GOVERNMENT OF INDIA
MINISTRY OF RAILWAYS
(RAILWAY BOARD)

INDIAN RAILWAYS STANDARD SPECIFICATION for D.C.POLARISED RELAY, 3-POSITION (TENTATIVE)

Serial No. S 31-80

0. FOREWARD

0.1 This specification is issued under the fixed serial No. S-31, the final number indicates the year of original adoption as standard, or in the case of revision, the year of last revision.

ADOPTED, 1965, REVISED, 1980

0.2 This specification requires reference to the following Indian Railway Standard (IRS), Indian Standard (IS), British Standard (BS) and British Railway (BRS) specifications which shall also be complied with to the extent applicable:-

IRS:S 10	Mechanical Signalling and Interlocking Equipment.
IRS:S 23	Electrical signalling and interlocking equipment.
IRS:S 34	Testing Railway Signalling relays (General)
IS:617	Aluminium and aluminium alloy ingots and casting for general engineering purposes.
IS:1821	Dimensions for clearance holes for metric bolts.
IS:2389	Hex head bolts, screws, nuts and lock nuts (M 1.6 to M5)
IS:2507	Cold rolled steel strips for springs
IS:4800	Enamelled round winding wires.
IS:6320	Fine silver ingot.
BS:790	Nickel silver, sheet, strip and foil.
BS:2026	Tolerances for mouldings in thermosetting materials.
BS:2870	Rolled copper and copper alloys, sheet, strip and foil.
BRS:930	Miniature tractive armature DC neutral line relays, plug-in type for Railway Signalling purposes.

0.3 In this specification, wherever any of the above mentioned specifications/ drawings is referred to by number only without mentioning the year of issue/alteration number, the latest issue of that specification/drawing is implied.

0.4 This specification is intended chiefly to lay down the technical provisions and the provisions relating to supply of the equipment and so does not include all the necessary provisions of a contract.

1. SCOPE

1.1 This specification relates only to design and performance requirements for D.C. 3-position polarised relays with centre biased armature for use in Railway Signalling Circuits for use with single line and double line block instruments in Electrified and Non-Electrified Sections.

1.2 This specification does not, however, cover the wiring and protective devices used in conjunction with the 3-position polarised relay.

1.3 Relays covered by this specification should not be used in circuits where current through the relay coils is more than the rated current as specified in clause 16.2.5 of this specification.

2. TERMINOLOGY

2.1 The terminology referred to in this specification is covered by the definitions given in IRS specification Nos. S:23*and S:34**.

2.2 The terms referred to in this specification but not covered by IRS Specification Nos. S:23* & S:34** are defined below:

2.2.1 Normal Position - The position of the armature when the relay is energised with the positive coil terminal R1 connected to the positive and R2 connected to the negative terminals of the battery reference clause 13.1.1.

2.2.2 Reverse position - The position of the armature when the relay is energised with the positive coil terminal R1 connected to the negative and R2 connected to the positive terminals of the battery (Reference clause 13.1 .1) .

2.2.3 Pick up Value - The value of the current which is just sufficient to close normal or reverse contact of a relay under. .the specified conditions.

2.2.4 Drop away value - The value of the current at which the normal or reverse contact of a relay just opens under specified condition.

2.2.5 Arm -The moving part of the contact.

2.2.6 Arm Contact - The moving contact which remains, in between Normal and Reverse Contacts when the relay is de-energised.

2.2.7 Normal Contact - The fixed contact on the left hand side of the relay when viewed from the front of the case, and which is closed when the armature is in the normal position.

2.2.8 Reverse Contact -The fixed contact on the right hand side of the relay when viewed from the front of the case, and which is closed when the armature is in the reverse position.

2.2.9 Residual gap - The length of air gap between the core/pole face centre and nearest point on the armature when the armature is in the full operated position.

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*Electrical signalling and interlocking equipment.
** Testing Railway signalling relays (General).

3. GENERAL REQUIREMENTS

3.1 Design and Drawings:-

3.1.1 The relay shall meet the requirements of this specification for material, design, assembly and finish etc. in entirety and also relevant requirements in other specifications.

3.1.2 The relay shall be designed to have a minimum bulk in weight consistent with essential requirement of safety and reliability.

3.1.3 The relay shall be of substantial design, robust and capable of withstanding such handling as encountered in service, storage, transit and installation. It must function perfectly within the temperature range of -25^{o}C to +70^{o}C throughout its service life.

3.1.4 Provision shall be made in the design or proper cleaning of bearings and other moving parts of the relay, wherever necessary.

3.1.5 Necessary technical particulars including drawings forming an essential part of an offer for relay to this specification may be asked to be furnished for examination by the purchaser.

3.2 Case, Cover and Sealing

3.2.1 All moving parts of the relay shall be enclosed in a case fitted with gasketted cover in such a manner that they shall, with the exception of the screened breather, if provided in the rear portion of the relay be dust and vermin proof.

3.2.2 The relay cover shall be provided with a transparent window which affords clear visibility of its moving parts including contacts for inspection from outside.

3.2.3. The case shall be so secured that a minimum clearance of 3mm exists between it and all moving parts.

3.2.4 The relay case and cover shall be free from detrimental distortion which may disturb positions and adjustments of contacts or other moving parts or which may reduce the clearance as specified in sub-clause 3.2.3 either from temperature or moisture changes or long term ageing or from release of locked up stresses.

3.2.5 Sealing arrangement shall be provided for relay so that there is no possibility of unauthorised interference with its vital parts. Before the relay is sealed, the inside of it shall be completely cleaned of all foreign matter filings, dust etc.

3.3 Breather

3.3.1 A fixed breather opening in, the case shall be provided, if specifically asked by the purchaser, but it shall not affect normal mounting of the relay.

3.4 Air-Clearance Distance

3.4.1 An air clearance distance of not less than 3mm shall be provided between any exposed current carrying part and any other metallic part insulated therefrom, except for contact clearance as per clause 11.3.1.

3.5 Surface Leakage Distance

3.5.1 A surface leakage distance of not less than 6 mm shall be provided between any exposed metallic part carrying current and any other metallic part insulated therefrom.

3.6 Other requirements

3.6.1 These shall be as in clause 4 of IRS Specification No. S:23* (except sub clauses 4.5, 4.6, and 4.9 to 4.11).

3.6.2 All nuts and screws shall be securely locked and shall not loosen while in service due to vibration or other causes as normally met with in railway usage.

3.6.3 Screw threads in parts fabricated of materials which do not lend themselves to successful tapping shall be formed in bushes made from suitable material and these bushes shall be properly moulded, embedded or otherwise securely fixed.

4. DIMENSIONS

4.1 The overall dimensions of the Relay shall not exceed the following, unless otherwise approved by the purchaser:

Height	-	156 mm (6-1/8")
Width	-	162 mm (6-3/8")
Depth	-	119 mm (4-11/16")

4.2 Limits and fits shall be in general as per sub-clauses 6.1 and 6.2 of IRS specification No. S:23*, except where, specified or required otherwise for proper functioning of the equipment

4.3 Dimensions on which tolerances are not indicated shall be within the following limits, depending also on related dimensions for correct functioning, unless otherwise agreed upon by the purchaser.

(a)	Castings and sheet metal parts	-	± 0.50 mm
(b)	Insulating moulded parts	-	As per BS:2026**
(c)	Spacing of machined holes	-	± 0.05 mm
(d)	Angular dimensions	-	± 1/2^{o}
(e)	Linear dimensions	-	± 0.5 mm
(f)	Diameter of drilled holes (clearance holes)	-	As per IS:1821*** (Fine)

5. WORKMANSHIP

5.1 The standard of workmanship shall be as per Cl. 5 of IRS specification No. S:23*.

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* Electrical signalling and interlocking equipment.
** Tolerances for mouldings in thermosetting materials.
*** Dimensions for clearance holes for metric bolts.

6. MATERIALS

6.1 Materials employed in the construction of the relay shall allow them to function perfectly within a temperature range from -25°C to + 70°C and shall be in accordance with specification for materials in the IRS Specification No. S10* or other appropriate approved standard specifications, as far as applicable.

6.2 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 or which would cause alteration in performance during storage life or which are not capable of maintaining all their essential electrical and mechanical properties during service life of the relay.

6.3. Transparent material for relay window in cover shall be permanently transparent and tough.

6.4 Magnetic materials shall comply with clauses 10.1, 10.2 and 10.3 of IRS Specification No. S:23**.

6.5 All insulating materials shall be tough, non-hygroscopic, self-extinguishing and shall be unaffected by changes in temperature between -25°C and +70°C.
All insulating materials in contact with current carrying parts of the relay shall comply with following tests.

"Two 6 mm dia electrodes shall be placed 3 mm apart on a sample of the material, which is at a temperature of not more than 20°C. The sample shall then be transferred to a test chamber having a temperature of 55°C and a humidity of 95%. The insulation resistance measured at a voltage of 500 VDC between the electrodes shall not then fall below 1 megohm while the samples remain in the test chamber for a period of not less than 15 seconds."

6.6 Material used for impregnation or insulating the coil shall be chemically neutral and physically stable between temperature limits of -25°C and +70°C.

6.7 Insulating materia1 used for fillers in winding coils shall be chemically neutral.

6.8 Electrical contact spring shall be made from one of the following materials:-

1. Phosphor bronze, grade Pb 102 (extra hard) to Specification BS:2870*** or,
2. Nickel Silver, grade 106 (18% Nickel, Silver) to specification, BS:790@
3. Spring steel, grade 5 (hardened and tampered) to specification IS:2507$

6.9 Contact element shall be made from silver, grade fine silver of minimum 99.9% purity to specification IS:5320****.

6.10 Gasket material shall be suitable for tropical and environmental conditions outlined in clause 18.4.2(b), shall not work loose in service and gasketting with this material shall render the equipment dustproof under service condition and vermin proof.

6.11 The relay case and cover shall be made from aluminium alloy casting grade A-6-M to IS:617*****.

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* Mechanical signalling and interlocking equipment.
**Electrical signalling and interlocking equipment.
***Rolled copper and copper alloys, sheet, strip and foil.
**** Fine Silver Ingot
*****Aluminium and aluminium alloy ingots and casting for general engineering purposes
@ Nickel, silver, sheet, strip and foil
$Cold rolled steel strip for springs.

7. PROTECTION AGAINST CORROSION

7.1 Protection against corrosion shall be provided as per Cl. 13 of IRS Specification No. S:23*

7.2 Materials used for protection against corrosion shall neither melt nor flake under ordinary conditions between temperature limits of -25°C and +70°C.

7.3 All parts, both separately and in combination shall either be resistant to corrosion or so be treated as to resist corrosion. Dissimilar metals used in contact with each other shall be so chosen or protected as to minimize the effect of electro-chemical action.

8. MAGNETIC SYSTEM

8.1 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 service life of the relay.

8.2 The armature supports shall be so designed as to ensure a reliable operation of the armature. The movement of the contact shall be controlled solely by the movement of the armature, indirect control by any other means being disallowed. When the relay is de-energized or current in relay coils reduces to, drop away value the arm contact, shall be vertical in the middle of' normal and reverse contacts due to gravitational force biased with permanent magnet.

8.3 The armature shall be positively located so as to prevent any displacement other than that required for proper operation of contacts. End play of the armature when pushed or slided from one end to the other end shall be not less than 0.25 mm and not more than 0.5 mm.

8.4 A stop pin of non-magnetic anti-corrosive material shall be placed between each pole face and armature and so located as to prevent the possibi1ity of armature coming closer than 0.15 mm to the core/pole faces at any point.

8.5 In relays fitted with pivot bearings, the armature pivots and bearings shall be cylindrical and bearings shall be not less than 0.05 mm nor more than 0.1 mm larger in diameter than the pivots. The armature pivots and bearings shall be of dissimilar materials possessing high resistance to corrosion under service conditions, shall fit rigidly in their supports and be suitably secured and so constructed that they cannot restrict the desired motion of the armature.

8.6 The dimensions of pivot bearings shall be such as to ensure durability of bearings for the whole service life of the relay and shall be within the limits given in Cl. 8.5 of this specification.

9. ELECTRO-MAGNET COILS

9.1 Electro-magnet coils shall comply with the requirements as per Cl. 8 of IRS specification No. S:23* (except sub-clause 8.2, 8.6, 8.11 & 8.12).

9.2 Coil Resistance:-

9.2.1 Relays to this specification shall have normally two separate coils each of 38.5 ohms nomina1, resistance at 20°C. The standard nominal resistance of the coils on assembly shall be obtained by connecting the two coil windings in series.

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* Electrical signalling and interlocking equipment

9.2.2 The coil resistance shall not vary from the nominal value by more than ±10% measured at 20°C.

9.3 Coil Design, General

9.3.1 Coils shall comply with the relevant operating characteristics specified in Cl. 16.1 and dielectric requirements as specified in Cl. 9.5.

9.3.2 Coils shall be replaceable without affecting magnetic or mechanical adjustments of the relay, as far as practicable.

9.3.3 Coils shall be suitably protected from mechanical damage or injury due to vibration and other causes as normally encountered in service.

9.3.4 Coils shall be provided with means to prevent their rotation or movement with respect to the cores.

9.3.5 Each coil winding shall be formed preferably from one continuous length of conductor. If joints are necessary between coil conductor, these shall be securely soldered and efficiently insulated. Normally not more than one joint shall be permitted in one coil. The flux used for soldering shall be non-corrosive.

9.3.6 Coil shall be layer wound with the best quality insulated winding wire to IS:4800* and treated to protect the wire from moisture so as not to be injuriously affected by specified environmental conditions or by changes in temperature between -25^{o}C and +70^{o}C. No conductor smaller than 0.1 mm shall be used for coil winding, unless otherwise approved by the purchaser.

9.3.7 Coil shall be impregnated by vacuum and pressure with insulating varnish or compound in such a manner as to fill all interstices and effectively seal the coil against the moisture, in accordance with established practice.

9.3.8 Coil design shall be such that it shall be able to withstand 120% of the rated current continuously at an ambient temperature of 60^{o}C±2^{o}C without injurious heating.

9.3.9 Coils of same design shall be similar in all respect.

9.4 Coil leads

9.4.1 Coils shall have leads of sufficient length to enable the coils to be connected in series.

9.4.2 When the size of wire forming the winding is less than 0.9 mm, the coil leads shall be of flexible wire and shall consist of strands of copper not larger than 0.2 mm in diameter. The aggregate cross section of the strands shall not be less than 1.00 sq. mm. The coils shall be provided with insulated sleeves and eyelets for termination.

9.5 Dielectric requirements

9.5.1 Coils shall be so insulated that they shall withstand the high voltage tests specified as below:-

The coil shall be mounted on a close fitting metal mandrel and the test voltage of 2000V AC (rms) of approximately sine wave form, at a frequency between 25 and 100 Hz shall be applied for one minute between the mandrel and the winding. A test shall also be made by standing the coil on each end in turn on a metal plate and applying the test voltage between the plate and the winding for one minute.

* Enameled round winding wires

9.5.2 The insulation between coil windings and between each winding and the other parts of the relay must be able to withstand the test voltage of 1000V AC (rms), 25 to 100 Hz approximately sine wave form for one minute.

9.5.3 Immediately after the tests specified in Cl. 9.5.1 and 9.5.2 insulation resistance shall be measured between the coil and other parts insulated therefrom, at a potential of not less than 500V DC. The minimum value of insulation resistance shall not be less than 50 M.ohm in dry conditions and 10 M.ohm under humid conditions obtaining during rainy season in coastal areas.

9.6 Coil identification

9.6.1 The particulars of the coil in respect of the following shall be exhibited on a label/tag of non-conducting materials plainly and indelibly marked which shall be located at a conspicuous position and securely fixed, preferably below the first layer of the coil sheathing,

(a) Manufacturer's trademark.
(b) Nominal resistance at 20^{o}C.
(c) Number of turns; and
(d) Size of wire and kind of wire insulation.

10. ELECTRICAL CONTACT SPRINGS

10.1 Contact spring shall be formed in such a way that the main axes lie at not more than 45^{o} from the direction of rolling of the strip so that abrupt changes in dimensions, giving rise to high localized stresses, do not occur.

10.2 The design shall be such that contact spring shall not be subjected to any twist about their longitudinal axes.

10.3 Contact spring shall be of uniform thickness and the tolerance in thickness shall not exceed specification limits as laid down in the relevant specification.

10.4 Contact spring shall be made of such materials and so proportioned that they shall not stress beyond half of their elasticity limit. Movements of contact spring shall ensure self-aligning, self-cleaning and wiping action between the contacts.

10.5 Contact spring shall be free from scratches and uneven surface.

10.6 Endurance limit of contact spring shall be as high as possible so as to withstand the service life of the relay.

11. CONTACTS

11.1 Contact equipment

11.1.1 The relay shall be provided with the standard contact arrangement having one normal and one reverse contact of metal to metal type.

11.1.2 The arm contacts shall be mounted on the contact spring which moves in unison with the armature. Contact element made of fine silver purity shall be soldered to contact spring on all sides. The flux used for soldering the contacts shall be non-corrosive.

11.1.3 Fixed contacts shall be in a form of tips (of fine silver having 99.9% purity to IS:5320*) soldered to adjustable contact holder type mounted on the normal and reverse terminals. The flux used for soldering shall be non-corrosive.

11.2 Contact weldability or failure

11.2.1 There should be no risk of any one of the Normal or Reverse contact remaining accidentally closed.

11.3 Contact clearance

11.3.1 When the armature is in vertical mid-position with the relay in the de-energised position, the contact clearance between the arm contact and any of fixed contacts shall be not less than 1.5 mm, the contact clearance shall be equal on both sides.

11.3.2 When the relay is de-energised, the arm contact shall not make a forced contact with either normal or reverse contact with an external force of 3 grams applied at its tip.

11.3.3 When the relay is energized, the arm shall make contact squarely and centrally with normal or reverse contact tip.

11.3.4 The contact of the opposite polarity shall not make after the relay has been energized to twice the pick-up value and suddenly de-energised.

11.3.5 The value of contact clearance must not vary by more than 20% throughout the endurance test to Cl. 18.4.2(d).

11.4 Contact pressure

11.4.1 The contact pressure shall be minimum 2 grams when the relay is energized at a current 50% in excess of the specified maximum pick-up value.

11.4.2 The contact pressure shall be minimum 4 grams when the relay is energized at a current 100% in excess of the specified maximum pick-up value.

11.4.3 The contact pressure throughout the endurance test of the relay under Cl. 18.4.2(d) shall not be less than minimum contact pressure specified in Cl. 11.4.1 and 11.4.2.

11.5 Contact resistance

11.5.1 The initial clean contact resistance for a new relay shall not exceed 0.10 ohm when the contact is carrying a direct current of 0.1A and the relay is energized at the rated current.

11.5.2 Throughout the endurance life of the relay under Cl. 18.4.2(d) the contact resistance shall not exceed 0.25 ohm.

11.6 Contact rating

11.6.1 Continuous current rating – Each contact shall be capable of carrying current of 1A continuously and 2A for 30 seconds without injurious heating when the relay is energized at the rated current.

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*Fine Silver Ingot

11.6.2 Low current breaking capacity – The normal and the reverse contacts shall be capable of breaking the current in an unquenched circuit consisting of three parallel connected 24V rated DC relays of the type conforming to BRS:930*, when operated 1,00,000 times at a rate of two breaks per minute when the DC polarized relay 3-position is energized at rated current.

11.6.3 High current breaking capacity – The contacts shall be capable of breaking a current of 2A at 24V in non-inductive DC circuit when operated 12 times at a rate of 2 breaks per minute without damage to the contact or increase of contact resistance.

11.7 Contact life – Contact life shall conform to endurance life of the relay under Cl. 18.4.2(d).

12. TERMINALS

12.1 Terminals shall be of minimum 5 mm (IS:2389**) bolt size and of 'nut type'.

12.2 Terminals shall be placed not less than 25 mm apart between centres.

12.3 Terminals studs and bolts shall be formed and fastened in their support as to prevent their rotation or becoming loose in service or breaking over the neck underside the head.

12.4 Where terminals carry fixed contacts they shall be no fastened in their supports as to preclude adjustment of any kind without first breaking the seal of the relay.

13. TERMINAL MARKING AND ARRANGEMENT

13.1 Coil terminals

13.1.1 The terminals connected to the coil assembly shall be marked R1 & R2 the left hand, bottom terminal (R1) being the positive terminal and the right hand bottom terminal (R2) being the negative terminal.

13.2 Contact terminals

13.2.1 The terminals connected to the fixed contacts and the arm shall be identified by the letters as follows:-

N = Normal Contact
R = Reverse Contact
A = Arm

13.3 Terminal arrangement

13.3.1 Terminals shall be so located as to be easily accessible and no terminal shall be located behind the relay coil assembly.

13.3.2 The coil terminals shall be located in an accessible position adjacent to the coils.

13.3.3 The terminals shall be arranged to permit the use of an insulated box spanner of maximum height 75 mm and width 40 mm.

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* Miniature Tractive Armature, DC Neutral Line Relay, Plug-in type for Railway Signalling purposes.

** Hex head bolts, screws, nuts and lock nuts (M1.6 to M5)

14. FLEXIBLE CONNECTION

14.1 The flexible conductor between the arm terminal and the contact spring (arm) shall be so formed and attached as not appreciably to affect the torque of the armature. This conductor shall be capable of carrying 2A continuous current without injurious heating.

14.2 The length of the flexible conductor used in the relay should be such that there is no possibility of their coming close to any fixed contacts still maintaining the necessary flexibility for the free movement of the armature.

15. STORAGE LIFE

15.1 The relay shall be considered as having a possible period of up to 2 years in reasonable storage conditions prior to being brought into use without verification or examination and without any adverse effect on its operating characteristics.

16. OPERATING AND OTHER CHARACTERISTICS

16.1 The relay shall be so adjusted on assembly as to conform to the operating characteristics, as shown below or as laid down in the clauses of this specification reference of which is given below:-

.1	Coil resistance at 20^{o}C	-	Cl. 9.2
.2	Pick-up current for both Normal contact and Reverse contact	-	Cl. 16.2.1
.3	Drop-away current for both Normal contact and Reverse contact	-	Cl. 16.2.2
.4	Percentage release (Min.)	-	50% Cl. 16.2.2
.5	Variation in pick-up values in normal & reverse contacts	-	+10% (Max.) of pick-up current of normal contact
.6	Dielectric strength (high voltage test)	-	Cl. 16.3.1
.7	Insulation resistance (Min.)	-	Cl. 16.3.2
.8	Contact resistance	-	Cl. 11.5
.9	Contact rating	-	Cl. 11.6
.10	Contact clearance (Min.)	-	Cl. 11.3
.11	Contact pressure	-	Cl. 11.4
.12	End play of armature	-	Cl. 8.3
.13	Residual gap (Min.)	-	Cl. 8.4
.14	Clearance between case and moving parts (Min.)	-	Cl. 3.2.3
.15	Surface leakage distance (Min.)	-	Cl. 3.5.1
.16	Air clearance distance (Min.)	-	Cl. 3.4.1
.17	Overall dimensions	-	Cl. 4.1
.18	AC immunity	-	Cl. 16.4
.19	Rated current	-	Cl. 16.2.5

16.2 Operating values

16.2.1 Pick-up current – The pick-up current shall be between 15-18 milli-amps.

16.2.2 Drop away current – The drop away current shall not be less than 50% of pick-up values.

16.2.3 The variation in pick-up values in normal and reverse contacts shall not vary by more than 10%.

16.2.4 Permissible variation in operating values during endurance life of relays. During and on completion of the endurance test on the relay [Cl. 18.4.2(d)] the rise in pick-up current must not exceed 10% of the initial value; the decrease in drop away current must not exceed 15% of its initial values and the percentage release must vary by no more than $1/5^{th}$ of initial percentage release value.

16.2.5 Rated current – The rated current of the relay covered by this specification shall be 25 milliamperes.

16.3 Dielectric requirements

16.3.1 The assembled relay shall withstand for one minute the test voltage 1000V AC (r.m.s.) of approximately sine wave form, at a frequency between 25 and 100 cycles per second, applied between all the parts of electric circuit and other metallic parts insulated therefrom.

16.3.2 Immediately after the test specified in Cl. 16.3.1 insulation resistance shall be measured between all parts of electric circuits and other metallic parts insulated therefrom at a potential of not less than 500V DC. The minimum value of insulation resistance shall not be less than 50 M.ohm in dry conditions and 10 M.ohm in humid conditions obtaining during rainy season and in coastal areas.

16.4 Immunity to 50 Hz, alternating voltage

16.4.1 When 10V, 50 Hz, alternating voltage is abruptly applied on the relay coils carrying 150% of its maximum pick-up current in either direction, as shown in Appendix 1, the contacts of the relay must not break.

16.4.2 When 15V, 50 Hz, alternating voltage is abruptly applied to relay coils as shown in Appendix 1, the contacts of the relay must not make in either position.

16.4.3 When 45V, 50 Hz, alternating voltage is gradually applied to relay coils as shown in Appendix 1, the contacts of the relay must not make in either position.

16.4.4 When 100V, 50 Hz, alternating voltage is applied continuously to relay coils for 30 minutes, the heat generated in the coils will not damage the insulation of the coils.

17. DETERMINATION OF OPERATING AND OTHER CHARACTERISTICS

17.1 Measurement of drop away and pick-up currents (Normal and Reverse contacts)

17.1.1 The relay shall be energized 4 times the specified maximum pick-up current applied in the normal working direction. The current shall then be gradually reduced and the value at which contact opens shall be recorded as the drop away value for this direction. The current shall then be reduced to zero and then increased until the relay is energized and the contact is closed. The value at which this occurs shall be recorded as the pick up value. Similarly, drop away and pick up currents of reverse contact shall be measured by energizing the relay with current of reverse polarity.

17.2 Measurements of percentage release

17.2.1 The percentage release shall be a ratio calculated as under:-

$$\text{Percentage release} = \frac{\text{Drop away current (measured value)}}{\text{Pick up current (measured value)}} \text{ X } 100$$

17.3 Non-weldability test

17.3.1 This test shall be carried out by means of a discharge of the capacitor. The two elements constituting the contact shall be connected with the plates of a bank of capacitors of the value of 200 Micro-farads according to the sketch shown in Appendix 2. The bank of capacitors shall be charged at the direct current intensity and then discharged into the two contact element with the contact in make position together by energizing the relay at the working current. The relay current shall then be increased to 4 (four) times the specified maximum pick-up value and then decreased until the front contacts open. This current shall be measured and shall not be less than the initial drop away current of the relay. This test shall be repeated 10 consecutive times. The first test series shall be carried out with a capacitor energy of 5 Ws and then at energies of 10, 20, 40 Ws etc. according to geometrical series.

17.3.2 The characteristics of the capacitor and connections for the loading circuit shall be as per Cl. 17.3.2.1.

17.3.2.1 Characteristics of the capacitor :-

(a)	Composition	-	2 elements in parallel of 100 micro-farad ±5% each (on dry paper)
(b)	Operating voltage	-	600V Director Current
(c)	Insulation at 500V at +20^{o}C	-	100 Megohm
(d)	Resistance of connecting leads	-	<0.05 ohm

18. INSPECTION AND TESTING

18.1 General

18.1.1 Inspection and testing shall be carried out in accordance with Cl. 11 of IRS specification No. S:34* read with Cl. 14.1 of IRS:S 23**.

18.1.2 Visual inspection shall be carried out in accordance with Cl. 4.1.1 of IRS specification No. S:34* read with Cl. 14.2 as far as applicable, of IRS specification No. S:23**.

18.1.3 Provisions contained in this specification shall apply wherever, in any details they differ from those in IRS specification Nos. S:34* and S:23** as referred to in sub-clauses 18.1.1 & 18.1.2.

18.1.4 Inspection and test may be carried out, partly or wholly and in combination either at the place of manufacturer or in a Railway Laboratory or in National Laboratory or in any other approved laboratory or Workshop wherever suitable facilities may exist, as desired by the purchaser or the inspecting authority.

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* Testing – Railway Signalling Relays (General)

** Electrical Signalling and Interlocking Equipment

18.2 Test by manufacturer

18.2.1 Before any supplies of the relays covered by this specification are offered for inspection, the manufacturer shall have carried out on each individual relay, tests specified in Cl. 11.4.1 of IRS specification No. S:34* read with Cl. 16 of this specification.

18.2.2 The test result shall be recorded in a suitable proforma, approved by the inspecting authority. The recorded test results shall enable the inspecting authority to check upon and confirm the performance, reliability and quality of the product.

18.2.3 The test results shall be produced and supplied along with each relay offered for inspection. In case the inspecting officer observes as a result of tests carried out by him that the recorded test results are not reasonably accurate for one or more relays, he may reject the complete lot and at his discretion call upon the manufacturer to have the relays retested before any further supplies are inspected or accepted.

18.3 Tests by inspecting authority:-

18.3.1 Type tests – As laid down in Cl. 18.4.

18.3.2 Acceptance tests – As laid down in Cl. 18.5.

18.3.3 Manufacturing tests – As laid down in Cl. 11.3 of IRS Specification No. S:34*.

18.3.4 Investigation tests – As laid down in Cl. 14.3.1 of IRS Specification No. S:23** as far as applicable.

18.4 Type tests

18.4.1 Type tests shall apply whenever a relay covered by this specification is offered for the first time by a manufacturer. Type tests approval shall be valid for a period of 3 years or unless any change is made in the design, material or processes of manufacture for the relay vitally affecting the working of the relay. The decision of the inspecting officers shall be final in this regard.

18.4.2 Type test shall be in accordance with Cl. 11.2 of IRS:S 34* and shall comprise of the following tests:-

(a) Group 0 :- Performance and General Tests – As per Cl. 4 of IRS:S 34* read with Cl. 16 of this specification.
Tests to verify characteristics laid down in sub-clauses 16.1.1 to 16.1.8 of this specification shall be made on all sample relays meant for type tests while tests for remaining characteristics laid down in sub-clauses 16.1.9 to 16.1.18 shall be made only on two relay samples meant for Gr. 0 tests.

(b) Group I – Climatic tests on 2 sample relays to Cl. 5 of IRS:S 34* read with sub-clauses 16.1.2 to 16.1.4, 16.1.6 and 16.1.7 of this specification. The values of these parameters shall not be less than those specified in the relevant sub-clauses, except in respect of insulation, which shall not be less than 1 M.ohm at the end of each cycle and shall not be less than 10 M.ohm after recovery.

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(c) Group II – Damp heat long term test on 1 sample relay with the coil of the relay energized at 20% of the rated current during this tests as per Cl. 6 of IRS:S 34* read with sub-clauses 16.1.2 to 16.1.4, 16.1.6 and 16.1.7. The values of these parameters shall not be less than those specified in the relevant sub-clauses, except in respect of insulation, which shall not be less than 1 M.ohm at the end of the cycle and shall not be less than 10 M.ohm after recovery.

(d) Group III – Endurance tests to Cl. 7.1 of specification IRS:S 34* on two relays. However, this tests shall be carried out on one relay at room temperature loading all the contacts with the contact loads specified in Cl. 11.6.2 and the second sample at $70^{o}C \pm 2^{o}C$ as laid down in Cl. 7.1 of specification IRS:S 34*, loading all the contacts as specified in Cl. 11.6.2, parameters specified in sub-clauses 16.1.2 to 16.1.8, 16.1.10, 16.1.11 and 16.1.18 of this specification shall be checked and measured. The values of these parameters shall not be less than those specified in the relevant sub-clauses of the specification.

(e) Group IV – Mould Growth Test – On one relay as laid down in Cl. 8 of specification No. IRS:S 34*.

(f) Group V – Salt mist test – On one relay, as laid down in Cl. 9 of IRS:S 34*. After this test, parameters specified in sub-clauses 16.1.2 to 16.1.4 shall be checked and measured, in addition to visual examination for corrosion or any apparent deterioration. The values of these parameters shall not be less than those specified in the relevant sub-causes of the specification.

(g) Group VI – Normal storage test – On one relay as laid down in Cl. 10 of IRS:S 34*, read with sub-clauses 16.1.2 to 16.1.4, 16.1.7, 16.1.8 and 16.1.18 of this specification. The values of these parameters shall not be less than those specified in the relevant sub-clauses of the specification.

(h) Bump Test – This test shall be conducted on one relay as laid down in Cl. 14.4.5 of IRS:S 23**. After this test, the parameters specified in sub-clauses 16.1.2 to 16.1.4 and 16.1.11 of this specification shall not be less than those specified in the relevant sub-clauses of the specification.

(j) Test for vibration and resonance effects – This test shall be made on one relay mounted in its normal position to see that the relay is free to resonance effects under vibration of 0.125 mm amplitude at frequencies between 3-40 Hz or 0.025 mm amplitude at frequencies 40-100 Hz. Under such conditions, with relay energized at the rated current, normal/reverse contact shall give reliable contact and with relay in de-energized position, no contact shall make.

(k) Temperature rise test – This test shall be made on one relay. After the relay has been energized continuously for a sufficient length of time for the temperature to reach a stable value, the temperature measured in any point of the winding shall not exceed the maximum permissible for the class of insulation employed. This test shall be carried out at an ambient temperature of $60^{o}C$ and with the relay energized at 20% above its rated current.

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* Testing – Railway Signalling Relays (General)

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18.4.3 Test samples – Total 5 samples shall be required for complete range of type tests as per Cl. 18.4.2. These samples shall be selected at random, as far as possible from at least twenty numbers of relays. These samples shall be selected and sealed by the inspecting officer. Samples of relays which have been subjected to type tests shall not from part of the supply.

18.5 Acceptance tests

18.5.1 Inspecting authority shall carry out acceptance tests as specified in Cl. 16 (except clause 16.1.9 & 16.1.13) and clause 18.5.2 of this specification.

18.5.2 The inspecting authority shall carry out visual inspection specified in Cl. 18.1.2 on every relay.

18.5.3 In the absence of any specific agreement between the purchaser and supplier, the inspecting authority may also carry out Gr. I, climatic tests, as specified in Cl. 18.4.2(b) on two samples for every supply lot or total supplies of near about 1000 relays.

18.6 Sampling

18.6.1 The sampling plan for acceptance purposes shall be subject to agreement between the supplier and the purchaser in the absence of any such specific agreement, the sampling procedure as laid down in Cl. 11.5.2 to 11.5.4 of IRS:S 34* shall be followed.

19. REJECTION

19.1 Any of the materials which do not comply with the requirements of this specification and any other specification stipulated in the order in the opinion of the inspecting authority or the purchaser or his nominee, may be rejected.

19.2 Any supply of materials, covered by this specification may, in case of urgency of requirements, be inspected and accepted on provisional basis, pending carrying out or completion of type tests of long term duration e.g. endurance test, damp heat (long term) tests and normal storage test. In such cases, the manufacturer shall guarantee the materials against defects and shall be responsible, at his entire cost, to rectify the defects or to replace the defective materials accepted provisionally even when put into use as may be desired by the purchaser, in case the above mentioned tests of long term duration, on completion, are found to have been not complied with.

19.3 The manufacturer shall be responsible, at this entire cost, to rectify the defects or to replace the defective materials, where materials already inspected at manufacturer's place and accepted, or, subsequently on receipt by the consignee, found to be defective in respect of such of the characteristics for which tests were not made or made by the inspecting authority only on a percentage of accepted lot.

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* Testing – Railway Signalling Relays (General)

20. MARKING AND IDENTIFICATION

20.1 A name plate shall be provided in a conspicuous position giving the following information:-

(a) Manufacturer's name or code.
(b) Year and month of manufacture.
(c) Type/class of relay.
(d) Serial number of relay.
(e) Specification reference.
(f) Coil resistance at 20^{o}C.
(g) Pick-up, drop-away and rated current.

20.2 The package/box containing relays and meant for transport to the consignee shall be plainly marked on the outside with the following particulars:-

(a) Name and address of consignee.
(b) Name and address of consigner.
(c) Requisition number and package number.
(d) Purchaser's order reference and date.
(e) Direction arrow for guidance during handling.
(f) The package shall also be marked with the word "FRAGILE".

21. PACKING

21.1 The relays shall be so packed as to permit convenient handling and to protect against loss or damage and ingress of moisture during transit and storage.
21.2 The relay shall be packed securely and all necessary precautions shall be taken to avoid jolting and damage to moving parts and components during transit.
21.3 The relay with its packing shall be fit to withstand the bump test to sub-clause 18.4.2(h) of this specification.

22. INFORMATION TO BE SUPPLIED BY THE TENDERER

22.1 Whenever relays covered by this specification are offered by a tenderer either for the first time or to a modified design anyway different from his earlier supplies, necessary technical details including the following information shall be supplied with the tender.
22.1.1 List of drawings forming an essential part of the tender (Cl. 3.1.5).
22.1.2 Overall dimensions of the relay (Cl. 4.1).
22.1.3 Weight of the relay (Cl. 3.1.2).
22.1.4 Materials test results and other relevant specifications details of the materials used in the fabrication of the following relays components, if so desired by the purchaser (Cl. 6).

(a) Electromagnetic parts, i.e. armature, core and yoke etc.
(b) Insulating parts.
(c) Metal contacts.
(d) Contact springs.

22.2 Deviation statements giving complete details of deviations, if any, from the requirements in this specification, shall be furnished by the tenderer with the tender for relays covered by this specification. In cases where specification is being fully complied with, a nil deviation statement shall also be submitted.

23. IMPORTANT NOTE

23.1 Any clarification or additional information relating to the equipment covered by this specification, shall be obtained from the Purchaser or his nominee.

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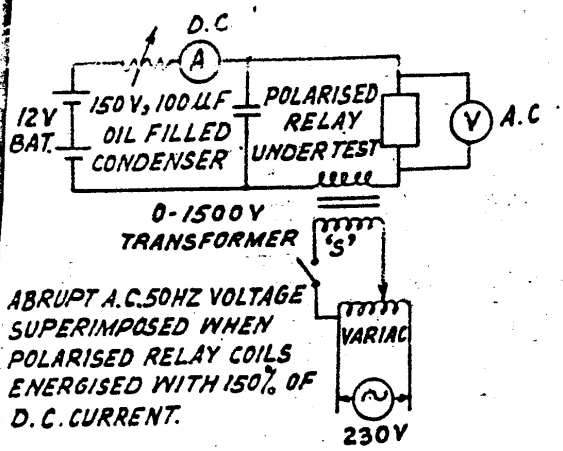
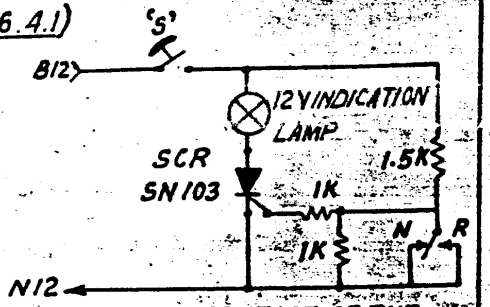
APPENDIX I

(CLAUSE 16.4.1)

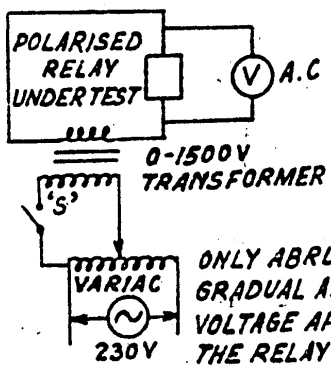


ABRUPT A.C. 50HZ VOLTAGE SUPERIMPOSED WHEN POLARISED RELAY COILS ENERGISED WITH 150% OF D.C. CURRENT.

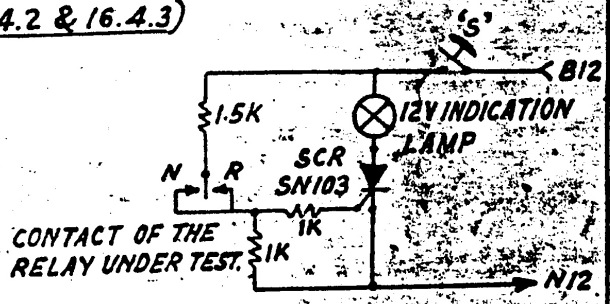


INDICATION CIRCUIT FOR THE MOMENTARY/ STEADY BREAK OF THE CONTACT.

(CLAUSE 16.4.2 & 16.4.3)



ONLY ABRUPT OR GRADUAL A.C. 50HZ VOLTAGE APPLIED TO THE RELAY COILS.



INDICATION CIRCUIT FOR THE MOMENTARY/ STEADY BREAK OF THE CONTACT.

CIRCUITS FOR TESTING A.C. IMMUNITY OF 3-POSITION POLARISED RELAY

5. IN PLACE OF THE INDICATION CIRCUIT SHOWN ABOVE, AN OSCILLOSCOPE MAY BE USED FOR INDICATION.
4. THE INSTANT OF APPLICATION IN THE CYCLE SHOULD NORMALLY BE SET BY A CHRONOSTARTER. TILL SUCH TIME AS A CHRONOSTARTER IS NOT AVAILABLE, AT LEAST 10 APPLICATIONS AT RANDOM INTERVALS MAY BE MADE FOR THIS TEST.
3. THERE SHALL BE AN INTERVAL OF 1SEC. MINIMUM BETWEEN TWO ABRUPT APPLICATIONS OF VOLTAGE.
2. THE SWITCH 'S' IS MANUALLY OPERATED FOR ABRUPT APPLICATION OF A.C. VOLTAGE AT DIFFERENT INSTANTS/PHASE ANGLES OF A.C. CYCLE.
1. VOLTAGE REGULATION OF STEP-UP TRANSFORMER SHOULD BE AS LOW AS POSSIBLE AND THE VOLTMETER READING SHOULD BE TAKEN AFTER CLOSING THE SWITCH 'S'.

NOTE

No. IRS:S31-80

Government of India
Department of Railways
(Railway Board)

N.B. Printer to please insert here 21 mm block of Coat of Arms of Govt. of India.

AMENDMENT NO. 1 OF MARCH 1986

to

INDIAN RAILWAY

STANDARD SPECIFICATION

for

DC POLARISED RELAY, 3-POSITION

(Tentetive)

Serial No. S31-80

(Page 7, clause 6.11, line 2)- Substitute 'Grade 4600' for 'Grade A-6-M'.

(Page 10, clause 9.5.1, line 4)- Substitute '1000 Volts' for '2000 Volts.'

(Page 16, clause 16.4.1, line 2)- Add word 'specified' in between 'max.' and 'pick up'.

(APPENDIX I)- Substitute "RS" for switch "s" in the indication circuits and add 'note 6' as following.

'6 'RS' indicates the resetting switch of indication circuits.'

Lucknow-11.
Dated: 2/1/86

(S. RAJAGOPALAN)
for Director General/MP