-2001

I N D E X

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 - Part - I - including Appendix 'A'
 - Part - II - Motor specification
 - Annexure I - Rating of the blower/motor.

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Specification for
Motor Driven blower.

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दिनांक/DATE : 06-07-2000

General clauses

1.0 Scope of the contract:

1.1 This specification covers the manufacture and supply of equipments described in Part I & II for installation on the 25 KV Single Phase 50 Hz ac Electric locomotives of the Indian Railways.

2.0 Design and Workmanship.

2.1 The equipment offered shall be

- Simple in design
- Of good workmanship
- Easy for maintenance and operation
- Robust and Rugged in construction.

2.2 Wholly indigenous equipment, if coming up to the standards of this specification, shall be given preference consistent with the reasonableness of the offer.

3.0 Deviation:

3.1 Any deviation from the standards laid down with a view to improving the performance, may be given due consideration provided, full particulars with justification, thereof, are furnished. It may, however, be noted, that due to limited availability of space in the locomotive and the necessity to ensure inter-changeability with the existing equipment increase in the overall and mounting dimensions shall not be allowed normally.

4.0 Documents to accompany tender quotation:

4.1 The tenderer shall inter-alia furnish the following information along with the quotation.

- i) Clause-wise comments on the specification and test programmes.
- ii) List of recommended spares for maintenance of the equipment for two years.
- iii) Technical documents and drawings.
- iv) Sufficient informations to prove that the manufacturer has adequate facilities and capacity to manufacture and test the equipment offered.

Specification for
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- v) Name and address of manufacturers of major components.
vi) Technical data as per Appendix 'A' & '01'.

5.0 Approval of samples:

- 5.1 The supplier shall offer the prototype of the equipments proposed to be supplied by him for inspection and tests at his works and advise the Dy.Chief Electrical Engineer/Design Chittaranjan and RDSO/Lucknow as and when he is ready with the prototype and necessary testing and measuring apparatus.
- 5.2 After the above tests, if it is considered necessary by the Dy.Chief Electrical Engineer(Design) or his authorised representative to carry out any further tests or trials of the prototypes at Chittaranjan the supplier will arrange for the same by the quickest means.
- 5.3 Any short comings or defects in the design and workmanship of the equipment, shall be pointed out after the tests, to enable the manufacturer to incorporate the necessary improvements, before bulk manufacture is commenced without affecting the guaranteed deliveries or guaranteed performance characteristics.
- 5.4 The supplier shall provide all facilities to the inspecting officer at his works, to inspect and test the equipment at various stages of manufacture and also of the complete equipment.
- 5.5 Any testing and approval by the purchaser of the design, working drawing and prototype shall in no way absolve the supplier of his responsibilities under the terms of the contract for the equipment supplied.
- 5.6 The supplier shall not offer any equipments of series production to the inspector authorised under the contract until the prototype has been finally approved.

6.0 Conditions of contract:

- 6.1 The standard I.E.S. conditions of contract will be applicable for the supply of the equipment.
- 7.0 Technical documents and drawing to be furnished by the supplier as part of the contract.
- 7.1 The following drawings and documents shall be supplied by the supplier.

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दिनांक/DATE : 06-07-2000

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I. Type test report of certificate:

This shall be supplied in standard 'A4' size of sheets with punched holes for filing. It shall be suitably enclosed in a cover. Type test reports shall have to be signed both by the suppliers' engineers and CLW's engineers. Ordinarily 10 copies of the report shall be supplied in the format described in Appendix 'C'.

II. Routine test certificate:

This shall be supplied in standard 'A4' size of sheets with punched holes for filing. Routine test certificate shall be submitted along with each individual equipment in 6 copies, where an equipment or apparatus is composed of sub-units, in addition to the overall test certificate for the total assembly, routine test certificates shall be supplied for the individual sub-units also.

III. Maintenance manuals.

Maintenance manuals shall be prepared in standard 'A4' size paper with punched holes for filing. A draft manual shall be submitted in 5 copies within two months of the clearance of the prototype equipment, to the Dy. Chief Electrical Engineer (Design), Chittaranjan Locomotive Works, Chittaranjan, District Burdwan. One copy of the corrected draft shall be returned to the supplier, duly signed by the above officer or his authorised representative.

10(Ten) copies in excess of no. of the eqtpt. supplied of the maintenance manual duly incorporating the corrections shall then be despatched by the supplier to the Dy. Chief Electrical Engineer (Designs) by Registered post, at the same time as the first lot of bulk supply of equipment is despatched.

Technical documents, drawings and details to be furnished by suppliers as part of the maintenance manual wherever applicable.

- 1) A dimensioned drawing of the equipment in 'A4' or 'A3' size as necessary indicating salient features including weight. Separate drawings indicating machining tolerance at bearing seats etc. of rotors of motors.
- 2) Enlarged dimensioned view of the bearings
- 3) Exploded isometric view of the equipment indicating sequence of assembly or disassembly.
- 4) Photograph of the equipment and important components to give an appreciation of these.
- 5) Full technical data as per specification.

Specification for
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- 6) Detailed technical write-up indicating method of working of the equipment, precautions to be taken while working, periodicity of attention to various parts, lubrication details etc.
- 7) Drawings of terminal box indicating cable entry and clamping, sizes of terminals etc.
- 8) Detailed technical particulars, method of working, maintenance attention required and dimensional drawings of any patented or specialized components or equipments used.
- 9) Spare parts catalogue indicating in detail the list of spares, their identification code and recommended spares for 2 years of running maintenance. Where necessary photograph of important spares shall be included.
- 10) Address of suppliers of components or part requiring periodical replacement and not manufactured by the main supplier himself.

IV. Drawings:

Detailed dimensional assembly drawings in twenty (20) copies shall be supplied indicating the constructional features. In the case of rotary equipments like blowers, motors etc. drawings shall without exception be in 'A0' size for each view, viz. Plan, elevation, end-elevation, half elevation etc.

Two sets of the above drawings shall also be supplied in reprintable tracing cloth.

- 8.0 Guarantee: The supplier shall give a guarantee of clear 24 months from date of supply of equipment or a clear 18 months guarantee, on all components, from the date of commissioning of the equipment on the locomotive whichever is earlier and any damage or defect noticed during the period due to defective material or bad workmanship will be replaced by the supplier free of cost. The manufacturer shall arrange to send his Technical Officer for any investigation to the place (anywhere on the Indian Railways) where the equipment will be working on the locomotive and shall submit a report of his investigation together with his proposals for any modification or improvements to the Deputy Chief Electrical Engineer (Design) for approval before commencing the repair works under guarantee.

8.0 Submission of tender quotation:

- 8.1 All tender documents including the quotation shall be submitted in triplicate including any correspondence till a contract is finalised.

Specification for motor driven blower.

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9.2 The tenderer shall give sufficient information to prove that his factory has adequate facilities and capacity to manufacture the equipment, to meet fully the technical requirements of the specification and quality of material and workmanship.

9.3 The tenderers are permitted to quote for alternative designs for the equipment and sub-assemblies. For such deviations full particulars shall be furnished as required in para 3.1

9.4 Quotations shall not be considered complete unless all informations are furnished and are therefore liable to be rejected.

9.5 Quality Assurance Plan

Tenderers should submit their own Quality Assurance Plan (QAP) for this item, otherwise offer is liable to be technically unsuitable.

10.0 Special condition

10.1.1 Once a prototype is approved no contractor shall change his source of supply or sub contractor for purchased components and sub assemblies without CLW's approval.

10.1.2 Complete type test shall be done on the equipment once in every five years to judge the consistency in the material, workmanship and performance of the equipment i.e. the motor as well as the blower motor set of each type.

10.2 Identification:

Blower and motor manufacturers should clearly emboss the following details at suitable visible places on different parts like impeller, casing, hub etc for blower and rotor, stator etc. for motor to assess the performance of various makes and to determine their total life for replacement decision.

- Month and year of manufacturing.
- Serial no.
- Name of manufacturer.

10.3. ISO Certification:

CLW reserves the right to procure the item from ISO certified manufacturers only.

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PART-I

BLOWER

TECHNICAL SPECIFICATION
AND
TEST SCHEDULE
FOR
A.C. 3 PHASE INDUCTION MOTOR DRIVEN
BLOWERS
(CENTRIFUGAL & AXIAL TYPE)
FOR
ELECTRIC LOCOMOTIVE

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दिनांक/DATE: 06-07-2000

0. FOREWORD

- 0.1 The centrifugal and axial flow fans covered by this specification are capable of working against pressure.
- 0.2 In preparing this specification, assistance has been taken from the following specifications:
- IS:4894 - 1983 - Specification for centrifugal fans
 - IS:3588 - 1981 - Electric axial flow fans
 - IS:648 - - Methods of testing fans for general purposes.
- 0.3 This specification contains clauses which call for agreement between the purchaser and the supplier and which requires the manufacturer to supply certain technical informations at the time of submitting tender.
- 0.4 The specification is in two parts, Part I, dealing with blower and part II, dealing with the driving motor, performance requirements and tests on the combined unit are dealt with in part I. Part I shall be read in conjunction with part II.

1. Scope

- 1.1 This standard covers the performance requirements and tests of centrifugal and axial flow fans having impellers directly coupled to ac electric motors fitted in 25 kV ac 50 Hz Electric Locomotives.
- 1.2 Power for driving the auxiliaries is obtained from an auxiliary winding in the main single phase transformer. Single phase supply is converted to 3 phase by an Arno converter and 3 phase squirrel cage induction motor are used.
- 1.3 The following blowers are used in an ac electric locomotives
- traction motor blowers-centrifugal type (VMT)
 - transformer oil cooler blower-centrifugal type (VMO)
 - smoothing reactor blower-axial or parallel flow type. (VSI)
 - Silicon rectifier cooling blowers- axial flow type (VSI)

2. Terminology, Symbols and Units

- 2.1 For the purpose of this specification, the Definitions given in IS:4894, IS:3588, and IS:648 shall apply.

specification for motor
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3. Capacity and rating

- 3.1 Individual ratings of the blowers shall be furnished along with the tender.
- 3.2 Rated output- The rated output of the blower shall correspond to the rated speed of the motor. The output requirement of the blowers at voltage 290V is indicated in Annexure-I.
- 3.3 Starting performance- The blower shall accelerate from stop to the full speed within 6.0 seconds over the entire range of supply voltage under all the service conditions specified in clause 4.4 of part II of this specification.
- 3.4 Tolerances- The tolerance of (-5%) shall be allowed on the air delivery output of the blower & + 10% on the input power to the fan.

4. Service conditions

- 4.1 Ambient temperature- The general ambient temperature of air at the inlet to the blower and the motor will be 5°C - 65°C maximum with humidity varying upto 100% (saturation).
- 4.2 Maximum altitude- 1000 metres above mean sea level.
- 4.3 The equipment and mounting arrangement shall be of robust design for traction duty and shall withstand satisfactorily the vibration 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 - 2.0 g

- 4.3.1 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 equation.

$$a = 25/f \quad \text{for values of } f \text{ from 1 Hz to 10 Hz}$$

$$a = 250/f^2 \quad \text{for values of } f \text{ exceeding 10 Hz & upto 50 Hz}$$

- 4.3.2 In the direction corresponding to the longitudinal movement of the ~~xxxx~~ vehicle, the equipment is subject for 2 minutes 50 Hz vibrations of such a nature that the maximum acceleration is equal to 3% (amplitude $a = 0.3\text{mm}$).

specification in motor
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5. Design and general construction

5.1 Drive and coupling- The fan impeller shall be directly mounted on the motor shaft. In case of cast aluminium impellers, a steel boss of hexagonal shape should be cast integrally with the impeller. The drive may be locked by a key of adequate strength with the impeller in position by a securing bolt and washer at the shaft end. The bolt shall be further locked against unscrewing in service by locking plates. Alternatively, a tapered shaft without a key but with locking arrangement by bolt and locking plate may be used. The impeller mounting arrangement shall be subjected to prior approval by CLW.

5.2 Direction of rotation- An arrow indicating the direction of rotation shall be permanently marked on the blower casing.

5.3 Balancing- The rotor and the blower impeller shall be dynamically balanced individually after coupling. The vibration level shall not exceed the limit specified in sheet No-16. The balancing shall be done as per IS 1940 grade G2.5.

5.4 Mounting arrangement- The mounting arrangement shall be subjected to prior approval by CLW.

5.5 Lifting arrangement- Suitable lifting arrangements for the blower fan and the motor separately and for the complete unit shall be provided. In case of transformer cooling blower the casing shall be so designed that it should be possible to remove the motor with the impeller without dismantling the entire casing.

6. Special constructional features:

6.1 Special manufacturing process- As the blowers operate for long periods at high speeds, the end rings, the impeller blades etc. should be designed with a higher margin of safety as compared to normal industrial design. Non cast impeller shall be fabricated out of high tensile steel of weldable quality of minimum 2.5mm thick conforming to either DQREX 4004 or St-55 HW of IS:6500 or St-52 of IS:1079 or 316LW or stainless steel of grade AISI 304 or any other steel having superior or similar quality for the application of fraction motor cooling blower (MWC), which has been adequately tested to ensure mechanical strength and dimensional uniformity. For transformer oil cooling blower H.S conforming to IS:1079 (Gr.2 or IS:2062 grade A/C or any other steel having superior quality may be used for fabrication of impeller. Casing for blowers should be fabricated from H.S conforming to IS:1079 (Gr.2 or IS:2062 Grade A/C or any other steel having superior quality of minimum 3.1mm thickness. The tenderer should clearly indicate grade of steel used otherwise the tender will be treated as cancelled.

specification for motor
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The cold pressed blades shall be stress relieved. The blades shall be welded but the welded joints will be free from undue stress either by stress relieving or by improved welding techniques. The quality of welding shall also be tested by the purchaser from time to time. Necessary test certificates should be produced as and when required.

6.2 Pocket for mounting air flow relay- A pocket for mounting an air flow relay for minimum air flow protection to be fitted by the Railways shall be provided on the casing on the outlet side of centrifugal blowers and on the inlet side of the axial flow blowers. The dimensions and mounting arrangement will be given by the Railways.

6.3 Traction motor blowers- The casing shall be designed to minimise loss of head and shall not deform during lifting. Suitable guards shall be provided on the inlet side of the blowers to prevent accidental contact with the rotating impeller.

6.4 Transformer oil cooler blower- The construction shall permit the motor with the impeller being withdrawn from the motor side of the involute casing without the need to dismantle the suction side of the casing which is bolted to the transformer oil cooling radiator.

A suitable inspection hole with proper cover shall be provided at the bottom of the discharge duct to facilitate removal of foreign matter. A suitable designed guard shall also be provided at the delivery end.

6.5 Smoothing reactor blower- The mounting arrangement of the blower on the casing shall be properly secured so as to avoid loosening during the vibrations encountered in service. A suitably designed guard shall be provided on the top of the inlet casing.

6.6 Silicon rectifier blower- The mounting arrangement of the blower on the casing shall be properly secured so as to avoid loosening during the vibrations encountered in service.

7. Finish:

7.1 The fan motor, the blades and the casing shall be suitably treated to remove rust and should be coated with an anti-rust primer and finished with two coats of light grey paint as per IS-631 of IS-5. All hardware shall be cadmium plated.

8. Interchangeability:

8.1 The motors, blowers impellers and casings shall be interchangeable such that the performance of the blower is kept within the limits of the standard.

Specification for motor driven blower

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9. Marking plate:

9.1 Each blower shall have indelibly marked on a suitable name plate atleast the following informations:

- | | |
|---|---------------------------------|
| (a) Manufacturer's name, type and serial number | (f) Power consumption in Kw. |
| (b) Air delivery | (g) Impeller diameter |
| (c) Total head at 20°C | (h) Weight |
| (d) Rated speed | (i) Manufacturing date and year |
| (e) Make of the motor | |

10. Technical documents:

10.1 The manufacturer shall supply detailed maintenance instructions as desired by the purchaser.

11. Drawing:

11.1 The drawing (to be given by the purchaser) giving the overall dimensions of the blower shall be supplied with the tender.

12. Data:

12.1 The particulars of the blower set shall be furnished in the data sheet at Appendix 'A'.

13. Tests:

13.1 General-Tests are classified as type and routine tests. Type tests shall be carried out on one machine for 50 machines supplied.

13.2 The following are the different tests on the complete blower unit:

- | a) <u>Type tests:</u> | b) <u>Routine Tests</u> |
|-------------------------|---|
| i) Air delivery test | i) Checking of obligatory dimensions & clearances, workmanship and impeller fixing/locking arrangement. |
| ii) Starting time test. | ii) Starting time test |
| iii) Starting duty test | iii) Vibration level test |
| iv) Endurance test | iv) Any one unit out of 20 unit of Model 1 & Model 2, picked up at random shall be subject to air delivery test as per 13.4 |
| v) Vibration level test | |
| vi) Weight | |

Specification for motor driven blower


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- vii) Condition of bearing by shock pulse meter
- v) Condition of bearing by shock pulse meter
- viii) Checking of dimensions, workmanship, clearance of impeller flying and locking arrangement.

12.2 Unless otherwise specified in the context, the tests and the method of measurements adopted shall comply with Indian Standard specification for centrifugal and axial flow fans.

12.3.1 Manufacturers should use instruments of 0.2 accuracy class only during type test. During routine test 0.5 accuracy class instruments may be used. However, all meters should be properly calibrated and copies of calibration certificates for all instruments used during test should be submitted along with test results.

12.4 Air delivery test

12.4.1 Type test-tests shall be carried out with the supply to the driving motor maintained at 290V, 320V, 415V & 500V unbalanced. Adequate number of observations shall be made on both sides of the operating point to plot the characteristic curve. Measure the following quantities.

Line voltage
Line current
Power input
Speed
Total pressure
Ambient temperature

The manometer pressure readings shall be taken atleast at 2 points to arrive at a mean value.

Calculate the blower output at standard conditions

$$W_p = 1.2 \text{ kg/m}^3$$

Record method of test, details of equipment used and their calibration for observed and calculated results.

Plot curves of total head developed in mm water gauge, static head in mm water gauge, speed efficiency, air horse power, power input to the motor in kW against output in cubic metre per minute.

12.5 Starting time test

12.5.1 Type test - With test installation similar to that adopted

specification for motor driven blower


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WEST BENGAL, INDIA

क्रमांक/NO. CLD/Design-14 ALX/8
दिनांक/DATE: 06-07-2000

for the air delivery test, start the blower successively at the following unbalanced supply voltages:

200V
320V
415V

Measure oscillographically or by any other accurate method starting time of the motor blower unit to come upto full speed from zero speed. Record final load current and voltage reading.

- 13.5.2 Routine Test: Conduct test on 10% of the blowers at 290V unbalanced. The starting time obtained shall not exceed 5 seconds.

Note: Measurement of starting time & current by oscilloscope is mandatory during type-test. During routine test measurement may be done by oscilloscope or by any other accurate method.

13.6 Starting duty test

- 13.6.1 Type test: The blower unit shall be subject to repeated start and stop cycling for 1000 times at a supply voltage 415V unbalanced. The 'ON' and 'OFF' period shall be 1 minute in each case. If the unit takes more than 1 minute to stop freely, the next start shall commence immediately after the unit has stopped.

At the end of the test the efficacy of impeller locking device shall be checked. The impeller shall then be disassembled and various parts like key, key-way and the fit of the impeller on the shaft shall be examined for abnormal wear.

13.7 Endurance test

- 13.7.1 Type test: This test shall be conducted for a period of 48 hours with rated output and head and with a 415V unbalanced supply at the motor terminals.

After the test, the blower and the motor shall be dismantled and examined for wear and tear of the parts, condition of end rings and bearings etc.

13.8 Measurement of vibration intensity

- 13.8.1 Type test: For the measurement of vibration intensity an electronic vibration measuring equipment having a frequency range of 5 to 2000 cps. shall be employed. The machine under test shall be mounted in accordance with IS:4729. The machine shall run at rated voltage and rated speed.

Specification for motor
driven blower

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दिनांक/DATE: 02/07/2000

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ORIN.

Limit of vibration intensity

Name of the equipment

The peak to peak value shall not exceed

1. Traction motor cooling blower coupled with 24kV, 7 pole motor. 25 microns on motor bearing and 45 microns at all positions of blower casing
2. Transformer oil cooling blower coupled with 22 kW 4 pole motor. -do-
3. Smoothing reactor and silicon rectifier cooling blower coupled with 2.2kW 2 pole motor. 10.4 microns on motor bearing and 15.0 microns at the blower casing
- 13.8.2 Routine test-same as 13.8.1
- 13.9 Condition of bearing by shock pulse
- 13.9.1 Two test
Condition of bearing shall be checked at 5% unbalanced voltage at 120, 415 and 500V. The deflection shall be within green zone of the instrument.
- 13.9.2 Routine test
Condition of bearing shall be checked at balanced 415V on each machine. The deflection shall be within the green zone of the instrument.

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Specification for motor driver blower

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कमांक/NO. 14/14-14 Alt. 7/8
दिनांक/DATE: 07/07/2000

DATA SHEET FOR BLOWER
(Clause-12.1)

DATA SHEET FOR BLOWER

A-1

The supplier shall furnish the following particulars of the blower set at the time of tender, other wise tender will be considered incomplete.

- i) Type, model and make
- ii) Free air delivery in m^3 per minute and total head in mm WG corrected to 20°C and 760mm barometric pressure.
 - a) At rated voltage (unbalanced)
 - b) at lowest voltage (unbalanced) of the driving motor
- iii) Design data-
 - a) Impeller diameter
 - b) Type of impeller blades
 - c) Number of blades
 - d) Method of fixing of the blades
 - e) Clearance between inlet cone and impeller (Maximum and minimum)
 - f) Maximum shaft speed of the impeller
 - g) Motor shaft and impeller bore diameter (Maximum and minimum) (Sketch to be enclosed)
 - h) Method of fixing of impeller on motor shaft and locking arrangement (Sketch to be enclosed)
 - i) GD^2 value of the impeller (indicate the various variation in manufacture).

NOTE : GD^2 VALUE OF THE IMPELLER WILL BE USED FOR CALCULATING THE STARTING PERFORMANCE OF THE BLOWER WITH REGARD TO THE SPECIFIED ELECTRIC MOTOR, AS SUCH SH. VAL. TO BE FURNISHED SHOULD TAKE INTO ACCOUNT THE INERTIA, THE FRICTION AND THE RELATIVE VALUE OF THE IMPELLER WHEN IT IS BEING STARTED.

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दिनांक/DATE: 06/01/2000

- iv) The manufacturer shall furnish the speed-torque characteristic of blower. This is required for matching the motor and the impeller.
- v) Torque necessary for the blower when working against constant rated head and delivering the rated output.
- vi) The supplier shall enclose the following characteristic curves: at 20° & 55° C.
 - a) Total and static head Vs. Air delivery
 - b) Total and static efficiency vis. Air delivery
 - c) Air horse power Vs. Air delivery.
 - d) Power absorbed Vs. Air delivery
 - e) Motor output Vs. Air delivery
- vii) Vibration level in microns.
- viii) Necessary dimensional drawings of the blowers showing the constructional and assembly details should be submitted.
- ix) Normal setting recommended for the working of the easily to monitor the operation of the blower.
- A2 Special tools to be supplied as part of the contract for maintenance and operation.
- A3 Spare parts supplied as part of the contract.
- A4 Chemical composition of sheet steel used for manufacture of impellers.
- A5 Detailed calculations for impeller locking arrangements indicating safety factors in design.

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क्रमांक/NO. 14. अ. ५/०
दिनांक/DATE: 06/07/2020

BLOWER FATING AT 290 VOLT AND RATING OF DRIVING MOTOR

ANNEXURE - I

Sl No	Nomenclature of Equipment	Reference Drg.Nos.	Qty/loco WAG-7,	B L O W E R			DRIVING MOTORS						
				Total head mm w/o at 20°C	Air delivery very cubic metre per minute at 20°C	Approx synch HP/KW chro-grate nom speed rpm	Motor Type of chro-grate bearing	Size of cable (External) ELAS -TOMER for termination	BE	SDE	Size	O/D in mm	
1	2	3	4	5	6	7	8	9	10	11	12	13	
1	Transformer Oil Cooling Blower(NVHT)	CLW/ES/ SK-1/B-14	L/1	180.0	370.0	30/22	1850	200W (SPDP)	6313 (IMPORTED)	6313	3854 mm	12.1±0.8	
2	Traction Motor Cooling Blower(NVHT)	CLW/ES/ SK-2/B-14	L/2	308.0	278.0	36/28	3000	200W (SPDP)	6313 (IMPORTED)	6313	3854 mm	-do-	
3	Smoothing Reactor Cooling Blower(NVSL)	CLW/ES/ SK-3/B-14	2/2	80.0	75.0	3 1/2.2	3000	110W	6306 (IMPORTED)	6306	352 mm	5.5±0.5	
4	Silicon Rectifier Cooling Blower(NVSL)	CLW/ES/ SK-4/B-14	2/2	47.5	57.0	3 1/2.2	3000	110W	6306 (IMPORTED)	6306	352 mm	-do-	

1) Motor T-Box should be provided with suitable sized 3 Nos. cable gland (of minimum 1/3 1/2mm) to accommodate 3x12x56 sq.mm cable with socket (Palm width 15.2 ±0.5mm) for NVHT, NVSL & NCP (both 14 & 27.6 HP)

11) Bearings shall be either of M/s.GSF or FAG or NSK (All imported) make.

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PART-II
MOTOR

TECHNICAL SPECIFICATION
AND
TEST SCHEDULE
FOR
A.C. 3 PHASE, INDUCTION MOTORS
FOR
DRIVING BLOWERS, COMPRESSORS AND EXHAUSTERS

(THIS SPECIFICATION IS A COPY OF RDSO'S SPECIFICATION NO
SPEC/E-10/3/08 , REVISED SEPT' 95 WITH AMENDMENT NO. 1 & 2

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0.1 This specification deals with 3 phase induction motors for driving the various auxiliary machines on electric locomotives, such as centrifugal and axial blowers, reciprocating and rotating exhausters, compressors and pumps, 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 the offer to suit the exact requirements given in the specification. However, where, for technical reasons the tenderer 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 3 phase induction motors.
IS: 1231-1991	Dimension of 3-phase foot mounted induction motors.
IS:2223-1983	Dimensions of 3-phase flange mounted induction motors.
IS:4029-1991	Guide for testing 3-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:11164-1984	Enamelled and varnish bonded glass fibre covered round copper wires.

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বিত্তরঞ্জন রেল ইঞ্জিন কারখানা

পশ্চিম বঙ্গ, কলকাতা

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তারিখ/DATE 25/04/2000

INC: 60349-1 (1999-11)

Rules for rotating machines
for Rail and Road vehicles.

IS: 4691-1985

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 manufacturer 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 driven equipment.

1.0 SCOPE

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 Power for driving the auxiliaries is obtained from an auxiliary winding in the main single phase transformer. Single phase supply is converted to 3-phase by an arm converter and 3-phase squirrel cage induction motors are used for driving the auxiliaries like blowers, exhausters, compressors and pumps.

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

1.3.1 Blowers

- | | |
|---|------------------------------|
| - Traction motor cooling blower (VMT) | Centrifugal type. |
| - Transformer oil cooling blower (VRH). | Centrifugal type |
| - Smoothing reactor cooling blower (VSL). | Axial or parallel flow type. |

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प्रभाग
कोश
दस्तावेज
नं. 60349-1
दिनांक 01.01.2000

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दिनांक/DATE: 0/9/2000

- Silicon rectifier cooling blower (VSI).
- Transformer oil circulation pump (WPH).

Axial or parallel flow type.
Centrifugal type for cooling of transformer oil

1.3.2 Compressor/Exhausters/Pumps

- Air compressor (CP) - Reciprocating type for supplying compressed air to pneumatic equipments and loco brake system.
- Exhauster (EV) - Reciprocating or rotary type exhausters for creating vacuum in train pipe i.e., vacuum brake application.

1.3.3 The latest IAW specification for driven equipment may be referred for details.

2.0 TERMINOLOGY-SYMBOLS AND UNITS.

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 referred.

4.0 SYSTEM CONDITIONS & BASIC DESIGN FEATURES FROM CONSIDERATIONS OF PERFORMANCE.

4.1 Nominal rated voltage is 415V, 3 phase, 50 cycles. An average voltage unbalance of 5% exists. The supply voltage may, however, vary from 290V to 500V with 5% voltage unbalance.

4.2 Rated frequency - The rated frequency shall be the standard frequency of 50 Hz with a permissible variation of $\pm 3\%$.

4.3 Supply voltage has maximum voltage unbalance of 5% defined as the ratio of negative sequence to positive sequence component of voltage. For type tests/routine tests, the voltage unbalance shall be calculated as ratio of maximum deviation from average voltage to the average voltage, under all load conditions.

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दिनांक/DATE: 08-02-2000

4.4 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 34 duty (80% 'ON', 20% 'OFF' period for 27.5 HP motor and 50% 'ON', 50% 'OFF' period for 14 HP motor) shall be adopted.

Compressor unit when supplied at the lowest voltage and lowest temperature, (0°C) working against the back pressure of 10.5 kg/cm² 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 value of starting and full load torque as well as CB² 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 requirement of the driven equipment.

4.5 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 pole motors i.e. for $M-V/\sqrt{3}V$ applications.

4.6 The slip at rated voltage shall be 2.75% Permissible value of slip at lowest voltage for motors greater than 3.2 Kw rating shall be 6%. However, the slip at lowest voltage shall be between 5 to 8% for smaller motor having rating from 2.2 to 3.2 Kw and are of 3000 RPM.

4.7 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 assured that the starting torque produced by motor shall be 10 to 15% more than the requirement of driven machine at lowest voltage.

4.8 The magnetic design of motors shall be such that the motors do not exhibit saturation behaviour upto 500V. The no load current versus voltage curve for the motors shall have linear characteristics upto 500V, i.e. with no abrupt 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.

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

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दिनांक/DATE : 6-3-20

5.0 SERVICE CONDITIONS

5.1 Ambient temperature: The general ambient temperature of air at the inlet to the motors will be 0 to 55°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 shocks. . . 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 -

$$a = \frac{25}{f^2} \text{ for values of } f \text{ from 1 Hz to 10 Hz.}$$

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

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 $a = 0.3 \text{ mm}$).

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.

53 Sheet 25	53 Sheet 25	53 Sheet 25	53 Sheet 25
	53 Sheet 25	53 Sheet 25	53 Sheet 25

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6.0 TYPE OF ENCLOSURES

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

With dual coated
enamelled covered
copper winding wires.

(Ref. clause 11.1)

MMNT, MVRN, MPV - ID 23

MVSI, MVSL ID 54

12-54

7.0 FRAME CONSTRUCTION AND MOUNTING.

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

7.2 The type of mounting for MVM, MPV & MVRH shall be foot-cum-flange mounted and RVV may be of foot mounted also. However M-VV will be foot mounted only. MVS1 and MVS2 shall be vertically mounted. MPV shall be flange mounted. Antivibration pad shall also be provided on all motors along with the drive equipment. Size and type of anti-vibration pad shall be decided by motor manufacturer. The mounting design shall be subject to prior approval of RDSO.

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 except for 3000 RPM compressor driving motor for which terminal box shall be on top. The terminals shall be clearly marked U/V/W by embossing on the terminal block to obtain the correct direction of rotation with the supply phase sequence of U/V/W. 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.

6.2 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 absorbent and free from porosity.
- It shall not deteriorate when working continuously at an ambient of 55°C and when tested at 120°C.

वित्तसंयोजन, रेल, इंधन, स्वास्थ्य, विधि, विज्ञान, प्रशासन, परिवहन

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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 pole end tube shall be of 2.0 mm. Thickness of socket tube shall be at least 1 mm.

8.3.8 Terminal box cover: The top cover of the terminal box shall be of epoxy moulding conforming to IS: 10192-1982 Grade EP2. No metallic cover should be used for the terminal box to avoid flash over between terminal stud & metallic cover.

8.2.9 Hardware:

All types of high tensile fasteners excluding spring washers shall be of either M/s Unbrako, M/s Sundaram Fasteners, or M/s LPS make.

All types spring washers shall be of 'FORBE' make only.

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क्रमांक/NO. CLW/ES/8-14 आ. ४/४
दिनांक/DATE: 06.02.24

9.0 STATOR CONSTRUCTION

9.1 Cold rolled M-45 grade, CRNGO low loss type both side insulated stamping should be used in the stator construction. The stator winding shall be suitably strengthened mechanically and vacuum pressure impregnated with solventless insulating resin to resist vibration and the effects of lubrication oil fumes, dust and moisture. Adequate clearance but not less than 10mm between stator core outer diameter and frame shall be maintained for S/D motors to ensure proper cooling or core. The overhand design should not obstruct passage of air in this region. The motors shall preferably be designed with maximum possible air gaps (not less than 0.8mm for MVMT, MVEN and 0.5 mm for other motors to ensure good performance under minor shaft deformation or vibration. Dummy stampings shall be suitably tack welded at tooth portion on all teeth, after mounting on stator. This is to ensure that end lamination do not open out in service, which could lead to insulation failure on account of electro magnetic vibrations generated in them.

9.2 Cold rolled M45 grade, CRNGO, low loss type both side insulated steel stamping should be used in rotor construction. Rotor should be balanced of grade G2.5 of ISO 1940-1973 or IS:11723-1985. Rotor should also be balanced alongwith motor cooling fan and blower impeller 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.

9.3 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 requirement 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 bearing shall be suitably pre-loaded.

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- (iii) The minimum L10 life of bearings shall be 100,000 hours. L10 life design shall be worked out based on parameters as per CI-5
- (iii) Only SKF/FAG make bearings of European origin and NSK/Japan makes bearings shall be used.
- (iv) Sealed or Semi-sealed bearings may also be used, provided it meets the requirements of L10 life in para (ii) above.
- 9.4.1 All bearings shall be inspected for boundary dimensions, radial clearance, free running surface finish etc. The bearings shall be checked with shock pulse meter for noise/vibrations. All bearings shall have radial clearance of 'C3'.
- 9.4.2 Simple gap type seals with labyrinth and two or more grooves in the bearings covers shall be provided to ensure proper retention of grease.
- 9.4.3 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 dismantling of any parts of motor or its driven unit are needed. Suitable vent for escape of old grease shall also be provided. The motors in 200 frame size and above shall be provided with a bearing covers of suitable design with pocket for retentions of discharged grease.

10.0 VENTILATING FANS

Ventilating fan shall be either steel fabricated or cast steel or Aluminium alloy. Fan should be balance 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 Dual coated enamelled round copper winding wires as per IS 13730 Part 13-1993 Grade 2 may be used. Dual coat means that base coat with polyesterimide enamel HT533.39A/Terebac TR 543.38/ 180-MID 866 /37 and top coat with Alotherm 602L35A /602L-31S/20:HV1011/28 of Schenck-ady-Bock India only.

The enamel thickness shall comply with IS 13730 Pt.6 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.

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11.2 The test on enamelled winding wire 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 enamelled double glass covered conductor shall be conducted as per IS:11184-1984 and on dual coat wire as per IS:13730-13-1993.

12.0 IMPREGNATION

12.1 Vacuum pressure impregnation (VPI) process shall preferably be adopted, with impregnating varnish Dabakon PT-2015/2005/5005N of Schemetady Beck India Ltd.

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 silicon sealant and over-tape with two layers of half lap tesa flex 76593 tape (supplier 98) 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

Nonex 410-Kanton-Nonex 410 (with calendered Nonex 410) shall be used for slot liner and wedge separator. Unaltered Nonex 410-Kanton-Nonex 410 shall be used for inter-layer and inter-phase 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 correspond to class 180°, i.e. all motors used on Electric Locomotive will be of class-H.

15.1 The temperature rise of stator windings above ambient of 65°C . during continuous duty at rated output at all voltages (i.e. 290V to 500 V) with 5% voltage unbalance shall not exceed in following limits: -

80°C - if enamelled windings are used with class 'M' insulating material.

15.2 Particular attention is invited to clause 19.6.7 regarding temperature 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 at 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 with 5% unbalance. 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 deg. 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 light grey paint as per IS: No. 531 of 1955.

17.0 INTERCHANGABILITY

The various components of the motor shall be manufactured with such a tolerance as to enable complete 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.

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DIN.

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- b) Rated voltage and voltage range.
- c) Winding connections.
- d) Rated frequency.
- e) Rated current.
- f) Rated speed.
- g) Rated output in k.W. and HP.
- h) Class of insulation.
- i) Weight.

19.2 Embossing.

All motor manufacturer shall clearly emboss the following details as name of manufacturer b) Year and month of manufacturing and c) Sl.No. at suitable visible places on stator as well as on rotor to assess the performance of various makes and to determine their codal life for replacement decision.

18.3 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.

18.4 Lubrication - Plate giving lubricating instructions shall be affixed at a convenient location near the bearings indicating the type, quantity and 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 and the driven auxiliary, specification of CLW/RD30 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 proved earlier as per this specification. Routine tests are required to be conducted on every motor, except where otherwise stated of the supply.

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CLW/ALW-1412

19.5. cont.

- 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, 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 voltage drop method in terms of IS:4029-1991. For this purpose the motor shall be left in standstill condition for atleast 12 hrs 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 U/Va/W terminals of the motor.

19.6.3 No load test - No load test as per IS:4029-1991 at voltage varying from 150V to 500V in 5% unbalanced condition in steps of 50V shall be conducted. However, at 290, 320, 415 and 500V 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 calculated. Record the calculated test results including the calculated values. Repeat the no load test under balanced voltage conditions.

19.6.4 Locked rotor test - Locked rotor test shall be conducted at 150V, 290, 320 and 415V balanced supply as also with an unbalance of 5%. The test at 290V for compressor motor shall be done in four positions with 90 degree rotation of rotor. For other motors, this test shall be done at 320V with four position of rotors 90 degree apart.

19.6.5 Pull up and pull out torque - Determine the pull up and pull out torque of the motor at the lower voltage with 5% unbalanced and extrapolate it at 290V.

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19.6.6 Load test - Immediately after the tests as specified in clause 19.6.7, a test at an input voltage of 415V unbalanced shall be conducted 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 unbalanced supply. The total loss shall be restricted to guaranteed value + 10%.

Measured 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 87% for smaller motors viz. MSL, MSL and MHL. Draw curves of speed, efficiency, power factor and mean current against motor output torque. Power factor shall not be 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 290V/ for (a) one hour, (b) steady state condition.
- ii) Starting from cold condition, conduct temperature rise test at 500V for (a) one hour and (b) steady state conditions.
- iii) Starting from cold condition, conduct temperature rise test at 415V for (a) one hour and (b) continue this test for ascertaining maximum temperature rise under steady state conditions.

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NOTE

- (a) The voltage specified for the tests are with 5% unbalance.
- (b) Maximum allowable temperature rise.
- Dual coat
Enamelled
Copper
Conductors
(IS:13730-13/1998)

80°C

(with H class 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 temperature 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°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 for the temperature rise and linear scale for time. The points of abscissae exceeding 90 second shall be disregarded 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.

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(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 overspeed 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 shall be driver separately.

19.6.9 **High Voltage Test:**

On hot windings, perform a dielectric test at 3300V RMS, 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 Clause 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 Tests :**

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 lowest voltage and five successive starts at 500V (5% unbalance under both conditional while developing a torque corresponding to the 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)

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- Temperature 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 type test values by more than 5%. The winding temperature differences may also be corrected as per IS:325-1970, 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 415 v balanced. The ratio of no load current at 500V to that of at 415V shall not exceed the values achieved during type test.

- 19.7.4 Locked Rotor test:

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 temperature 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

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19.8

TEST RESULTS

The test results should be submitted in full as per proforma included in Appendix 'E'.

NOTE: Attention is invited to clause 3.6 of Appendix 'C' regarding acceptability of results obtained during routine test with respect to results obtained for type tests during prototype tests.

19.9 SPECIAL TEST (As agreed between manufacturers & DRD)

19.9.1 Endurance Test :


The question of conducting certain special endurance test on typical motors of different manufacturers is under the consideration of DRDO. The test will be destructive in nature and are intended to bring out 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 unbalanced conditions of 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 motor 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 DRDO is being conveyed through 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 square wave 1 -

Temperature rise test of at 415V, 310W shall also be conducted with square wave voltage supply in order to assess the suitability of these motors in 3 phase thyristor electric locomotive fitted with static inverter.

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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 exhaustor and at 55 degree C for blower and pump motor.

19.9.4 Motorcycle Test.

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

19.9.5 Compatibility test :

In case of any new type of enameled 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 data shall be furnished in 4 stages i.e., (i) at the offer stages (ii) design stages (iii) prototype manufacturing/ inspection stage; and (iv) after successful testing of prototype.

21.0 MAINTENANCE INSTRUCTION

21.1 The manufacturer shall supply detailed maintenance instructions and maintenance schedule based on monthly, bi-monthly quarterly and annual overhauling.

22.0 QUALITY ASSURANCE PLAN

22.1 The manufacturers shall supply the detailed quality assurance plan as per ISO-9000/IS:14000 followed by them for their product.

19.9.3 19.9.4 19.9.5 20.0 20.1 21.0 21.1 22.0 22.1	19.9.3 19.9.4 19.9.5 20.0 20.1 21.0 21.1 22.0 22.1	19.9.3 19.9.4 19.9.5 20.0 20.1 21.0 21.1 22.0 22.1	चित्तारंजन रेल इंजन कारखाना पश्चिम बंगाल, भारत CHITTARANJAN LOCOMOTIVE WORKS WEST BENGAL, INDIA आदेश NO. : CLW/ES/B-M 19.9.3 19.9.4 19.9.5 20.0 20.1 21.0 21.1 22.0 22.1
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APPENDIX 'A'

FRAME SIZE AND OUTPUTS OF MOTORS CURRENTLY IN USE

Application	Frame size	Speed Syn-chronous	Continuous rating output KW/hp	Type of enclosures
MVRH	200 M	1500	22/30	SPDP
MVMT	200 M	3000	26/35	SPDP
MVSL *	112 M	3000	2.2/3	TEFC
MVSI *	112 M	3000	2.2/3	TEFC
MPH	112 M	3000	3.2/4.3	TEFC
MPV	200 M	1000	7.5/10	SPDP
MCP	1) 180 L	1000	10.4/14	TEFC with high starting torque (minimum 17kg-M at 290V)
	11) 225M	1000/750	20.5/27.5	TEFC -do- (minimum 37kg-M at 290V)
	111) 180L **	3000	8.5/11	SPDP

** For Gerlikon compressors type 2A115

* Motor for MVSI & MVSL

These motors shall be identical in all respects.

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APPENDIX 'B'

BEARING DESIGN DETAILS OF AUXILIARY MOTORS

Sl. No.	Name of Motor	Bearing type	
		Non-driving end	Drive end
1.	MVRH	6313	6313
2.	MVMT	6313	6313
3.	MVSL	6306	6306
4.	MVSI	6306	6306
5.	MPV	6312	6312
6.	MCP (14 HP)	6310	6310
7.	MCP (27.5 HP)	6313	6313

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

- 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.

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TEST DATA FOR INDUCTION MOTOR1. Motor ParticularsRating

Make	V
Type	Hz
Machine No.	Kw/HP
Order No.	A
Type of winding	FE
Class of Insulation	N
Type of enclosure	
Type of winding	
Type of Rotor	

2. Resistance Measurements & Insulation Resistance

Resistance with KELVIN Bridge.

Phase	I (amb)	Resistance	Resistance I.R. at 70°C R20	Av R/Phase
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UV

VW

MU

Resistance by V.I. Method

Phase	I (amb)	V.I.R = V/I	R20°C	I.R.	Av R/Phase
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UV

VW

MU

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 terminal	A	B	C

4. No load test : As per clause No.15.6.3 on different V input record following.

V input	I	Power input	Power factor	Speed
UV VW MU	U I V I W	P1 P2 I P	cos φ	N

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

Input			V Average			I			I av.	P (input)			Power	Torque in		
UV	UW	WU	UV	VW	WU	UV	VW	WU		P1	P2	P1 factor				kg.m.
													cos ϕ			

- 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 320/290V, 500V 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	WU	UV	VW	WU	P1	P2			
									P	Speed Slip	T in	T out

(Contd.)

Bearing Temp. °C		Temperature after stoppage °C				Temperature rise °C			
NDE rim	DE rim	Frame winding	Stator winding	Stator Core	Rotor Winding	Rotor core	Cooling air	DE Brg.	NDE Brg.

(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 office. Log-scale graph shall be used for extrapolating zero time hot resistance.

7. Motor Characteristics :-

As per clause 19.6.6 record following :

S	V			I			Power input			Rotor	Out-	Power	Effi-	Torque
No.	UV	W	WU	U	V	W	P1	P2	P	Slip%	put	Factor	ciem-	Kg.m.
											KW	COS ϕ	cy %	

8. Starting Test :-

As per clause 19.6.12

S	Voltage			V.av.	% UB	Current			Starting time
No.	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

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

1.

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DY. CEE. (D)

चिन्नरंजन रेल इंजन कारखाना
वीरम गंग, भारत
CHITTARANJAN LOCOMOTIVE WORKS
WEST BENGAL, INDIA
क्रमांक/NO. 024/ES/8-14 A.R./8
दिनांक/DATE: 6-7-24

DATA TO BE FURNISHED AT OFFER STAGE
(Refer Clause 0.2 & 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 (290V)
9. Slip at full load in percentage at -
 - a) Rated voltage (415V)
 - b) Lowest voltage.
10. Class of Insulation.
11. Type of Enclosure.
12. Method of ventilation.
13. ~~XX~~ Type of protection.
14. Frame size
15. Overall dimension
17. Type and make of bearing
18. size of bearing and their estimated L10 life.
19. Weight of the motor
- Weight of Rotor.
20. Rotor construction
21. GD² value of the rotor

(Indicate the maximum variation)

258 CHKD DRN	 उप.सु.वि.क. (सम.) DY. CEE. (D)	चित्तारंजन लोकोमोटिव कारखाना राविवर प्रसाद, एमडी CHITTARANJAN LOCOMOTIVE WORKS WEST BENGAL, INDIA क्रम/NO. CLM/LS/B-14 A दिनांक/DATE : 6-7-20
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APPENDIX-DI (Cont..)

22. Starting current and torque in Kgs.
 - a) at 290V unbalanced.
 - b) at 500V unbalanced.
 - c) at 415V unbalanced.
23. Any deviations from the specification indicating reasons thereof may please be explained.
24. List of sources for major items used like winding wires, insulation and bearing etc. shall be furnished by the suppliers. It should be in line with RDSO SMI No. RDSO/ELRS/SMI/185 of Feb'97 and its amendments 1, 2, 3 & 4
25. Quality assurance plan being followed by manufactureres of these motos shall be furnished to RDSO for approval.

CHITTARANJAN LOCOMOTIVE WORKS
WEST BENGAL, INDIA

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उप.मु.वि.क. (प्रति.)
DY. CEE. (D)

चितरंजन रेल इंजन कारखाना
पश्चिम बंगाल, भारत
CHITTARANJAN LOCOMOTIVE WORKS
WEST BENGAL, INDIA
क्रमांक/NO. CLW/SS/ 8-14 ALN/MB
दिनांक/DATE : 6-7-68

DATA TO BE FURNISHED AT DESIGN STAGE

(Refer Clause 0.4 & 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/mm²
13. Conductor size (diameter and area)
 - a) Bare
 - b) With insulation
14. No. of conductor/slot and no. of wire
15. No. of slot, slot drawing slot area.
16. Slot insulation detail

1	Details to be furnished
1	with drawing and
1	literature on insulating
1	material used.
17. Overhang insulation detail

1	
1	
1	
18. Interlayer insulation detail

1	
1	
1	
19. Phase resistance at 20°C.
20. Type of winding wire used -
 - a) As per IS:
 - b) Double glass covered conductor as per IS:18184-84 on medium covering of enamel as per IS:

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उप.सु.वि.अ. (अभि.)
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CHITTARANJAN LOCOMOTIVE WORKS
WEST BENGAL, INDIA
क्रमांक/NO. CLW/BS/8-1A A- १०
दिनांक/DATE: 6-7-2K

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 bars.
29. Size of bar
30. Material specification of -
 - i) Rotor bar
 - ii) End ring
 - iii) Rotor stamping
32. Class of tolerance followed -
 - a) Between inner race and shaft.
 - b) Between outer race and housing.
33. Clause of clearance adopted for bearing.
34. Material specification for shat.

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:4600 Pt.III
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.

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वितरन रेल इंजन कारखाना
चिट्तारनजन लोकोमोटिव वर्क्स
WEST BENGAL, INDIA

क्रमांक/NO. CLM/ES/B-1A Alt. ४५३
दिनांक/DATE : 6-2-24

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, efficiency, 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 tolerance 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.
5. Rewinding details of Stator winding along with developed winding diagram and former drawing.
6. Quality Assurance Plan.

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चितरंजन, भारत
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क्रमांक/NO. CLW/ES/8-14 A/LT. ४ B
दिनांक/DATE: 6-7-2K

APPENDIX-EGUIDELINES FOR INSPECTORS

1. Three aspects are to be covered :-
 - i) Inspecting and testing of motors offered for inspection.
 - ii) Inspection of records 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 manufacturer. This may include shafts, housings, 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.

FORM No. 4.TDP.500-025

DRM.

CHITTARANJAN LOCOMOTIVE WORKS
WEST BENGAL INDIA

NO. OF CLN/ES/14 ALT 4/81.

DATE : 6-7-2K

BY C.E.E. (DRM)

- 1.0 The following points shall be jointly checked/inspected by the motor manufacturers and the Railway Inspector during the ~~XXXXX~~ prototype tests/routine inspections. Points marked in ~~ast~~rick (**) are for routine inspection.
- ** 1.1 Record the type of motor and its name plate rating particulars.
 - ** 1.2 Check for identification plate for direction of rotation of the motor. Instruction plate regarding grease may be checked.
 - ** 1.3 Provision of lifting hooks.
 - ** 1.4 Dismantling and assembly procedure of the motor. (Report any difficulty likely to be encountered during routine test).
 - ** 1.5 Report any deviations observed in the motor during routine test when compared to type tests results.
 - 1.6 Check for rotor number, stator No. and year of manufacture.
 - 1.7 Rotor should be constructed from the cold rolled steel M45 grade, CRNGO type
 - 1.8 **
 - 1.9 Rotor should be pressure die cast and rotor bars should be free from ~~porosity~~ blow holes, discontinuity, cracks at the junction of rotor and end rings. Out of 50 rotors, ~~one~~ 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. Railways Inspector may check the record during routine inspection.
- ** Rotor should be dynamically balanced on an appropriate balancing machine suitable for 500 kg.wt. with balancing grade of G2.5 of ISO-1940-1986 or IS 11723-1996. Rotor & blower impellers will be balanced separately as well as combined. Manufacturer should have suitable portable balancer for balancing of rotor and blower together in position at the works of blower manufacturer.

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CHITTARANJAN LOCOMOTIVE WORKS
WEST BENGAL, INDIA
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दिनांक/DATE: 6-7-2K

2.0 MECHANICAL ITEMS

2.1 Shaft

- ** .1 Material used supported by certificate from the manufacturers regarding chemical composition and physical properties. Shaft material should be of EN-24 steel. Ultra sound test should be conducted for checking the healthiness of shaft.
- .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 catalogue.
- ** .4 Tolerances on the bearing seats shall be within the specified limits indicated by motor manufacturer.
- .5 Check the key/keyway, shaft for the dimensions. The dimensional tolerance these components shall, if not specified by within the IS:1231:1974 limits.

2.2 Bearing Housings:

- 2.2.1 Check for dimensional tolerances, quality and taper should be recorded for both the bearing housings and this should be within the specified limits of SKF/FAGIRSKA

2.2.2 Parallelism of motor base with respect to shaft axis

- 1) Complete motor should be placed on a surface plate. Ensure that all 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.

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चितरंजन रेल इंजन कारखाना
चितरंजन, भारत

CHITTARANJAN LOCOMOTIVE WORKS
WEST BENGAL, INDIA

क्रमांक/NO. CLW/86/8-1A ALY 4/0
दिनांक/DATE: 6-7-2K

- 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 $0 \pm 0.25\text{mm}$.

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 clearances. These shall be within the specified limits.
- ** iii) When the motor is working, check for any abnormal sound with shock pulse meter.
- iv) Check the record of motor manufacturers for measuring boundary dimension, radial clearance, etc.
- v) Only imported bearing should be used. Check the record for the receipt of imported bearings in line with para 9.4 of this specification.

2.4 Lubrication :

- i) Liberal size of lubrication pipe diameter shall be adopted. Accessibility of grease nipple for lubrication may be checked.
- ii) Insure 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 bearings outer cover, with old grease outlet cover provided.
- iv) Check for quality of grease and regreasing intervals.

3.0 TERMINAL BLOCK

These should be Epoxy moulded type as specified in the specification. On one per cent of the Epoxy moulded 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.

৩৪ SHEET ৫৬ ৩৪ SHEET ৫৬	 প্র. ম. (স. অ. (অধি.) DY. CEE. (D)	চিত্তরঞ্জন রেল ভূজান কারখানা পশ্চিম বঙ্গ, ভারত CHITTARANJAN LOCOMOTIVE WORKS WEST BENGAL, INDIA ড্রইং NO. : CLW/BB/8-14 ৩৪/৫৬-৫৬
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3.2 Insulation

- i) Epoxy glass moulded slot liner shall be used for slot closure.
- ii) Obtain internal test report from the manufacturer regarding quality of insulation 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 certificate of supplier of the insulating materials. The supplier should be BISO approved and as per BISO SMI No. ELPS/185 and its amendments.
 - a) Slot Liner: Nomex 410-Kapton-Nomex 410 (NKM as per IEC:60626-5)
 - b) Interphase separator: Nomex 411-Kapton-Nomex 411 (NKM)
 - c) Sleeves type 1/100 T6 as per BS2648-1973. Thickness of wall ~~shall~~ be 0.9mm and BDV should not be less than 5.0KV for 1 minute.
 - d) Connecting lead should be used as per BISO approved supplier. Check the record.
 - e) All the input materials used for insulation shall be as per BISO approved suppliers list. Purchase certificates.

3.3 Winding wires

- ** 1) Conduct following checks:

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 reports.

3.4 Varnish and Varnishing procedure

Record the following:

- i) Type of varnish used.
- ii) No. of impregnating cycles, curing temperatures cycles during each stage.
- iii) Viscosity check on varnish.
- iv) Provision of epoxy gel coating as per recommended procedure.

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वीरभद्र बंगला, बाराक
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- v) Compatibility test. (Pencil hardness test may be got done by Railway's 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.

3.5 Terminal Leads

- i) On 20% of samples, conduct U.T.S test as specified in the specification (Clause-6) Record the value.
- ii) Ensure provision of flexible terminal leads.

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तारीख/DATE: 6/3/20

(Appendix-I cont.)

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- iii) Insulation of terminal leads shall be as per specified procedure.
- iv) Ensure that neutral point is silver brased.
- v) Check for any abnormal noise etc. on the assembled motor with S.P.M.
- vi) Record vibration.

3.6 Routine Tests :

The various performance parameters observed shall be statistically evaluated for first ten motors and limits of ± 16 for satisfactory performance of motors for future lots shall be laid down jointly by RDSO and motor manufacturer.

CHITTARANJAN LOCOMOTIVE WORKS
WEST BENGAL, INDIA.

No. *CLW/ES/B-1A ALP B.D*

DATE : *6/7/2K*

[Signature]
DY. C. E. E. (D)

RATING OF VARIOUS AUXILIARY MOTORS

Sl no.	Motor for	Dirn. Of rotation & T.B. location	HP /Kw rating	Syn. speed	Frame size & Type of enclosure	DE Bearing	NDE Bearing	Cable Size in mm sq	Cable Overall dia in mm	Total weight of combined unit in KG (max.)
1	Traction motor Cooling blower (MVMT)	Anti-clock/L.H side	35/26	3000	200M/SPDP	6313-C3	6313-C3	3X25	12.5 +0.8	350
2	Transformer oil Cooling blower (MVRH)	Anti-clock/R.H side	30/22	1500	200M/SPDP	6313-C3	6313-C3	3X25	12.5 +0.8	550
3a	1000 LPM main compressor (MCP)	Anti-clock/L.H side	14/10.4	1000	180L/TEFC	6310-C3	6310-C3	3X25	12.5 +0.8	410
3b	2000 LPM main compressor (MCP)	Anti-clock/ TOP	27.5/20.5	1000	225M/TEFC	6313-C3	6313-C3	3X25	12.5 +0.8	1000
4	High vacuum exhauster (MPV)	Anti-clock/R.H side	10/7.5	1000	200M/SPDP / TEFC	6313-C3	6313-C3	3X10	9.3 +0.7	650
5	Smoothing Reactor cooling Blower (MVSL)	Clock-wise (seen from top)	3/2.2	3000	112M/TE	6306-C3	6306-C3	3X3	5.5 +0.5	80
6	Silicon Rectifier cooling blower (MVSI)	Clock-wise (seen from top)	3/2.2	3000	112M/TE	6306-C3	6306-C3	3X3	5.5 +0.5	70

NOTE: 1) Make of bearing shall be either SKF / FAG / NSK (all imported).

2) Direction of rotation & T.B. location as viewed from driving end of the motor.

3) Terminal Box for MVMT, MVRH, MCP(both types) should be fitted with suitable size compression type cable gland to accommodate 3x1 core, 25 sq. mm cable with socket (palm width is 15.2 +0.5)

নিম্নলিখিত তথ্য অনুযায়ী
উপরে বর্ণিত, যন্ত্র

CHITTARANJAN LOCOMOTIVE WORKS
WEST BENGAL, INDIA

ইউসি/নং. CLW/BS/8-14 ALI.90

সিগন/DATE: 6.7.2005

সিগন/নং. (সিগন.)
DY. CEE (D)

1. APPROVED SOURCES FOR WINDING WIRE FOR AUX. MOTOR
(Vide RDSO's letter no. EL/2.2.8.4 dated 30-12-99)

A. FOR DUAL-COAT ENAMELLED WIRE AS PER IS: 15730 Pt. 13

Sl no.	Name of manufacturer	Status of approval	Validity of approval
1	M/s Shreyans Wires Ltd Garoba Maidan, Hagadganj Nagpur-440008 FAX-0712 760757	REGULAR	31-12-2001
2	M/s Embros Wires & Strips Ltd. Plot no. 6&7, Sector -5 Parwanoo-173220(HP) FAX-01792-32866	-DO-	-DO-
3	M/s G.K. Winding Wires Ltd. 134, DSIDC Complex, OKHLA Industrial Area, Phase-I	-DO-	-DO-
4	M/s Mimani Wires Pvt. Ltd. Suraj Sadan, 26/3, New Palasia Indore-452001 FAX-0731-430895	-DO-	-DO-
5	M/s Precision Wires India Ltd. Saiman House, J.A. Raul Street Sawani Road, Prabhadevi Mumbai-400025 FAX-022-4362593	-DO-	-DO-
6	M/s Ram Ratan Wires Ltd. D/46, Sardar Industrial Estate Ajwa Road, Vadodara-390019 FAX-0265-460054	-DO-	-DO-
7	M/s Shakti Insulated Pvt. Ltd. Datta Pada Road, Boriveli Mumbai-400036 FAX-022-8055671	Under Development (only upto 20 % of quantity)	31-12-2000
8	M/s Jayam Metal Pvt. Ltd. 4-D, Satyam apartment, Alkapuri shopping centre R C Dutta Road, Vadodara	-DO-	-DO-
9	M/s Paramount Conductors Ltd. 31, MIDC Industrial Area Nagpur-440028 FAX-0712-231556	-DO-	-DO-
10	M/s Swarangiri Wires Insulation Pvt. Ltd. S-10, Industrial Estate, Gokul Road Hubli-580030, Fax-0836-331780	-DO-	-DO-

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चितरंजन रेल इंजन कारखाना
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CHITTARANJAN LOCOMOTIVE WORKS
WEST BENGAL, INDIA
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दिनांक/DATE: 6-7-2008

11	M/s Khaitan Winding Wires Pvt. Ltd P-38, India Exchange Place, (opp) Esra Street, Calcutta-700001 FAX-031-2254486	Under Development (only upto 20% of quantity)	31-12-2000
12	M/s Alco Wires Product Pvt. Ltd. F-43-44, Varalaxmi Market Complex, 60 M.G. Road Secunderabad-500003 FAX-040-30788791	-DO-	-DO-
13.	M/s Classic Wire Insulation, D-4, Industrial Estate, B.H. Road, Tum Kur 572103 Ph.No.0816-282771 FAX No.0816-282774.	Under Develop- mental(Only upto 20% of quantity)	30.06.2001.
14.	Hindustan Wire Product Ltd., Factory Area, Patials-147001 FAX No.0175-364920	-Do-	30.06.2001

2. APPROVED SOURCES FOR CONNECTING LEAD WIRE FOR AUX MOTOR

- I M/s Jhaveri Thanawala Corporation
114-A, Pokhran Road, Khopat
Thane-400601
- II M/s Universal Cables Corporation
Satna, M.P.
- III M/s Fort Gloster Industries,
31, Chowringhee Road
P.B. No. 9126
Calcutta-700016
- IV M/s Remko Wire Industries Pvt. Ltd.,
6A, Dharam Thakur Industrial Estate,
Near Petrol Pump, Ulhasnagar-421 004.
(On developmental basis - for only 20% of
ordered quantity).

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WEST BENGAL INDIA
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दिनांक/DATE: 6-7-2001

3. APPROVED SOURCES FOR SILICONE SLEEVES FOR AUX. MOTORS.

- I. M/s Jhaveri Thanawala Corpn.
114/A, Pokhran Road, Khopat
Thane-400601
FAX-022-5475897
- II. M/s Tapac Industries
Sri Mohan Mills Compound
G.B. Road
Thane-400607
- III. M/s PIRE Permacel Pvt. Ltd.,
Hochest House, 8th Floor, 193 Beckbey Reclamation,
Wariman Point,
Mumbai - 400 0021.
- IV. M/s 3 A Associates Incorporated
Kanji Gokuldas Building
2nd Floor, 158, Lohar Chawl
Mumbai-400002
FAX-022-2060395
- V. M/s Bells Organics Pvt. Ltd.
Bells House
10 A, Hoshi Minh Sarani
Calcutta-700071
Fax-033-4745245
- VI. M/s Remco Wires Industries Pvt. Ltd.
6 A, Dharam Thakur Industrial Estate
(Near petrol pump)
Ulhas Nagar-421004
FAX-0251-531111

Authorised dealers of M/s Remco Wire Industries are :

- (i) M/s Zenith Enterprises D-117, Sector-26, NOIDA-201 201.
- (ii) M/s Sagar Electrical, Shop No.7, Satyam Complex,
Near Ashok Talkies, Ulhasnagar-421 003.

<p>अभि CHKO DRN.</p>	<p>उप.मु.वि.न. (अभि.) DY. CEE (D)</p>	<p>चितरंजन रेल इंजन कारखाना राजिब बंगला, मयपुर CHITTARANJAN LOCOMOTIVE WORKS WEST BENGAL INDIA क्रमांक/NO. CLW/ES/8-14 ALP. 4/9 दिनांक/DATE : 8-7-20</p>
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4. APPROVED SOURCES FOR SUPPLYING MS EPOXY MOULDED TERMINAL BLOCK

<u>Name of the suppliers</u>	<u>Status</u>
i) M/s Dusada Engg. Co.Pvt.Ltd, Zora Mandir, Kavi Guru Rabindra Path, Kancharepara, 24-parganas North (WB)	Regular
ii) M/s Hind Engg. Co.Todi Corner, 32- Ezra Street, 3rd floor, Room No.356, Calcutta Pin-700001	Regular
iii) M/s Atul Industries, E-925, Dabus Colony, New Industrial Township, Faridabad-121001 (Haryana)	Regular

5. APPROVED SOURCES FOR EPOXY MOULDED TERMINAL BOX COVER

i) M/s Dusada Engg. Co Pvt.Ltd, Zora Mandir, KaviGuru Rabindra Path, Kancharepara, 24-parganas North (West Bengal)	Regular
ii) M/s Hind Engg. Co, Todi Corner, 32-Ezra Street, 3rd floor, Room No.356, Calcutta-1	Regular
iii) M/s Atul Industries, E-925, Dabus colony New Industrial Township, Faridabad (Haryana) <u>Pin-121001</u>	Regular
iv) M/s Venus Enterprises, 40-B, Bhuru Co-operative Society, Behind para Hotel, Ambedkar Road, Chazisabad	For educational orders only
v) M/s Mica Ply, Sector 23-24, New Sec. phase-II Mandideep Bhopal-462046	For educational orders only.

चित्रा
CHITRA
DRN.

23/1/83
उप.प्र. वि. व. (अ.वि.)
DY. CEE (D)

चित्ररंजन रेल इंजन कारखाना
पश्चिम बंगाल, प्रयाग
CHITTARANJAN LOCOMOTIVE WORKS
WEST BENGAL, INDIA
क्रमांक/NO.CLV/ES/B-14 A & B
दिनांक/DATE :

4. Approved source for Romex-418 (Calendered)

- (a). M/s Du-pont, USA, Japan and their authorized distributors in India.
- (b). M/s PSE Pennacel, Mumbai
- (c). M/s BHEL, Bhopal

7. Approves sources for H-K-N

- (a). M/s Krenpel, Germany.
- (b). M/s Beico, Nasik
- (c). M/s PSE/Pennacel, Mumbai

8. Approved sources for Brazing material (Rupta Silver 14)

- (i) M/s ESAB India Ltd.,
Regd. Office Lloyds Centre Point, 2nd floor,
1096-Apasaheb Marathe Marg,
Prabhadevi, Mumbai-400025. Regular
- (ii) M/s Cookson India Ltd., 182/125,
Diamond har our Road, Thakurpukur,
Cal-700 Regular
- (iii) M/s Advani Darliken Ltd,
Bhandup, Lal Bahadur Shastri Marg,
Mumbai-78 Regular
- (iv) M/s Mekiflow Industries, 4721, GIDC
Phase-IV, Vatva, Ahmedabad,
pin-382445 Regular
- (v) M/s Khanna Traders & Engineer, CB-105,
Ring Road, Naraina, New Delhi-110028 -for
developmental orders

9. Approved suppliers for Terminal LUG

M/s Dowells Electro Works,
Gatguru Estate, Office Aarey Road,
Goregaon East, Mumbai-400063

अथवा
आरंभित
DRN.

उप.प्र.वि.सं. (प्र.वि.)
DY. CEE (D)

चित्ररंजन रेल इंजन कारखाना
पश्चिम बंगाल, भारत
CHITTARANJAN LOCOMOTIVE WORKS
WEST BENGAL, INDIA

क्रमांक/NO. CLW/ES/8-14 ALT. 4
दिनांक/DATE: 10.04.2001

Proforma for checks during Routine Inspection:Motors

1. Firm should submit the complete details as per Appendix D1,D2, D3,D4 and E of specification No.E-10/3/09(motor) with Amendment No.1(Motor for 3-phase Loco) and specification No.E-10/3/08 (Revised) with Amendment No.1(Motors for conventional loco).

2. Firm should ensure the use of the following critical itenssas mentioned below:

Sl. No.	Item	Material	Governing specification	manufacturer
1.	Winding wire	Enamelled winding wire	IS13730 pt.13 Grade-2, 1998	RDSO approved sources.
2.	Slot insulation	NKM(nomex 410-Kapton Nomex410) or Nomex416	IEC: 60626-3 (1996-11)	-do-
3.	Interphase/ Interlayer <i>Winding</i>	NKM (Nomex 411-Kpton Nomex 411)		-do-
4.	Wedge	Epoxy bonded glass fibre laminates	BDV 5 kv for 1 minute.	
5.	Wedge separator	Same as slot insulation	-do-	
6.	connecting lead wire	Flexible insulated fibre glass copper connecting lead wire with fire retardant silicon elastomer for temperature-50°C to 180°C and BDV of 6 kv 1 minute minimum	BSS:6195-1969 RDSO approved Type 8 'B' category C for 4 & 6 mm. size and category 'D' for 10mm size.	
7.	Sleeve	Fibre glass sleeve with coating of fire retardant silicon elastomer applied by extrusion of multidip process having temp. index of 180°C type 1/180 Tb having wall thickness of 0.9mm	BS:2846 and capable to withstand minimum BDV of 5kv for 1 minute.	-do-

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अंशित
DRM.

डि.सु.वि.प्र. (अति.)
DY. CEE (D)

चितरंजन रेल इंजन कारखाना
पश्चिम बंगाल, भारत
CHITTARANJAN LOCOMOTIVE WORKS
WEST BENGAL INDIA
क्रमांक/NO. CLW/ES/8-14 ALT-FD
दिनांक/DATE : 23-4-2001

Sl. No.	Item	Material	Governing Specification	Manufacturer
8.	Depregnating varnish	Dobeekon FT2015/2005/500 EX	Manufacturers test data	Scheneetady Beek India
9.	Stampings for stator and rotor	CRNGO Elect. steel sheets M45 grade with C3 coating	IS:648-1994	
10.	Shaft	EN-24 steel	BS970	
11.	Bearing	Deep grooved ball bearing with C3 radial clearance. Interference fit for type K5 and J6	Manufacturers test data.	SKF-France Germany. FAG/Germany NSK/Japan
12.	Terminal block	Epoxy moulded glass reinforced	BS:3615	BDSD Drawing No. SKEL2754A & 2784A. BDSO approved sources.
13.	Epoxy moulded Terminal Box cover	Epoxy moulding	IS:10192-1982 Grade Ep-2	BDSD approved sources.
14.	Dynamic balancing	Grade 2.5	ISO 1940-1973 or IS 11723-1992	
15.	Grease	Servogem RF-3	IS:7623-1973	IOC
16.	Drawing	Dimensional, longitudinal cross sectional drawing of motor, terminal box fitted with terminal block and connecting lead wire and lugs.	As per manufacturers drawing.	

*NOTE : For list of approved sources and complete description of material, please refer to BDSO SMI No. ELRS/SMI/165-2000 (Rev.001) with amendment No.1&2 dated 28-12-2000 & 15-3-2001 respectively.

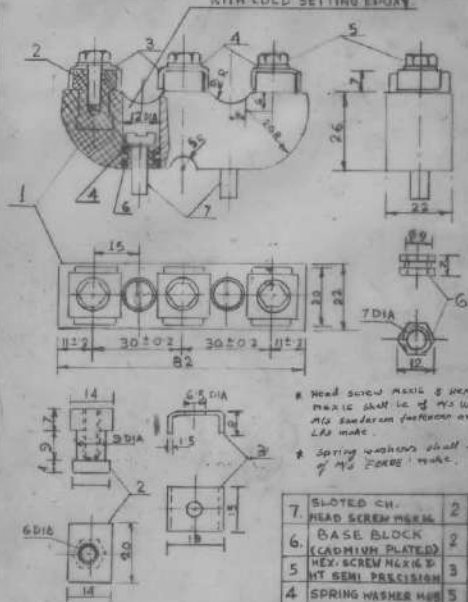
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ज.सु.वि.न. (प्र.वि.)
DY. CEE. (D)

चितरंजन लोकमोटिव वर्क्स
चितरंजन, भारत
CHITTARANJAN LOCOMOTIVE WORKS
WEST BENGAL, INDIA
क्रमांक/NO. CLW/ES/B-14 ALT-40
दिनांक/DATE: 23-4-2001

HOLE TO BE HALF FILLED
WITH COLD SETTING EPOXY

Sheet 69



* Head screw maxis 8 hex screw maxis shall be of M/S UNIKON, M/S SANDRAM fasteners or M/S LPS make.

* Spring washers shall be of M/S FOMEX make.

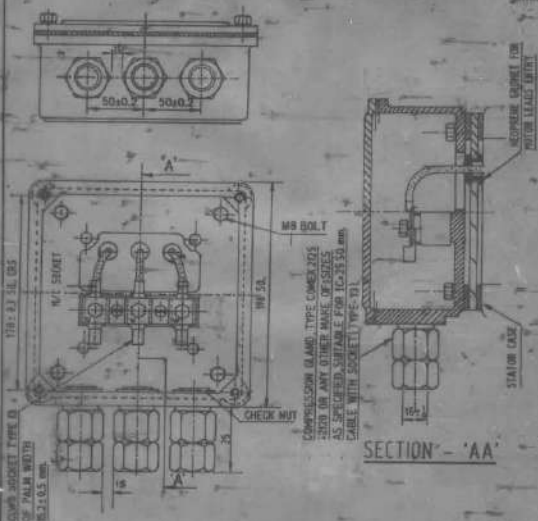
1. SURFACE FINISH FOR METALLIC PARTS IS 3073

2. TIGHTENING TORQUE SHOULD BE 0.75 Kgm TO 1.03 Kgm

7.	SLOTTED CH. HEAD SCREW M8x16	2	STEEL IS: 1364 RSD
6.	BASE BLOCK (Cadmium plated)	2	STEEL IS: 226, 1572
5.	HEX. SCREW M4x10 HT SEMI PRECISION	3	STEEL IS: 1364 RSD
4.	SPRING WASHER M4x5	5	IS 3063
3.	CLAMP (Cadmium plated)	3	STEEL IS: 226, 1572
2.	TOP BLOCK (Cadmium plated)	3	STEEL IS: 226, 1572
1.	EPOXY MOULDING	1	IS 3063
REF. NO.	DESCRIPTION	QTY.	MATERIAL SPECIFICATION

TERMINAL BLOCK FOR
AUXILIARY MOTOR
MCP, MPV, MVSL, MVSI

CHITTARANJAN LOCOMOTIVE WORKS
WEST BENGAL, INDIA
SHEET NO. 1CLW/ES/SK-5/B.1
DATE 6-7-14



TERMINAL AND CABLE ENTRY ASSEMBLY
FOR MCP, MWT, MVPH MOTORS

WAG-7 & WAP-4

BY: CEE (B)

CHITTARANJAN LOCOMOTIVE WORKS
WEST BENGAL, INDIA

WAG/NO. 62W/ES/SK-7/6/14
RINW/DATE: 2/10/2000

Guide No. TLE5/WR/0103

GOVERNMENT OF INDIA
MINISTRY OF RAILWAYS

GUIDELINES

FOR

MANUFACTURING OF BLOWERS USED ON

ELECTRIC LOCOMOTIVES

(CONVENTIONAL & 3-PHASE DRIVE ELECTRIC LOCOMOTIVES)

JUN - 2001

Issued by

ELECTRICAL DIRECTORATE

RESEARCH DESIGNS & STANDARDS ORGANISATION

MAHAK NAGAR, LUCKNOW - 226011

SPECIFICATION FOR MOTOR
DRIVEN BLOWER

BY. CEE/B-1

CLW/CRJ

NO.-CLW/ES/B-14 /B

DATE:- 07/01/2004

- 1.0 This guideline has been prepared for guidance of blower manufacturers who are supplying blowers to Indian Railways for Electric Locomotives (Conventional and 3 Phase drive locomotives).
- 2.0 This guideline comprises three Annexures details are as below: -
- | | | |
|-------------------|---|--|
| i) Annexure-I | : | Minimum essential test facilities. |
| ii) Annexure-II | : | A typical quality assurance plan for manufacturing blowers for Electric Locomotives. |
| iii) Annexure-III | : | Guidelines for inspectors during routine tests of blower motor set. |
- 3.0 This Guideline should be read in conjunction with latest RDSO Specification No. E-10/3/09 (blower) of Aug., 1997 and CLW Specification No. CLW/MS/B-3 for blowers with all amendments.
- 4.0 It is desirable to have ISO-9000 Certification by prospective blower manufacturers.

	SPECIFICATION FOR MOTOR DRIVEN BLOWER	 DY.CEE/D-1	CLW/CRJ NO.- CLW/ES/B-14/B DATE:- 07/01/2002

ANNEXURE-I

T-6T FACILITIES

The following minimum essential testing facilities are required for blowers.

- (1) Testing rig as per IS:3588
- (2) Manometers
- (3) 3-Phase voltage regulator(0-500V)
- (4) Facility for creating unbalance upto 5%
- (5) Control panel comprising wattmeters, ammeters, voltmeter, frequency meter etc.
- (6) Multimeter
- (7) Tong Tester
- (8) Tachometer
- (9) Vibration meter
- (10) Shock pulse meter
- (11) On OFF timer arrangement for starting duty test
- (12) Stop watch
- (13) Thermometers
- (14) Dynamic balancing machine suitable for balancing grade G 2.5
- (15) Portable Balancer
- (16) Weighing machine
- (17) Air velocity meter
- (18) Vernier Calipers, screw gauge, scale, etc.
- (19) Meggar
- (20) Oscilloscope for measuring starting time & current.

NOTE: All above instruments should be duly calibrated.

CHKD. 	SPECIFICATION FOR MOTOR DRIVEN BLOWER	 DY.CEE/D-1	CLW/CRJ NO:- CLW/ES/B-14/B DATE:- 07/01/2004

QUALITY ASSURANCE PLAN FOR MANUFACTURING BLOWERS FOR ELECTRIC LOCOMOTIVES

ASU-XDP-11

Sl. Components & No. operation	Characteristic	Classification	Type of check	Quantum of check	Acceptance norm.	Format of record	Agency
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)

1. MATERIAL

(a) Fan casing

(1) Side plate & stiffeners.

Surface & f-ct.

Major

Visual

100%

MS as per IS:2062 Inspection report.

Report of By U.C.C.

(1) Scroll.

(b) Impeller

(1) Impeller blade, Back plate and shroud.

Visual dimensional, chemical & physical.

Critical.

Visual & by Qm sample measurement, per lot at random.

chemical analysis, bend & tensile strength of plates.

IS:1079 IS:2062 (Domex-4008, ST-52-LS:1079 ST-55-4W of IS:961

saills 350 of SAIL AISI-304 or any other steel having superior quality. The steel should be welded with electric trodes.

Arrival & inspection report Welding strength calculation should be submitted. Welding should be on both sides of impeller with continuous run with flat & concave in nature to achieve better fracture toughness.

Report of By U.C.C.

SPECIFICATION FOR MOTOR DRIVEN BLOWER

DRN

CLW/CRJ

NO -CLW/ES/8-14/8
DATE: 08/01/2002

BY CEE/D-1

Contd...

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(c)	Sub	Surface defect.	Major	Visual	100%	IS:210 Free from surface defect.	Inspection report.	Review of report by D. G.
(d)	End-stal (1/2 sheet & Plates)	Visual, dimensional chemical and phys- ical.	Major	Visual measure- ment, chemical analysis bond & tensile tensile strength.	Qnr from each lot.	IS:1079 for sheet & IS: 2032 for plate & sections.	Arrival Note & Test Cer- tificate.	-do-
(e)	Hardware.	Visual	Major	Visual	100%	High tensile, grade 8.8 from reputed make e.g. GKN, TVS, etc.	Inspection certificate.	-
(f)	Welding electrode.	-	Critical	Visual	100%	MSB-5013 (For trans- former and other blo- wires). E-7018 (For IM blowers).	Arrival note.	-
IN PROCESS INSPECTION								
1.	Casing, side Plate, scroll.							
(a)	Marking, & cutting & forming.	Visual and dimensional.	Major	Visual and measurement.	100%	As per draw- ing.	Operation card	-do-
(b)	Tack weld- ing.	Dimensional check.	Critical.	Measurement	100%	-do-	-do-	-do-

SPECIFICATION FOR
MOTOR DRIVEN BLOWER

CHKD.

DY. CEE/D-I

CLW/CRJ
NO.-CLW/ES/B-14/B
DATE:- 07/12/2022

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(c)	Final welding.	Weld quality & dimensional check.	Critical	Measurement	100%	As per approved welding procedure. Welding should be continuous.	Operation Card	Q.C.
(d)	Straightening.	Visual.	Major	Visual.	100%	As per drawing.	-do-	-
(*)	Shot blasting/finishing.	Visual	Major.	Visual.	100%	Surface should be free from rust etc.	-do-	Q. C.
2. <u>Impeller.</u>								
(a)	<u>Hub</u>							
	Turning & Key way matching.	Dimensional Check.	Major	Measurement.	100%	As per Dwg.	-do-	Q.C.
(b)	Marking, cutting, forming and machining.	Visual & Dimensional.	Major	Visual & Measurement.	100%	As per part Drawings.	-do-	Q. C.

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SPECIFICATION FOR MOTOR DRIVEN BLOER	CHKD.	DY.CEE/D-1	CLW/C NO.-CLW/ES/8-14/8 DATE:- 07/01/2012
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(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(c) Welding.	Visual welding quality.	Major	Visual Op test X Ray test.	100% 70% on sam- ple basis.	As per approved welding procedure, destruction test.	As per Operation. card	Q.C.	
(d) Finish & set to gauge.	Concentricity on fixture.	Major	Visual	100%	As per drc.	-do-	Q.C.	
3. <u>On complete impeller.</u>								
(a) Truing	To see con- centricity.	Major.	Visual, by mounting on fixture.	100%	As per drc.	Operation card.	Q.C.	
(b) Static balancing.	Should rest at any position.	Major	-do-	100%	-do-	-do-	Q.C.	
(c) Dynamic balancing.	Balancing grade. Balancing machine type vibration motor.	Critical	On balancing machine of suitable size and weight manufacturers should have portable balanc- ing for combin- ing, i.e., blowing, i.e., rotor and blow- er together.	100%	Grade 2+5 ISO-1940- 1977 or ISO 1723- 1985, For blower as alone as well with motor. *	Internal test report. A certificate of calibration of blencing machine should be kept ready & should sub- mitted.	Q.C.	

* Balancing grade should be 2.5. Vibration should not be more than 40 microns on casing or any part of blower & 25 micron on motor for NVP & NVRH blowers. 15 on blower & 10 on motor for other blowers. Vibration meter should be duly calibrated.

SPECIFICATION FOR MOTOR DRIVEN BLOWER	 C.K.D.	DY. CEE/D-1	CLW/CRJ	contd....
			NO - CLW/ES/B-4/B DATE: 04/01/2024	

(1) - (2) -	(3)	(4)	(5)	(6)	(7)	(8)	(9)
4. <u>Podestal & base frame.</u>							
(a) <u>Marking, cutting & forming.</u>	Visual & dimensional.	Major	Visual & measurement.	100%	As per part drawings.	Operation card.	Q.C.
(b) <u>Welding.</u>	Visual.	Major.	Visual.	100%	As per approved welding procedure.	-do-	Q.C.
(c) <u>Strengthening.</u>	Visual	Major	Visual.	100%	As per Drg.	-do-	Q.C.
(d) <u>Shot blasting.</u>	Visual.	Major	Visual.	100%	1 -	-do-	Q.C.
5. <u>Assembly.</u>	Visual & dimensional.	Major	Measurement	100%	As per approved drg.	-do-	Q.C.
6. <u>Final Painting.</u>	Visual	Major	Visual	100%	As per RDSO/CM specification.	-do-	Q.C.
7. <u>Final inspection in presence of Client.</u>	Measurement.	Critical.	Measurement.	100%	As per RDSO/CM Specification.	-	Q.C & Client.

SPECIFICATION FOR
MOTOR DRIVEN BLOWER

CHKD.

DY.CEE/D-4

CLW/CRJ
NO- CLW/ES/B-14/B
DATE:- 07/01/2002

Guidelines for Inspectors during routine tests of Blower motor set.

- R-f: 1. RDSO Specification No. W-10/3/09(Blower) of Nov. 1977 for Blower of 3-Phase Drive Electric Locomotives(WAG9 & WAP5)
2. CLW Specification No. CLW/ES/B-3 for conventional locos (WAG7 & WAG5 etc.)

During the routine inspection of the blowers, following points are to be checked by Inspectors for conventional and 3-Phase drive Electric Locomos:

Sl. No.	Details	Check	Acceptance criterion
1.	<u>Material</u>		
(a)	Impeller	a) Grade of steel	For NVMF DOMEX400, ST-52 to IS:1079, SAILMA-350 of SAIL or AISI-304. For NVMH M.S. to IS:1079(Grade '0') Should be smooth & free from rust.
(b)	Fan Casing	a) Grade & quality of sheet. b) General finish.	IS:1079(Grade '0') or IS:2062(B/C) Should be smooth & free from rust.
(c)	Thickness	a) Impeller blades. b) Casing side plate. c) Casing scroll plate. d) Impeller back plate. e) Shroud.	As per approved drawing.
(d)	Physical & Chemical Properties.	a) Impeller blades. b) Back plate. c) Shroud.	As per respective specification (Test certificate from approved lab for each order).
2.	<u>Welding.</u>	a) Grade of Electrode. b) Welding quality. c) D.P. Test. d) X-ray test by sampling. e) Welding strength calculation.	MS-227018/MS-226013 Should be smooth & continuity welded from both sides. Should be checked at random. Submit X-ray record. Submit calculation. Should not be less than 50 kg/mm ² .

SPECIFICATION FOR
MOTOR DRIVEN BLOWER

CHKD.

DY. CEE/DH

CLW/CRJ

NO. CLW/ES/B-14/B

DATE:- 07/09/2007

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Sl. No.	Details	Check	Acceptance criterion
3.	<u>Measurement.</u>		
	a) Critical dimensions e.g. mounting, relay fixing etc.		As per approved drawing.
	b) Checking of impeller fixing & locking arrangement.		As per approved drawing.
	c) Clearance between inlet cone and impeller.		As per approved drawing.
4.	<u>Balancing</u>	(To be done in house on calibrated machines).	
i)	On impeller alone	G-2.5	ISO-1940-1973 or IS:11723-1985
ii)	With impeller & Rotor.	G-2.5	ISO-1940-1973 or IS:11723-1985
	OR		
iii)	By portable balancer on combined unit.	G-2.5	Submit values in gmm/kg for combined unit & impeller alone.
5.	<u>Tests</u>		
i)	Calibration.	Checking of calibration certificate of all testing equipment including balancing machine and vibration meter.	Certificate from approved lab.
ii)	Starting time test.	Measurement of starting time at lowest voltage (290V), Measure Oscilloscopically.	Should be less than 6 seconds.
iii)	Vibration level measurement.	Measurement of vibration level.	Vibration limit : - i) For MVM & MVRH: On Motor: 25 P-P On Blower Casing: 40 P-P. ii) For MVSL, MVSL & Seawing Blowers On Motor : 10 P-P on Blower casing : 15 P-P.
iv)	Condition of bearing	Measure the condition of bearing by stock pulse meter.	Should be in green zone.

SPECIFICATION FOR
MOTOR DRIVEN BLOWER

CHKD.

DY.CEE/D-1

CLW/CRJ

NO:-CLW/ES/B-14/B

DATE:- 07/01/2002

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Sl. No.	Details	Checks	Acceptance criterion
6.	<u>Name Plate</u>	Check the name plate detail.	RD90 /CLW Specification.
7.	<u>Painting.</u>	Check the quality of painting.	Light Gray IS:5. ISC-639
8.	<u>Hardware</u>	Check for cadmium plating and grade.	Should be of 8.8 grade of reputed make e.g. GMA, Sundaram Fastener, LPS, Unbrako and Boltmaster.
9.	<u>Unit weight.</u>	Measurement of weight.	should be as per the weight recorded during prototype test.
10.	<u>Manufacturing process.</u>	Random check of manufacturing process and various stages.	QAP of the firm.
11.	<u>Stage Inspection recorded and QAP.</u>	Check the stage inspection records at random.	As per the norms laid down in CLW/RD90 Specification and QAP submitted by the firm.

IN/B/12/2001.

SPECIFICATION FOR
MOTOR DRIVEN BLOWER

CHKD.

DY.CEE/D

CLW/CRJ

NO.-CLW/ES/B-14/B

DATE:- 07/01/2002