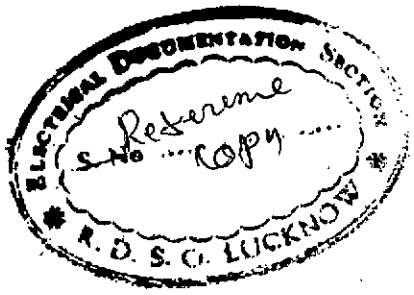
S. No._____ Specification No.SPEC/E-12/4/03

GOVERNMENT OF INDIA
MINISTRY OF RAILWAYS
(RAILWAY BOARD)



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SPECIFICATION AND TEST SCHEDULE

FOR

MOTOR STARTING CONTACTOR

FOR

ELECTRIC LOCOMOTIVES

SPECIFICATION NO.SPEC/E-12/4/03

FEBRUARY, 1973

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RESEARCH DESIGNS & STANDARDS ORGANISATION

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SPECIFICATION FOR MOTOR STARTING CONTACTOR FOR ELECTRIC LOCOMOTIVES

0. FOREWORD

0.1 The contactor covered by this specification is used on electric locomotives for direct on line starting of 3 phase squirrel cage induction motors driving the auxiliaries like compressor, exhauster and blowers. The contactors are operated by remote control from the driver's desk.

0.2 Assistance has been taken from the following for the preparation of this specification:-

IS: 2959 - 1965	Specification for ac contactors of voltage not exceeding 1000 V.
IEC 77 - 1968	Rules for electric traction equipment.
IEC 292-1-1969	Low voltage motor starterc - Part 1 - Direct on line (full voltage) ac starter.

0.3 Deviation

0.3.1 Any deviation from this specification calculated to improve the performance, utility and efficiency of the equipment, proposed by the manufacturer, will be given due consideration provided full particulars, with justification thereof, are furnished in the tender.

1. SCOPE

1.1 This specification covers the requirements of motor starting contactor for 25 kV ac electric locomotives. Eight contactors are required per locomotive.

2. SERVICE CONDITIONS

2.1 The contactor shall be suitable for operation in ambient temperature varying from 0°C to 55°C, relative humidity ranging upto 100%, at an altitude of 1000 metres above mean sea level and in dusty atmospheric conditions.

2.2 The equipment and its mounting arrangement shall be of 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	3.0 g
c) Maximum transverse acceleration	0.5 g
d) Maximum frequency 10 Hz with amplitude of	2.5 mm

("g" being acceleration due to gravity)

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

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

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

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

3. TYPE AND RATING

3.1	Type - 3 pole, 3 phase, 50 Hz, air break electromagnetic contactor.	
3.2	Rated voltage of operating coil	110 V dc
3.3	Normal operating voltage range	70 V to 125 V
3.4	Main contacts	
	i) Continuous rating	80 A, 500 V, 3Ø 50 Hz, ac
	ii) Maximum making current	800A at 550 V, .35 p.f.
	iii) Maximum breaking current	640A, at 550 V .35 p.f.
3.5	Auxiliary contacts	
	i) Continuous rating	10 A at 110 V dc
	ii) Make rating	15 A at 110 V dc
	iii) Break rating for cyclic duty	0.5 A inductive load (L/R=40± 5 ms) for 2 lakh make & break operations at 110 V dc
	iv) Maximum break rating	3 A inductive load at 110 V dc (L/R = 40 ± 5 ms).

NOTE: The contact ratings are conresponding to ambient conditions specified in clause 2.

Duty cycle

The contactor shall perform 30 complete operating cycles (closing and opening) in one hour duty. The standard duty cycle class shall be '0.3' and utilization category 'AC-3' as per IEC Publication 292-1 for intermittent operation. The q equivalent rating shall not be more than continuous rating of the contactor. The contactor shall also be suitable for continuous duty.

4. GENERAL DESIGN ASPECTS

4.1 General features

4.1.1 Materials shall be suitable for the particular application and capable of passing the appropriate tests.

4.1.2 High quality materials shall be used for a high reliability in operation. All wear-parts shall be easily replaceable.

4.1.3 The contactor shall allow for clear arrangement, easy and secure maintenance of components and shall be so designed and constructed that mechanical shock or external vibration shall not operate or damage it.

4.1.4 All nuts and screws shall be securely locked and shall not loosen in service due to vibration or other causes as normally met in traction duty.

4.1.5 All components, both separately and in combination, shall be either resistant to corrosion or be so chemically treated to resist corrosion.

4.1.6 The material used as insulation for terminals, and other components shall be tough, incombustible and non-hygroscopic and shall withstand the service conditions specified in clause 2.

4.2 Main contacts

4.2.1 The main poles shall have anti-welding contacts for long contact life and the contact system shall be designed to virtually eliminate contact bounce,

4.2.2 The moving contacts of the contactor shall be carried on suitable bearings to avoid any sluggish operation. The upper contact shall be fixed.

4.2.3 Compression spring shall be mounted on the moving contacts to give requisite contact pressure. The springs shall be of suitable rust proof material and designed so that it shall not be subjected to any deformation and loss of spring pressure during service.

4.2.4 The contact system design shall be such that when the contacts make, there is a certain amount of relative movement of "wipe", to keep the contacts clean automatically.

4.2.5 Both fixed and moving contacts shall be accessible from front for quick inspection and replacements.

4.2.6 Main mobile contacts and their carrier shall be so adjusted that they shall open and close exactly at a same moment.

4.2.7 Main contacts shall be capable of carrying its rated current as well as intermittent cycling duty without exceeding the temperature rise limit specified.

4.3 Arc chutes

4.3.1 The contacts shall be shrouded with suitable arc chute with magnetic blow out for quick and intensive arc quenching to prevent high loss of contact material during breaking of heavy currents.

4.3.2 Arc chute material shall be tough, incombustible, self extinguishing, non-hygroscopic and have low arc tracking properties, high resistance to heat and high dielectric strength. Its mounting arrangements on the contacts shall withstand service conditions specified in clause 2.

4.3.3 The side gap between main contacts and arc chute shall be at least 1.5 to 2 mm to ensure free movement of moving contact in the arc chute.

4.3.4 Arc chutes shall be inter-changeable.

4.4 Auxiliary contacts

4.4.1 The contactor shall be provided with 3 sets of auxiliary contacts (3 normally opened and 3 normally closed).

4.4.2 The design of the contact assembly shall be such that they are reversible from N.O. to N.C. and vice versa.

4.4.3 The contact springs shall be of suitable material and designed so that they shall not be subjected to any deformation and loss of spring pressure during service.

4.4.4 Contact elements shall be firmly secured so that they shall not shift or become loose during service.

4.4.5 If twin contact elements are employed, these shall be co-planer and shall make or break contact simultaneously.

4.4.6 Contacts shall be readily visible from the fon.

4.4.7 Contact fingers shall be made of such material and

so proportioned that they will not flex appreciably under operating conditions, i.e., shall not be loaded beyond half of their elastic limit. Movements of the contacts shall ensure self-aligning, self-cleaning and wiping action.

4.4.8 As far as possible, the opening and closing of the contacts shall not be accompanied by any rebound. The assembly shall be designed so as to reduce contact chatter, bounce and hesitation to a minimum on closure of the contact elements concerned. When the contactor is energised at rated voltage, or released, the contact elements shall establish steady contact conditions.

4.4.9 If a NC contact remains accidently closed (due to failure/welding), none of the NO contacts shall close or NC contacts open.

4.4.10 The minimum contact pressure on the auxiliary contact shall be 25 $\pm$ 5 gms and shall maintain its accuracy during the normal life of the contacts.

4.4.11 The contact gap shall not be less than 3 mm.

4.4.12 Movement of contact shall ensure self alignment, self cleaning and wiping action.

4.5 Core and armature

4.5.1 The core and armature supports shall be so mounted that the position of the core with respect to the armature and to the fixed parts at the contacts shall be maintained constant throughout the life of the contacts.

4.5.2 The armature supports shall be so designed as to ensure a reliable operation of the armature. The functioning of the contacts shall be controlled solely by the movement of the armature.

4.5.3 The gap between the armature and core must not be affected either by distortion or by wear. (The armature travel shall maintain its accuracy in service). The armature shall move freely without causing any rebounding, withholding or sticking.

4.6 Coils

4.6.1 In the construction of operating coil, either class E or class B insulating materials shall be used. The winding shall conform to IS:4800 (Part V) - 1968.

4.6.2 The coils shall be protected chemically and physically from injury caused by vibrations.

4.6.3 The coils shall be vacuum impregnated and backed

for tropical condition and further treated so as to make the surface smooth and imprevious to moisture under all service conditions. Materials used for impregnation and insulation of coils shall be chemically and physically stable for service conditions stipulated in clause 2.

4.6.4 Insulating material used for fillers in winding the coils shall be chemically heutral.

4.6.5 Coils shall be such that they will be able to carry 150% of the rated current continuously and 200% of the rated current for four hours without injurious heating under specified service conditions.

4.6.6 With no current flowing through the main circuit, the coils shall also withstand the following frequencies of operation, without exceeding temperature rise limits:-

One close-open operating cycle every 120 secs.	Interval of time during which the supply of the control coil is maintained - 60 secs.

4.6.7 The terminals of the coil shall be of robust design to prevent any movement while tightening a crimped lug of 3 mm^2 copper cable.

4.6.8 The coil shall be designed without any economy resistance and suitable for pick up at the lowest voltage (70 V) when hot and temperature rise at 125 V within limits.

4.7 Terminals

4.7.1 The terminals intended for external connections shall be arranged on either side vertically so that they are readily accessible. The connections to the equipment shall be made from the front by crimped 3 mm^2 copper cable.

4.7.2 Terminals shall be such that they cannot turn or be displaced when the connecting screws are tightened and such that the conductors cannot become displaced.

4.7.3 Terminal connections shall be such that the conductors be connected by means of screws or other means to have required contact pressure permanently.

4.7.4 No contact pressure shall be transmitted through insulating materials and the gripping of the conductors shall take place between metal surfaces.

4.8 Clearance and creepage distance

4.8.1 The clearances and creepage distances shall be

adequate and shall comply with the recommendations of IEC: 225-I-1967. Wherever practicable, ridges shall be incorporated in order to break continuity of conducting deposits.

5. TEMPERATURE RISE

5.1 The maximum temperature rise permissible on the various components shall not exceed the following values:-

Coil	55°C for class E insulation 65°C for class B insulation
Contacts:	
Pure copper or copper alloy not forming spring	45°C
Solie silver or silver plate	70°C
Blowout coils	65°C
Other parts like shunts, terminals etc.	60°C

5.2 The temperature of the surrounding air shall be measured by means of at least two thermometers, so placed as to take account of the maximum and minimum ambient temperatures and the mean reading shall be adopted for the purpose of ambient temperature.

6. MOUNTING

6.1 The contactor shall be panel mounted. The mounting arrangement shall be subject to approval of the purchaser prior to manufacture. The overall size of the contactor shall not exceed the dimensions given

7. ENCLOSURE

7.1 The auxiliary interlocks shall be provided with a totally dust proof and heat resistance, robust, transparent cover to preclude ingress of dust. The complete contactor need not be provided with a cover.

8. MARKING

8.1 Each contactor shall be provided with a rating plate carrying the following data, marked in a durable manner and located in a place such that they are visible and

legible when the contactor is installed :-

a) the manufacturer's name and trade mark

b) type, designation and serial number

c) rated voltage

d) rated current, frequency

e) rated making and breaking capacities

f) ~~rated~~ contact arrangement

g) rated supply voltage of the coil.

9. SCHEDULE OF PARTICULARS

9.1 The schedule of particulars of the contactor given in Annexure 1, shall be furnished with the tender.

10. DRAWINGS

10.1 General outline dimensional drawing of the contactor and its mounting arrangement shall be furnished with the tender. Details of the main and auxiliary contacts and electrical connection diagram shall also be included. All other possible details shall also be included.

11. TECHNICAL DOCUMENTS

11.1 The manufacturer shall supply the technical documents like maintenance instructions, type test reports, test certificates, 'as made' drawings, spare part catalogue, as desired by the purchaser, with the first batch of supply.

12. TOOLS

12.1 The supplier shall supply one complete set of tools and gauges for maintenance with each batch of 10 sets of equipments supplied. The list of tools to be supplied shall be furnished along with the tenders.

13. TESTS

13.1 Tests are classified as "type tests" and "routine tests". Type tests shall be carried out to the satisfaction of Railway/RDSO representative. If type tests have already been successfully completed, photostat copy of the type test report shall be submitted for approval. However, the purchaser shall have the right to ask the supplier to carry out type tests on the equipments, to the extent of 2%, to ensure compliance with the specification.

13.2 Type tests

13.2.1 Preliminary checking

.1 General inspection of the contactor shall be carried out to check the constructional aspects and quality of materials.

.2 Contact alignment - Main and auxiliary contacts shall be examined visually. They should operate correctly.

13.2.2 Contact gap and contact pressure

The contactor shall be fed at 110 V dc and the contact gap and contact pressure on the main and auxiliary contacts shall be measured with appropriate guages and results recorded.

13.2.3 Checking of mechanical operations

The tests consist in checking twenty times in succession that the contactor shall operate correctly within the limits of supply voltage.

13.2.4 Operating value test

Pick up voltage of the contactor shall be determined by gradually increasing the applied voltage to the operating coil until the contactor just operates.

The contactor shall operate satisfactorily between 70 V to 125 V under all service conditions. The hot operation at minimum voltage shall be considered to be satisfactory if the contactor, when cold, operates normally when it is supplied with a current equal to that which would flow through the contactor after 1 h of continuous operation at the minimum voltage and at maximum specified ambient.

13.2.5 Reset value test

The contactor shall be tested for the resetting value by gradually decreasing the dc voltage until the contactor returns to unoperated position.

13.2.6 Mechanical endurance test

1,000,000 mechanical operations (closing and opening) at the rate of 5 operations per second, shall be carried out with the magnet coil fed at the nominal voltage of 110 V, Operational values (pick up and drop out) contact pressure, contact gap and wipe of main and auxiliary contacts shall be measured at the commencement of the test, after every 200,000 operations and at the end of the test. At the expiry of the

test, the contactor shall be visually examined and it should be able to operate normally without special attention other than cleaning. The variation in operating values shall not exceed ± 5% after 11 million operations.

13.2.7 Test for withstanding vibration and shock

This test shall be carried out in accordance with the details given in Annexure 2. At the expiry of the test, verify that

- no screw or nut is loose
- the elastic inserts, if any, have correctly fulfilled their purpose
- no distortion or corrosion of any components
- resistance value is not altered
- insulating blocks are not cracked or broken
- firmness of coil tags and other terminals of contactors and no mechanical failure
- proper functioning of the complete unit without any attention or maintenance.

13.2.8 Resistance measurement

Resistance of the operating coil shall be measured and recorded, corrected to 20°C. The value shall not vary by more than ± 8% from the specified value.

13.2.9 Temperature rise test

.1 Temperature rise of various parts shall be determined at respective maximum continuous rated voltage and current for a period of time sufficient to enable the temperature rise to reach a steady value. The temperature rise shall not exceed the values given in clause 5.

.2 The value of current passing through the coil at various steps shall be recorded.

.3 With no current flowing through the main and auxiliary circuits, the steady state temperature rise of operating coil of the contactor shall be determined at the frequency of operation specified in clause 4.6.6. The temperature rise shall not exceed the values given in clause 5.

13.2.10 Switching capacity tests

.1 The following switching performance tests are intended to verify that the contactor is capable of making and breaking currents at voltages as specified in table 1. The verification of making and breaking capacity is done as separate tests.

TABLE 1

Verification of the rated making and breaking capacities

Category	Make			Break		
	I	U	Cos ∅	I	Ur	Cos ∅
AC-3 Ie less than 100A	10Ie	1.1 Ue	.35	8xIe	1.1 Ue	.35

Ie = rated operational current

Ue = rated operational voltage

I = current made or broken

U = voltage before make

Ue = recovery voltage

.2 The auxiliary contact shall be connected in a circuit so adjusted as to obtain a current equal to their maximum make or break rates as specified in clause 3.5 (ii) and (iv) respectively.

a) Make capacity test

The contactor shall be connected in a circuit so adjusted as to obtain a maximum make current at a voltage and power factor specified in table 1.

(i) The contactor shall successfully perform 50 closing operations at operating coil voltage of 70 V dc and 50 closing operations at operating coil voltage of 125 V dc. The current shall be interrupted by other devices while breaking heavy currents by contacts during opening.

(ii) The duration of the test current shall not be less than 50 ms(thereby

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exceeding the total bounce time, if any, of the contacts) and the time interval between an opening operation and the closing operation immediately following, shall be 10 seconds.

(iii) The test results for first five and last five operations shall be recorded oscillographically.

b) Break capacity test

The contactor shall be connected in a circuit so as to obtain the breaking current at voltage and power factor specified in table 1. The contactor shall perform 25 breaking operations at rated coil voltage. The duration of current flow shall not exceed 0.5 seconds per operation and the time interval between two successive breaking operations shall be 10 seconds.. The test results of first three and last three operations shall be recorded oscillographically.

.3 During the above tests, there shall be no permanent arcing, no flashovers and no welding of main and auxiliary contacts and any other sign of distress.

13.2.11 Electrical endurance test

.1 The electrical endurance test is intended to verify the contactor resistances to electrical wear after a number of on-load operating cycles corresponding to the service conditions given in table 2 below, which can be made without repair or replacement. The number of on-load operating cycles (for main contacts) shall be 1/20 of the number of no-load operating cycles corresponding to the mechanical endurance of the contactor.

TABLE 2

Verification of the number of on-load operating cycles

Category	Make			Break		
	I	U	Cos φ	I	Ur	Cos φ
AC 3	6xIe	Ue	0.35	Ie	0.17 Ue	0.35

Ie = rated operational current

Ue = rated operational voltage

I = current made or broken

U = voltage before make

Ur = recovery voltage

.2 .2 Main contacts - the currents to be made or broken shall be as given in Table 2 and the test circuit shall comprise of inductors and resistors so arranged as to give the appropriate value of current voltage and power factor. 50,000 on-load operating cycles at the rate of 30 operations per hour shall be carried out with the operating coil fed at a nominal voltage of 110 V dc. The test results of first five and last five operations shall be recorded oscillographically. At the expiry of the test, the contacts shall be visually examined and operate normally without any special attention and shall withstand dielectric voltage specified in clause 13.2.12.

.3 Auxiliary contacts - 2 lakh make and break operations at rated breaking current for cyclic duty shall be carried out, the frequency of operations being one per second. At the expiry of the test, the contacts shall be able to operate normally without any special attention.

13.2.12 Dielectric tests

Dielectric tests shall be made on new contactors mounted as for service, including internal wiring and in a clean and dry condition.

When the base of the contactor is of insulating material, metallic parts shall be placed at all the fixing points in accordance with the conditions of normal installation of the contactor and these parts shall be considered as part of the frame of the contactor.

.1 Main circuit

For these tests, the control and auxiliary circuits which are not normally connected to the main circuit, shall be connected to the frame. A test voltage of 3250 V rms at 50 Hz shall be applied for 1 minute as under:-

a) with the main contacts closed:

between all live parts of poles connected together and the frame of the contactor

b) with the main contacts open:

1) between all live parts of poles connected together and the frame of the contactor

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ii) between the terminals of one side connected together and the terminals of the other side connected together.

c) A test voltage of 2000 V rms, 50 Hz shall also be applied for one minute between the main contacts and arc chute.

.2 Control and auxiliary circuits

For these tests, main circuit shall be connected to the frame. A test voltage of 2000 V rms at 50 Hz shall be applied for 1 minute as follows:

a) between all control and auxiliary circuits connected together and the frame of the contactor.

b) between each part of the control and auxiliary circuits which may be isolated from the other parts during normal operation and all other parts connected together.

13.2.13 Inspection and weighment after type tests

.1 Check the following at the end of the tests and ensure that there is no variation in the original values other than the tolerances $\pm$ 5%:

- contact pressure (Main & auxiliary contacts)
- Contact gap -do-
- contact alignment -do-
- operational values (pick up & drop out).

.2 Weigh the contactor in working order.

13.3 Routine tests

13.3.1 Preliminary checking

This shall be carried out as per clause 13.2.1.

13.3.2 Checking of mechanical operation

This shall be carried out as per clause 13.2.3.

13.3.3 Operating value test

This shall be carried out as per clause 13.2.3.

13.3.4 Reset value test

This shall be carried out as per clause 13.2.5.

13.3.5 Resistance measurement

The resistance of the coil shall be measured and recorded, corrected to 20°C. The variation shall not exceed ± 8 %.

13.3.6 Di-electric test

This shall be carried out as per clause 13.2.12.

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Annexure - 1

SCHEDULE OF PARTICULARS OF 3 PHASE ELECTROMAGNETIC CONTACTOR FOR STARTING AUXILIARY MOTORS

1. GENERAL FEATURES

- Name of the manufacturer
- Type of contactor (include drawing and literature)
- Overall dimensions (with drawing)
- Weight of the contactor and its centre of gravity in mounted position
- Mounting arrangement (with drawing)
- Arrangement of terminal connections (with drawing)
- Type of enclosure for auxiliary contacts and its material specifications
- Test reports with relevant specification of the materials used in the fabrication of the following components:
  - a) Electromagnetic parts, i.e., armature core and yoke etc
  - b) Main and auxiliary contacts
  - c) Arc chutes
  - d) Blow out coil
  - e) Shunts
  - f) Enamelled wire of coil
  - g) Coil insulation
- Auxiliary contact arrangement (NO and NC)
- Rated insulation voltage

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Annexure 2

1. Test for withstanding vibration and shock

1.1 Conditions to be satisfied

The complete assembly shall be able to withstand without deteriorating the following tests:

1.1.1 In each of the 3 directions, viz. vertical, longitudinal and transverse sustained sinusoidal vibration in the frequency ranges from 1 to 50 Hz having amplitude given by the following equations

$$a = \frac{25}{f} \text{ for values of 'f' from 1-10 Hz}$$

and

$$a = \frac{250}{f^2} \text{ for values of 'f' from 10-50 Hz}$$

1.1.2 In the direction corresponding to the longitudinal movement of the vehicle, shocks producing maximum acceleration of $\pm$ 3.0 g)(g being the value of acceleration due to gravity).

1.2 Method of testing

The equipment is secured in a convenient position to a machine producing sinusoidal vibrations with adjustable amplitude and frequency and is then subjected to the tests described in paragraphs 1.3 to 1.5.

1.3 Determination of resonant frequency

1.3.1 In order to determine the possible existence of critical frequencies producing resonance, the frequency shall be varied progressively over the whole range of 1 to 50 cycles within a time of not less than 4 minutes, the amplitude of the oscillations being that indicated as a function of the frequency.

1.3.2 If resonance is produced, the corresponding frequency shall be maintained for a few minutes in each case with the apparatus alive. A check shall be made that no ill effects result on the operation of the apparatus (the dropping out of any part of the equipment, sparking at the contacts, temperature rise etc.)

1.4 Tests with sustained vibration

1.4.1 The equipment is subjected to a test with sustained vibration for a period of 20 minutes when cold and afterwards for 20 minutes when hot (1) either at the critical frequency, if any such well defined frequency has

been established in the course of previous test (2) otherwise, at a frequency of 10 Hz.

1.4.2 In both cases, the amplitude of the vibrating table is adjusted to the value corresponding to the frequency concerned.

1.4.3 The test is considered to be satisfactory if there is no resulting damage or abnormality in operation.

1.5 Tests to simulate the effect of shunting shocks

1.5.1 In the direction corresponding to the longitudinal movement of the vehicle on which it is to be mounted, the equipment is subjected for 2 minutes to 50 Hz vibrations of such a nature that the maximum acceleration is equal to 3 g.

1.5.2 The test is considered to be satisfactory if there is no resulting damage or abnormality in operation.

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2. DETAILS OF MAIN CONTACTS

- Contact pressure
- Contact gap
- Contact wipe
- Contact thickness and wear limits
- Rating of contacts in terms of current, voltage and number of operations for the following type of service:

  a) Continuous duty

  b) Maximum make duty

  c) Maximum break duty

- Normal life in terms of on-load operations, frequency of operating cycles per hour and load factor for continuous duty and intermittent duty

3. DETAILS OF AUXILIARY CONTACTS

- Contact pressure
- Contact gap
- Thickness, maximum wear limit
- Rating of contact in terms of current, voltage, time constant, and number of operations for the following type of service:

  a) Continuous duty

  b) Maximum make duty

  c) Maximum break duty

  d) Cyclic duty

- Normal life in terms of on-load operations, frequency of operating cycles per hour and load factor for continuous duty and intermittent duty

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4. DETAILS OF COIL

- Voltage range of operation
- Minimum pick up and drop out current and ampere-turns
- Coil resistance at 20°C
- Coil conductor size
- Number of turns
- Coil diameter and length
- Coil former material
- Maximum current density in coil
- Details of insulation
- Permissible temperature rise
- Overload capacity

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No.SPEC/E-14/3/01

Government of India
MINISTRY OF TRANSPORT
(Department of Railways)
(RAILWAY BOARD)

TECHNICAL SPECIFICATION

FOR

PILOT INDICATING PANEL WITH LEDs

FOR 25 kV AC ELECTRIC LOCOMOTIVES

Specification No. SPEC/E-14/3/01

NOVEMBER 1985

Issued by:

RESEARCH DESIGNS & STANDARDS ORGANISATION
LUCKNOW-226011.

E-14/3/01

2.2 The indicating panel shall be of robust design and duly approved by RDSO 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 transverse acceleration. - 2.0 g.

c) Maximum longitudinal acceleration - 3.0 g.

(g is acceleration due to gravity).

3. RATING AND OTHER PARTICULARS :

3.1 The indicating panel will comprise six sets of LED in cluster of six LEDs per set in 3 series and 2 parallel combination operated by a DC voltage of 70 to 130 V as shown in Drg.No. SKEL-3854.

3.2 Each indicating panel shall have 7 Nos. of terminal blocks of M5 size screw with proper plain and spring washers for connecting socketted 3 mm^2 cable, generally conforming to the Drawing No.SKEL-3854 of the specification.

3.3 The indicating panel will be provided with anodised aluminium chemically etched name-plates.

3.4 The LEDs used shall be of 5 mm dia and rated for continuous operation.

3.5 Series dropping wire wound resistors of 10 Kilo ohms, 5 W ratings as shown in the internal circuit in Drawing No.SKEL-3854 shall be incorporated in the assembly and housed in the common housing.

3.6 The negative side of the unit shall be provided with blocking diode (as shown in the Drawing) of 1 ampere, 1000 V, PIV rating.

3.7 The indicating panel shall be manufactured as per the assembly details shown in Drawing No. SKEL-3854. The colour scheme for LEDs is also shown in the drawing.

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PREAMBLE

Pilot indicating lamps are used on electric locos for showing the state of important equipments like circuit breaker, main rectifier, battery charger, etc. which require constant monitoring for reliable operation of locomotive. 110 Volts incandescent lamps along with coloured fixtures are at present used for all types of electric locos. These incandescent lamps as well as the brass holder for fixtures are very much prone to pilferage. The incandescent lamps are prone to getting fused resulting in poor reliability of the pilot indicating system. To eliminate these inherent drawbacks of the existing indicating panel with incandescent lamps, the use of light emitting diodes for this indicating panel was thought of quite a few years ago. Since then, many Railways/Electric Loco Sheds have provided different types of LED indicating panels on the electric locos of their Railways. Different Railways/Loco Sheds have used different size of LEDs, series dropping resistance with different number of LEDs in a cluster for one indication. The need for standardisation of this LED panel was, therefore, being greatly felt. The present technical specification gives the details of ratings and particulars as well as dimensions of various components of the LED panel including the type test and routine test to be carried out on the panel before being declared fit for use on locomotive. The railways may either fabricate these indicating panels in their Sheds/Workshops or obtain from Trade as they deem fit. For guidance of Railways, one prototype indicating panel, which has successfully undergone vibration test as well as performance trial on electric locomotive, is available at the Electrical Directorate of RDSO. The same may be seen here if felt necessary and in case of ambiguities or doubts, reference should be made to D.G./RDSO/Lucknow for any clarification.

1. SCOPE :

1.1 The specification gives the requirements, assembly details and internal circuit scheme for pilot indicating panel with LEDs for 25 kV AC Electric Locomotives.

C64875

2. SERVICE CONDITIONS :

2.1 The indicating panel will operate at an ambient temperature varying from 0°C to 60°C and with maximum humidity of 100% in an altitude of 1000 meters above mean sea level and dusty atmospheric conditions.

.../2.

4. TESTS :

The following tests are to be carried out on the indicating panel:

	TYPE TESTS	ROUTINE TESTS
4.1	Checking of the dimension of the indicating panel with the drawing and visual check of the quality.	Same as type test.
4.2	Performance checking by giving 110 V DC supply to the terminal blocks. The supply will be varied from 70 V to 130 V (in working range of control circuit voltage) and the voltage shall be applied continuously for a period of 24 hours.	Only performance checking by giving 110 V DC supply to the terminal blocks for a moment.
4.3	Determination of insulation resistance with respect to earth by shortening the terminals with the 500 V megger.	--
4.4	Vibration test as per IEC: 77 Clause 16 & 3.1.3 and IEC: 571 Clause 28.	--

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