

GOVERNMENT OF INDIA MINISTRY OF RAILWAYS (RAILWAY BOARD)

INDIAN RAILWAY STANDARD DRAFT SPECIFICATION

FOR

**KEY LOCK CHECKING RELAY with D.C. NEUTRAL RELAY, (A.C. IMMUNISED /
NON A.C. IMMUNISED) FOR RAILWAY SIGNALLING PURPOSES**

Number of pages 20

SPECIFICATION NO.RDSO /SPN / 219 / 2016

Version 1.0 d 1

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JE/SSE/Signal

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Title of Document Specification For KEY LOCK CHECKING RELAY with D.C. NEUTRAL RELAY, (A.C. IMMUNISED / NON A.C. IMMUNISED) FOR RAILWAY SIGNALLING PURPOSES		
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<p>Abstract</p> <p>This document defines Specification For KEY LOCK CHECKING RELAY WITH D.C. NE UTRAL RELAY, (A.C. IMMUNISED / NON A.C. IMMUNISED) FOR RAILWAY SIGNALLING PURPOSES</p>		

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Abbreviations used

IRS	Indian Railway Specification (Approved)
RDSO/SPN	RDSO Specification (Tentative)
DC	Direct Current
AC	Alternating Current
IS	Indian Standard
BRS	British Railway Standard

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FOR

KEY LOCK CHECKING RELAY with D.C. NEUTRAL RELAY, (A.C. IMMUNISED / NON A.C. IMMUNISED) FOR RAILWAY SIGNALLING PURPOSES

1.0 FOREWORD

1.1 This specification is issued under the fixed Serial No. RDSO/SPN/219 / 2016. The final Number indicates the year of issue or, in the event of Revision, the year of last revision.

1.2 The Key Lock Relay covered by this specification is for general use in line circuits including areas where alternating current at industrial frequency may be present in the circuit.

1.3 This relay must not be used to break circuits in which the energy dissipated at the contact exceeds the limit given in clause 12.1.

1.4 This specification requires reference to the following Indian Railway Standards (IRS) specification, Indian Standards (IS) specification & British Railway specifications(BRS):-

- IRS:S:23/88 - Electrical Signalling & Interlocking Equipment.
- IRS: S:46/74 - DC Neutral Line Relay (Proved type) for Railway Signalling
- S:46/74 - Except clause 1.3 which shall be read as under:-
Relay covered by this specification are meant for use in external circuit in Non electrified as well as in electrified area at industrial frequency
- BR 931 A - Miniature Tractive Armature, A.C. Immune, D.C. Neutral line relay, plug-in-type for Railway Signalling purposes.
- IRS: S:34/68 - Testing of Railway Signalling Relays [General]
- IRS: S:60/78 - A.C. immunisation characteristics of DC neutral tractive armature miniature plug in relays for Railway Signalling
- IS 9000 - Basic environment testing procedures electronics and electrical items
[Part I - IV]

2.0 **SCOPE:** - This specification relates to design requirements for tractive armature D.C. Neutral Key Lock Checking Relay (KLCR) with inbuilt AC Immunity for 25 kV AC traction area or without AC Immunity. The relay is meant for locking and releasing of Crank Handle Key for manual operation of IRS point machine (IRS : S – 24/2002), for transmitting control from ASM's office to LC Gate etc.

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- 2.1 General Description: Key Lock Checking Relay (KLCR) is used at Level Crossing Gate for Control Transfer, Point Crank Handle Interlocking, Ground Frame Control Transfer and also for transmitting the control key from ASM's office to crossover location besides many other applications. In KLCR a common key with a specific ward controls the entry of Crank handle in group of point machines. In KLCR, assembly of bare relay in Metallic Enclosure is being done, along with this 1 No. key and 1 No. Ward plate any one from A to Z, as applicable.
- 3.0 **TERMINOLOGY:** - For the purpose of this specification, in addition to terminology given in IRS:S: 23, IRS:S: 34, IRS:S: 46 Cl. 2.2.1 to 2.2.15 the following shall apply:-
- | | |
|---------------------------------|---|
| Operated | That condition of the Relay when Crank Handle / Key can be electrically released for extraction and Key `IN` proving contacts is open. |
| Released | That condition of the Relay when
a) Operate coil is de-energised and
b) On insertion and turning of Key by 90° clockwise, the Key gets locked causing Key `IN`/Back contacts to make. |
| Key `IN`
/Back Contact | A contact which is closed when Key is locked in the Relay and operate coil is de-energised. |
| Key `OUT`
/Front
Contact | A contact which is closed when Key is electrically released by energizing the operate coil and remains mechanically latched as the Key is turned anticlockwise by 90 °for taking it OUT. The contact breaks only on insertion and turning of key by 90° provided the lock coil is de-energised. |
| Contact
element/Silver tip | The contact piece which is attached to a contact spring. |
| Contact Spring/
Leaf Contact | The spring strip to the end of which the contact element is secured. |
| Direct Current | Current from a battery or smoothed rectified A.C. with a ripple content not exceeding 1.25% r.m.s. |

4.0 DESIGN / GENERAL REQUIREMENTS

- 4.1 The complete assembly shall consist of two main parts, viz:-
a) A suitable Key with user specified combination of wards.
b) A Locking and releasing Relay with in which relay is fitted with Key IN/Back contact/ proving contacts and key out/front contacts and Key release indication and terminals strip for control and proving.
- 4.2 The Relay shall be designed to have minimum bulk and weight consistent with the prime necessity for safety and reliability, and its construction shall

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be such as to minimize accidental damage sustained during transit or installation.

- 4.3 The Relay shall include a rigid base for mounting on a vertical/ flat surface or on mounting rails.
- 4.4 A provision shall be made such that the cover cannot be removed without breaking the seal.
- 4.5 There shall be a minimum clearance of 3.0 mm between the cover and any moving part of the Relay. The material of the cover and construction of the Relay shall be such that the application of a force of 14 Kg. at any point on the surface of the cover of the assembled Relay, shall not result in its deflection to an extent sufficient to interfere with the operation of the Relay. The material shall be of such resilience that after removal of this force it shall restore to its normal condition.

The cover shall be free from detrimental warping which may reduce this clearance, either from temperature or moisture changes or long term ageing or release of locked up stresses.

- 4.6 The cover and base plate of the Relay when assembled shall ensure that KLCR shall be dust free.
- 4.7 Surface leakage distances shall not be less than 2.1 mm internal and 6.0 mm external parts.
- 4.8 There shall be a minimum of 0.4 mm clearance between any moving part and any other part, which might interfere with its correct operation, and the design must be such that this clearance is maintained throughout the rated life of the Relay.
- 4.9 The locking assembly shall be chrome plated / Zinc/Nickel Plated mild steel or brass material having adequate strength.
- 4.10 The locking notch/lock plate face on the locking drum / sector shall be sharp square cut.
- 4.11 It shall not be possible to insert a wrong key to make the Key IN/Back contact. No master key(s) release shall be possible.
- 4.12 It shall be possible to change the ward plate, whenever required without changing the whole unit.
- 4.13 The Key shall always be provided with a female socket for running fit on to a male pin in the relay.
- 4.14 Locking Drum / sector shall be provided with spring loaded ball arrangement for holding in extreme positions.
- 4.15 It shall not be possible to extract the key without energising the coil in any of the axis.

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- 4.16 The mounting screw, if any, shall be of M4/any suitable size and rust free material.
- 4.17 The terminals for permanent external wiring of Relay shall allow up to a maximum of two wires to be connected to each termination. The maximum size of wire to be accommodated will be of overall diameter, not greater than 3.4 mm with a conductor diameter of 1.0 mm. The material used for terminals shall comply with IRS: S : 76 or IS:694 as far as possible.
- 4.18 The equipment shall be maintenance free throughout its working life (regular cleaning for dust/silver sulphide is necessary for hassle free life).
- 4.19 A KLCR shall include ward plates minimum 3 Nos., one with KLCR and two spares.

5.0 DIMENSIONAL CHECK

- 5.1 i) Key & ward shall be as per Appendix A1 and
ii) Dimension of Key Lock Relay shall be as under :
L = 175 mm Max, H = 175 mm Max, W = 80 mm Max.

6.0 LOCKING ARMATURE & SUPPORTS

- 6.1 The locking armature shall be positively located so as to prevent any displacement other than that required for the proper operation of the contacts. The Locking plunger/Lock plate shall be of nonmagnetic material and lift by at least 3.5 mm before key gets unlocked. The width of locking area on plunger shall not be less than 5 mm.
- 6.2 The locking armature shall be held in place in a manner, which permits free movement throughout the normal stroke. There shall be no displacement of the armature.-
- 6.3 Any pivot bearings if used, armature pivots and bearings shall be of dissimilar materials possessing high resistance to corrosion under service conditions. They shall fit rigidly in their supports, and suitably secured and so constructed that they don't restrict the desired motion of the armature.
- 6.4 In Key Lock Relay fitted with pivot bearings, the armature pivots/pivot holder and bearings/ball shall be cylindrical.
- 6.5 The design shall be of failsafe design such that the breaking of a pivot /shaft shall not allow `Key IN' / Back contact to close in absence of Key.
- 6.6 It shall not be possible to extract the Key, when any of Key IN/Back contact gets fused/ welded.
- 6.7 No external screw/bolt, that can obstruct the internal locking arrangements, shall be provided.

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7.0 MATERIALS

- 7.1 All materials used in the construction of the Relay shall comply with the appropriate clauses of IRS: S : 23 unless otherwise stated.
- 7.2 No materials shall be used in the construction of the Relay and Key which would cause alteration in performance during service life, except as provided for in clause 12 or which are not capable of maintaining their essential electrical and mechanical properties during rated service life.
- 7.3 All non-metallic materials used in the relay and terminals shall be non-hygroscopic, self-extinguishing, free from detrimental warping, deformation, or embrittlement and, when transparent, permanently so, over the external temperature range -10°C to $+70^{\circ}\text{C}$ when the Relay is continuously energized at 20% above rated voltage.
- 7.4 No materials shall be used in the construction of the Relay which are capable of supporting growth of mould, or which are subject to deterioration by exposure to sunlight.
- 7.5 All parts both separately and in combination shall either be resistant to corrosion or be so treated as to resist corrosion. Dis-similar metals used in contact with each other shall be so chosen or protected as to minimise the effect of electro-chemical action.
- 7.6 All materials used in the construction of the Relay and or for the impregnation of coils etc., shall be chemically and physically inert over the temperature range specified in clause 7.3.
- 7.7 All soldered joints in conductors shall be made with soft solder. Non-corrosive flux shall be used in making such joints. After completion of the soldering, excess flux shall be removed.
- 7.8 All screwed fastenings shall be securely locked to prevent movement in service. Mechanical means, which do not abrade the surface and produce loose pieces of material shall be used to secure all pins, nuts, screws, etc., against working loose.

8.0 MOUNTING

It shall be possible to mount the relay on a vertical board/ or mounting rails.

9.0 LIFE

- 9.1 The rated life of the Relay shall be taken as **7 Years** or 3,00,000 operations under specified conditions of operations where one cycle consists of an operation to release the key followed by its relocking in the relay.
- 9.2 The Relay shall be considered as having a possible period of up to 3 years in reasonable storage conditions prior to being brought into use

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without verification or examination and without any adverse effect on its rated life.

10.0 MAGNETIC CIRCUIT

10.1 All parts forming the magnetic circuits of the Relay, i.e. armature, yoke and core, shall be of suitable quality magnetic materials so as to ensure consistent performance.

10.2 A non-adjustable residual stop pin of non-magnetic material shall be provided which shall be so designed that the Relay continues to meet the requirements of clause 13.2 throughout its rated life as per IRS : S 46/74.

10.3 The components used for AC immunity from industrial frequency shall be passive relays. No active relay shall be used. These components shall be so used to prevent any failure on unsafe side.

11.0 COILS

11.1 The coil winding shall be formed preferably from one continuous length of conductor. If joints are necessary between coil conductors, these shall be securely soldered and efficiently insulated.

11.2 No conductor of a smaller diameter than 4 mils (42 SWG) shall be used for coil windings.

11.3 Coil resistance shall not vary from the nominal value by more than $\pm 10\%$ measured at 20°C.

11.4. Each coil shall be so fixed as to prevent movement with respect to its core.

12.0 CONTACTS

12.1 Contact ratings shall be as follows:-

The contacts shall be capable of carrying 3A continuously, without injurious effect to the contact. Over the rated life of the Relay, each contact shall be capable of making and breaking the current in an unquenched circuit consisting of three line Relays of a type covered by BR specification, BR 931 A , connected in parallel.(as per IRS:S 46-74 clause No 10.6)

12.2 Key IN / Back contact proving contacts may be a combination of non-fusible/metal or metal/metal shall be as per IRS : S:46/74.

12.3 After a contact pair has been loaded to the requirements of clause 12.1 over the period of rated life of the Relay, contact pressure shall not be less than 40% of those stipulated in clause 12.6. and there shall remain a

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minimum distance of 1 mm between the metal element of the contact and the metal support of the associated element.

- 12.4 Proving contact equipment / Contact configuration shall be as shown in the following table:-

Number of Independent Contacts	Key OUT	2
	Key IN	2

OR

Four front contacts & Four Back contacts	4F/4B
Two front contacts & two back contacts	2F/2B
Five front contacts & Three Back contacts	5F/3B

12.5 CONTACT ASSEMBLIES

- 12.5.1 Contact springs / Leaf contact shall be formed in such a way that their main axes lie at not more than 45° from the direction of rolling.
- 12.5.2 The design shall be such that springs shall be not subjected to any twist about their longitudinal axis.
- 12.5.3 Contact elements/ Leaf Contacts shall be firmly secured so that they will not become loose in service, and the material used for this purpose shall be such as not to cause corrosion. They shall not be out of centre with respect to each other by more than 0.5 mm. When the contact is fully closed the point of contact shall not lie nearer to the edge of either element than half the distance from the point to the centre of that element.
- 12.5.4 When the last Key IN /Back contact is just broken all Key OUT /Front contacts must be open by at least 0.5 mm and vice versa.
- 12.5.5 All similar contacts, i.e. either Key IN (Back contact) / or Key OUT(Front contact), shall function approximately simultaneously when the Relay is operated or released.
- 12.5.6 If twin contact elements are employed, these shall be coplanar and shall make or break contact approximately simultaneously.
- 12.5.7 In the event of any Key IN contact remaining permanently closed as a result of fusion or locking, it shall not be possible for any Key OUT contact on the Relay to close when the Relay is energised up to 35% in excess of the nominal voltage. Alternatively, Key IN contacts must be non-fusible.
- 12.5.8 The Relay shall be designed so as to reduce contact chatter, bounce and hesitation to a minimum on closure of the contact elements concerned. When the Relay is energised at rated voltage, or released,

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the contact elements shall establish steady contact conditions in not more than 100 ms after the initial contact closure.

12.5.9 Non-fusible type contact, if used, shall be so designed that they cannot become mechanically locked or fused to the metal element by abnormal flow of current, and the formation of metal elements shall be such that they will not undercut the non-fusible element by continual rubbing.

12.5.10 The material of the contact tags shall be as per IRS : S : 46/74.

12.6 The minimum contact pressures shall be as follows:-

Type of contact	For metal to metal contact
Key OUT contacts (when in the operate position)	15 gms (Min.)
Key IN contacts (when in the release position)	15 gms (Min.)

13.0 OPERATING PARAMETERS

13.1 The operating values shall be as follows:-

(a) Working Voltage:

The relay shall be suitable for operation on nominal supply voltages of either 24 or 60V DC as specified by purchaser. The relay shall also be suitable to use on un-smoothed rectified A.C. supplies having the same nominal voltages.

(b) Maximum Power Consumption

The maximum power consumption for Key lock operate coil shall be 10W at rated voltage at an ambient temperature of 20°C.

13.2 Operating Voltages

(a) The operating voltages for 24V and 60V Relays shall be as follows when tested with the coil temperature at 20° C :-

Test Voltage	24 V Relay	60 V Relay
Maximum voltages across windings for Operate / Pick-up Voltage	< or = 19.2 V D.C.	< or = 48.0 V D.C.
Minimum voltage across windings for Release / Drop off Voltage	> or = 4.8 V D.C.	> or = 12 V D.C.

(b) The maximum voltage across windings to operate shall be as shown in clause 13.2(a), which must not be increased by more than 20% when the Relay has been continuously energised at 20% above the rated voltage for a period of two hours at an ambient temperature of 50°C.

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13.3 Operating Time

When the Relay is energized at 80% of rated voltage with on ambient temperature of 20°C, the time interval between the breaking of the first Key IN contact and the making of the last Key OUT contact must not exceed 600 m/s. The equivalent time interval when the Relay is de-energized must not exceed 400 m/s.

13.4.1 The test circuit for Immunity to industrial supply alternating current at 50 Hz shall be as per IRS:S : 60 or AC immunity is done 750 V AC & 300VAC as per SIF 1468 Ver. 1.

13.4.2 The immunization of relay should satisfy the requirements laid down as per IRS : S : 60 as far as possible. Any deviation should be approved by the competent authority.

14.0 TESTS AND PERFORMANCE REQUIREMENTS

14.1 Unless otherwise specified, all tests shall be carried out under ambient atmospheric condition.

14.2 For inspection of material, relevant clauses of IRS:S : 23 & IRS:S : 34 & IRS : S: 46 shall be applicable.

15.0 TEST PROCEDURES

15.1 **Dielectric Strength Test:** - A test voltage of 1,200V AC (r.m.s.) of sine wave form at 50 c/s, applied for one minute between all metallic parts of the Relay and other metallic parts insulated there from. This requirement shall include tests between separate coil windings, where applicable, and between coil windings and metallic parts.

15.2 **Insulation Resistance Test:** - After the dielectric strength test as per Cl. 15.1, immediately the insulation resistance shall be measured between all parts of electric circuits and other metallic parts insulated there from a potential not less than 500V DC. The insulation resistance shall not be less than 50 Mega ohm.

15.3 **Operating Characteristics Test:** - After dielectric and insulation resistance tests, operating voltage & operating time test, to check that the relay complies with clause 13.2(a) & 13.3.

15.4 **Contact Resistance Test:** - The value of contact resistance shall satisfy IRS : 46/74 as far as possible. Any deviation should be approved by the competent authority.

15.5 **Performance Test:** -

15.5.1 One relay at room temperature shall work for continuous 1000 cycles of operation at rated voltage, 500 cycles at -10% of rated voltage & 500 cycles at +20% of rated voltage. The contacts shall be loaded with

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inductive load of 3 relays in parallel with BR 930A or IRS:S 46/74. Throughout the test, relay shall operate efficiently and without failure. After completion of test & during test, the contact resistance shall not exceed values as given in Cl. 15.4 above.

15.5.2 A 300 V AC 50 Hz shall not cause any `Key IN' contact to break, while key is IN & turned.

15.5.3 The sudden application of 750 V AC, 50Hz to a relay with key IN must not result in making of any key OUT contact and/or release of key.

15.5.4 That the Relay is so designed to withstand shocks equivalent to a free drop of 100 mm on to a solid concrete surface.

15.6 CLIMATIC SEVERITY TEST

15.6.1 **DRY HEAT TEST:** - This test shall be conducted as per IS: 9000 (Part-III, Section-3) for 16 hours at $70\pm 2^{\circ}\text{C}$. The relay shall be operated kept energised with the external, dummy load during this test. After completion of the cycle, the relay shall then be removed from the chamber after recovery period of 1 to 2 hours. Insulation resistance of the relay shall not be less than 50 Mega ohm, no part shall be damaged or cracked on visual inspection.

15.6.2 **DAMP HEAT (ACCELERATED) TEST - FIRST CYCLE:** - This test shall be conducted as per IS : 9000 (Part V, Section 1) at $55\pm 2^{\circ}\text{C}$ and relative humidity 90-95%. The relay shall not be energised during this test. After removal from the test chamber, the relay shall be wiped with a dry cloth to remove condensed water from the surface and the insulation resistance measured as per Cl. 15.2 after a period of 1 to 2 hours shall not be less than 1 Mega ohm.

15.6.3 **COLD TEST (AFTER FIRST CYCLE OF DAMP HEAT):** - This test shall be conducted as per IS : 9000 (Part-II, Section 3) for 2 hours at -10°C continuously to see that the relay is working satisfactorily and that there is no seizure. The relay shall be visually inspected to see that no part is damaged or cracked.

15.6.4 **DAMP HEAT (ACCELERATED) REMAINING 5 CYCLES TEST:** - The heat cycle test shall be performed as per Cl. 15.6.2. The insulation resistance as per Cl. 15.2 measured after each damp heat cycle shall not be less than 1 Mega ohm and not less than 10 Mega ohm after final cycle and full recovery period.

15.7 VISUAL INSPECTION

The physical condition of the relay shall be visually inspected to ensure compliance of general requirements covered by Cl. 4, and it shall be free from any physical defect.

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15.8 ACCEPTANCE TEST

15.8.1 The following tests shall be conducted;

- | | |
|--|----------|
| a) Visual inspection | Cl. 15.7 |
| b) Dimensional check | Cl. 5.0 |
| c) Dielectric strength | Cl 15.1 |
| c) Insulation Resistance Test | Cl 15.2 |
| d) Functional Tests | |
| I. When No Voltage is applied Key should not get removed. | |
| II. Increase the voltage & note the Pickup Voltage. Relay should pickup at : < OR = 48V DC for 60V DC (ACI/ Non ACI) Relay. Relay should pickup at : < OR = 19.2V DC for 24V DC (ACI/Non ACI) Relay. | |
| III. Once the Relay is picked up, Key should get removed. | |
| IV. Once the Key is removed, cut off the supply voltage the relay should not drop. | |
| V. With voltage cut off, put back the key & rotate the key, the relay should drop. | |
| VI. With no voltage applied, Key should not get removed. | |
| VII. With the help of Key, once Pickup the relay. Now rotate the key in anti-clock wise direction, the key should not rotate (Relay being in picked up condition). | |
| VIII. With the help of Key once drop off the relay. Now rotate the key in anti-clock wise direction, the key should not rotate (Relay being in drop off condition). | |

Note:- The bare relay used with Key Lock Relay should be RDSO inspected

15.8.2 Tests shall be carried out on 10% relays in a lot to be supplied subject to a minimum of 2 & maximum of 25 samples selected at random. In case of failure in any of the above acceptance test, offered lot shall be rejected.

15.9 ROUTINE TEST

15.9.1 The following tests shall be conducted on 100% relays;

- | | |
|-------------------------------|--------------|
| a) Visual inspection | Cl. 15.7 |
| b) Dimensional check | Cl. 5.0 |
| c) Dielectric strength | Cl. 15.1 |
| d) Insulation Resistance Test | Cl. 15.2 |
| e) Functional Tests | Cl.15.8.1(d) |

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15.9.2 The results of routine test shall be made available to the inspecting authority along with the inspection call letter.

15.10 TYPE TEST

15.10.1 The following shall constitute type tests:-

- | | |
|--|-----------------------------|
| a) Visual inspection | Cl.15.7 |
| b) Dimensional check | Cl.5.0 |
| c) Dielectric strength | Cl. 15.1 |
| d) Insulation Resistance | Cl. 15.2 |
| e) Performance Test | Cl. 15.5 |
| f) Fail Safe feature test on one sample | Cl. 12.5.7 |
| g) Climatic severity test on two samples | Cl. 15.6 |
| h) Functional Test | Cl. 15.8.1 (d) |
| i) Vibration test | Cl. 10.2.12 of IRS: S:46/74 |

15.10.2 Test Sample :- Total 5 samples selected randomly shall be required for complete range of type tests. These samples shall be selected at random, as far as possible from regular production lot. These samples shall be selected and sealed by the Inspecting Officer. Samples of the relay identified for type tests shall not form part of the supply. For initial type approval, minimum 20 samples shall be manufactured.

15.10.3 Validity of type approval carried out shall be as per ISO Apex documents.

16.0 LABELLING AND MARKING

16.1 A nameplate/stamp giving the following information shall be attached to the Relay in a conspicuous position:-

- i) Manufacturer's name.
- ii) Specification number.
- iii) Serial number of the Relay.
- iv) Rated voltage.
- v) Contact arrangement.
- vi) Month and Year

16.2 This nameplate/stamp shall be so situated that it is readily visible when the Relay is in its installed position, and shall be securely fixed in such a manner that it does not obscure the moving parts and cannot interfere with the operation of the Relay.

16.3 Following details shall be clearly and indelibly marked on the coil:-

- i) Manufacturer's identity/Trade mark.
- ii) Resistance (nominal) at 20°C.

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17.0 INFORMATION TO BE SUPPLIED BY THE PURCHASER :

17.1 Operating voltage 24 or 60 V DC. [Cl. 13.1 (a)].

17.2 Key ward/Ward plate configuration shall be as per Appendix A1.

FINAL DRAFT

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























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






















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Appendix - A1

Key Ward/Ward Plate Configuration (As applicable)

Code letter	a	b	c	d	e	f	g	h	i	k	l	m
Key hole shape												
Code letter	n	o	p	q	r	s	t	u	v	w	x	z
Key hole shape												

Code Letter	A	B	C	D	E	F	G	H	J	K	L	M
Key Hole Shape												
Code Letter	N	O	P	Q	R	S	T	U	V	W	Y	Z
Key Hole Shape												

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